AN INVESTIGATION INTO THE ASPECTS OF INNOVATION WITHIN THE DOWNSTREAM DOMAIN OF THE PHARMACEUTICAL SUPPLY CHAIN

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I dedicate this thesis to my husband Dionysios

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List of Abbreviations

AHP	Analytical Hierarchy Process
ATM	Automated Telling Machinery
BPI	Business Process Improvement
BPR	Business Process Re-engineering
BSC	Balanced Scorecard
CFA	Confirmatory Factor Analysis
CLMS	Closed-loop Management System
CMB	Common Method Bias
CMV	Common Method Variance
DoH	Department of Health
EEA	European Economic Area
EMA	European Medicines Agency
ERP	Enterprise Resource Planning
EU	European Union
GDP	Gross Domestic Product
GPs	General Practitioners
HDMA	Healthcare Distribution Management Association
HS	Healthcare Services
HSC	Healthcare Supply Chains
IM	Innovation Management
IPSCF	Innovative Pharmaceutical Supply Chain Framework
IS	Information Systems
IT	Information Technology
JIT	Just In Time
KMS	Knowledge Management Systems
LRA	Linear Regression Analysis
MS	Management Science
MT	Management Theories
NHS	National Health Service
NICE	Health and Clinical Excellence
NPs	Nurse Practitioners
OM	Operations Management
OP	Operations Policy
OPC	Operations Planning and Control
OR	Operational Research
OS	Operations Strategy
POM	Production and Operations Management
PSC	Pharmaceutical Supply Chain
QSAM	Quick Scan Audit Methodology
RBV	Resource-based View
RFID	Radio Frequency Identification
RL	Reverse Logistics
SC	Supply Chains

SCC	Supply Chain Costs
SCM	Supply Chain Management
SCMS	Supply Chain Management System
SCS	Supply Chain Strategies
SD	Standard Deviation
SN	Supply Network
SO	Service Operations
SS	Supply Strategy
SSCM	Sustainable Supply Chain Management
SSCM	Sustainable Supply Chain Management
TCE	Transaction-Cost Economics
TQM	Total Quality Management
VMI	Vendor Managed Inventory
VSM	Value Stream Mapping

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- Papalexi, M., Bamford, D., Dehe, B. & Tipi, N. (2016). *The Impact of Supply Chain Characteristics on the Adoption of Innovation*. In: 5th World Conference on Production and Operations Management P&OM, 6th - 10th September 2016, Havana, Cuba
- Papalexi, M., Bamford, D., & Dehe, B. (2015). A case study of kanban implementation within the pharmaceutical supply chain. *International Journal of Logistics Research and Applications*, 19(4), 239-255. http://dx.doi.org/10.1080/13675567.2015.1075478
- Papalexi, M., Breen, L., Bamford, D. & Tipi, N. (2014). *A preliminary examination of the deployment of lean and reverse logistics within the pharmaceutical supply chain (PSC) UK*. In: LRN Annual Conference and PhD Workshop 2014, 3-5th September 2014, University of Huddersfield
- Papalexi, M., Bamford, D. & Dehe, B. (2013). *Lean Deployment in Healthcare: A systematic literature review*. In: BAM2013 Conference proceedings: British Academy of Management, 10-12 September 2013, Liverpool, UK

Abstract

An investigation into the aspects of innovation within the downstream domain of the pharmaceutical supply chain

This research evaluates the implementation of innovative programmes within the downstream domain of the Pharmaceutical Supply Chain (PSC). Pharmacies are considered as key links between healthcare services and patients because they are responsible for dispensing and managing pharmaceuticals in order to prolong life. Considering the healthcare organisations' crucial role and that they face the challenge of minimising the cost of healthcare services while enhancing service quality, healthcare organisations tend to try improvement approaches and innovative interventions to enhance their efficiency and effectiveness. Specifically, they tend to focus on improving their Supply Chain Management (SCM) in order to reduce waste, in particular with regards to their medicine expenditure, and to provide improved services. However, implementing innovation within the Pharmaceutical Supply Chain (PSC) is not yet adequate; at present there appears to be a lack of experience and knowledge of how such initiatives should be undertaken. Research that examines potential innovative contributions might therefore make a defined contribution to the sector. This research, therefore, aims to assess the current medicine delivery process and identify the issues responsible for weak process performances and the factors that influence pharmacies' innovativeness within two diverse European contexts, the UK and Greece.

An exploratory research design, embracing a mixed-methods approach, was used to analyse the issues associated with PSC inefficiency and assess to what extent innovation could be adopted by hospital and community pharmacies to improve the delivery process of pharmaceutical products. The qualitative data was gathered through 30 interviews with key professionals working within the downstream domain of the PSC in the two selected geographical areas. A total of 21 in-depth interviews in the UK and 9 in Greece were conducted to examine the elements preventing the effective and efficient delivery of medicines. Simultaneously, an online survey was developed to collect the quantitative data. The final sample (N=130) consisted of specialists working within the down stream domain of the PSC in Greece and the UK. The quantitative data analysis aimed to identify the factors that support or prevent innovation within this specific and complex environment. The analysis and combination of these two sets of data enabled the researcher to gain a comprehensive understanding and recommend innovative solutions that are suitable to the system under investigation, leading to continuous improvement.

This research contriputes to academic literature as it adds more theoritical insights to innovative delively processes, especially those that have been characterised as highly complex. The results led to the generation of the Innovative Pharmaceutical Supply Chain Framework (IPSCF) that provides guidelines to healthcare organisations about how the identified problems can be overcome by implementing suitable innovative techniques. The implementation of Lean and Reverse Logistics practices, which are supported by integrated Information Technology (IT) systems, are suggested as a means for healthcare organisations to enhance their delivery system in terms of quality (products and service quality), visibility (knowledge and information sharing), speed (respond to customers and suppliers needs) and cost (minimisation of cost and waste) and therefore generate a competitive edge. The study's recommendations have important implications for pharmacies, as they provide guidance regards suitable innovative programmes that can be adopted. The outputs of this research are specifically relevant to the pharmacy sectors of the UK and Greece, but may have also relevance for European healthcare organisations.

1 Chapter One: Introduction

The first chapter of this thesis is intended to set the scene through providing information regarding the nature of the research and introducing the scope of the study and the thesis overview. Particularly, it presents a brief description of the concepts that have framed the research foundations. Initially, the research background is detailed, positioning the study within the literature context. An explanation of the motivations that are associated with the current research will be provided, followed by the research aims and objectives, and the particular research questions. Subsequently, the methodological approach adopted and the research process will be analysed. Finally, this chapter will conclude by summarising the thesis structure, which will guide the readers through this monograph.

1.1 The Research Background

Healthcare organisations are responsible for promoting public health though improving the individual patient care experience in terms of quality, access and reliability. They play one of the most important and longstanding roles in society, as the services they provide impact upon human life. The proper functioning of the healthcare system requires great investments and constant improvement in order to be able to meet the increased demand for high quality services and satisfy patients' needs (Smits *et al.,* 2009; Chassin, 2013). However, considering that healthcare costs, globally, are growing rapidly, there has been extensive pressure on healthcare organisations to minimise their expenses without sacrificing service quality (Cole & Radnor, 2010; Page, 2014). Particularly, healthcare organisations are forced to reduce their medicine spending, as it represents the highest non-staff revenue cost (Davis, 2010); the total worldwide drug expenditure in 2015 was $1,069 billion (Statista, 2016a). In addition to this, the perceived high level of wastage associated with pharmaceuticals significantly increases this cost (Cherrett *et al.,* 2012; Papalexi *et al.,* 2015); $14.5 billion was the estimated global medical waste management market in 2012 (Transparency Market Research, 2014). Literature indicates that the implementation of effective supply chain practices offers solutions to healthcare organisations and assists in facing this challenge (de Vries, 2011; Bhakoo *et al.,* 2012).

There is, therefore, a need for optimising the Pharmaceutical Supply Chain (PSC) to achieve cost saving, waste elimination and better services. Uthayakumar and Priyan (2013, p.52) defined the PSC as "*the integration of all activities associated with the flow and transformation of drugs from raw materials through to the end user, as well as associated information flows, through improved supply chain relationships to achieve a sustainable competitive advantage*". There have been a number of reported documents and articles suggesting the improvement of the PSC through applying innovative approaches. For the purpose of this study, the definition of innovation suggested by Omachonu and Einspruch (2010) has been adopted. They explained that *innovation is related to the introduction of new or significantly improved services, processes or products within the organisation that are likely to benefit it and wider society*.

More specifically, healthcare institutes, such as the Department of Health and the National Organisation for Medicines have outlined a series of guidelines aiming to determine how best practices can be adopted to enhance the delivery process (Department of Health, 2012; National

Organisation for Medicines, 2016). Furthermore, scholars investigating this particular supply chain found that benefits, such as effective inventory control, improved information reliability, reduction of any type of pharmaceutical waste and increased quality of healthcare services, can be claimed (e.g. Kim, 2005; Defee *et al.,* 2009; Kumar *et al.,* 2009; Breen & Xie, 2015). However, healthcare organisations are facing difficulties in undertaking innovative initiatives, which explains why they have limited experience in adopting innovation, when compared with non-healthcare sectors (Liddell *et al,* 2008; Stirman *et al.,* 2012). Brown *et al.* (2013) explained that the healthcare sector is different because healthcare services impact upon society and, as a result, the possibility of failure is not acceptable. Focusing on the PSC, the actual delivery process of medicines is lengthy and has been characterised as a more complex system than exists in other industries (Scheller & Smeltzer, 2006; Mustaffa & Potter, 2009).

Several factors contribute to the complexity of the PSC, as reported by Buchanan *et al.* (2007), Xie and Breen (2012), and Bhakoo *et al.* (2012), among others. Initially, the complexity of the delivery system is increased due to the involvement of numerous stakeholders within the PSC that have diverse roles and responsibilities (de Vries, 2011). Individual perspective, attitude and knowledge are likely to influence the success rate of innovation (Williams & Dickinson, 2008). In addition, a high level of trust and information sharing is often difficult to achieve within systems where myriad actors are involved; the success of innovative interventions relies on such ingredients (Augulo *et al.,* 2004; Simchi-Levi *et al.,* 2008). Furthermore, forecasting is a challenging process for pharmacies because, on one hand, pharmaceutical products are stored in several areas throughout the PSC (Mustaffa & Potter, 2009) and, on the other hand, there is a high level of demand variation (Danas *et al.,* 2006). The uncertainty in demand is one of the factors that hinder the design of well-structured supply chains (Waters, 2009). Moreover, the unpredictable demand does not support the push logistics practices that are currently employed and, as a result, high levels of safety stock are required to ensure the products' availability (Bhakoo *et al.,* 2012). Considering that medicines are relatively sensitive and expensive products, carrying safety stock increases the likelihood that these products will expire and more waste will be generated, which affects the population's health and the ecological environment (Wang *et al.,* 2015).

Interestingly, the existence of institutional and regulatory pressures stemming from the fact that particular laws and regulations might prevent the adoption and diffusion of innovation (Shah, 2004). Bamford (2011) stated that healthcare organisations are considered to be relatively centralised. Within functionally centralised organisations, the process of implementing innovative programmes might be ineffective or considerably slow (Greenhalgh, 2004). The organisational culture is considered another factor that contributes to the delivery system's complexity. Actors of the PSC tend to operate independently and any change that might impact upon their role could be perceived as a threat (Burnes & Jackson, 2011). Finally, the limited financial resources available and the lack of Supply Chain Management (SCM) knowledge can act as obstacles when attempts at adopting best practices are undertaken (e.g. Baltacıoğlu *et al.*, 2007; D'Este *et al.*, 2012; Davies *et al.*, 2013). The PSC complexity is presented in Findings Chapter (Chapter 4, p. 141) and illustrated in figure 4.1, which includes the different groups of stakeholders involved within the PSC and the challenges and issues that healthcare organisations need to deal with during the delivery process. The factors that are presented in this section will be analysed and detailed in the Literature Review chapter that follows.

This research, therefore, attempts to provide additional insights about the medicine delivery practices, and it is concerned with investigating the nature of this phenomenon through assessing the current delivery processes taking place within the downstream domain of the PSC employed in two diverse European contexts: the UK and Greece. It will be testing whether the described factors or some additional ones are affecting the delivery system's effectiveness and how the adoption of innovative approaches, such as Lean Philosophy and Reverse Logistics (RL) can address the specific issues, while optimising the PSC.

Initially, this exploratory research evaluates the pharmaceutical delivery process, applied within healthcare systems of the UK and Greek, by gathering qualitative data through conducting interviews with key professionals. In addition to this, the collection of supportive quantitative data, achieved through distributing a survey, enabled the researcher to appreciate the level of innovativeness that exists within the PSC in the two selected countries and provide an indication of the factors that might inspire or prevent hospital and community pharmacies to innovate. Finally, the current thesis demonstratse that the deployment of suitable innovative initiatives

enables healthcare organisations to optimise their supply chain practices, based on which a minimisation of the perceived waste and an increase of service quality can be achieved.

The following section will provide additional information regarding the motivations associated with this research. This will explain further the rationale behind the research idea and the particular interests of the researcher.

1.2 The Research Motivations

The motivations that inspired the current research can be categorised into three different groups. The first category is related to the theoretical motivations, which consider aspects of innovation and their influences upon the PSC. This will result in contributing to the existing established literature on the subject under investigation (e.g. Mustafa & Potter, 2009; Bhakoo *et al.*, 2012; Xie & Breen, 2012; Bravo & Carralho, 2015; Papalexi *et al.*, 2015). The second group, namely practical motivations, is driven by the attempt to assess the current medicines delivery systems employed in the two diverse European contexts in order to identify the issues associated with the system's inefficiency; subsequently, this will enable the researcher to recommend innovative improvement solutions. Finally, the methodological motivations, which is the last but equally important category, is related to the adoption of a mixed-methods approach under a pragmatic paradigm in order to best support this exploratory research (e.g. Creswell & Plano Clark, 2011; Creswell, 2013).

1.2.1 The Theoretical Motivations

Relevant literature generated a number of fundamental questions, which acted as a source of motivation for this research. The investigation into aspects of innovation that can be adopted within the healthcare sector, which has been a popular but not yet fully established subject, can offer a significant contribution to knowledge (e.g. Vermeulen *et al.*, 2014; Govindan *et al.*, 2015; Bamford *et al.*, 2015a). In addition to this, research focused particularly on the PSC has been inspiring (Kumar *et al.*, 2009; Cardoso *et al.*, 2013; Xie & Breen, 2014). Specifically, the identified gap in the literature, where academics and practitioners question and argue whether

innovative initiatives such as Lean and RL can be adopted and implemented within the highly complex pharmaceutical delivery system, has been recognised (e.g. Westrick & Mount, 2009; Bhakoo *et al.*, 2012; Narayana *et al.*, 2014; Bravo & Carvalho, 2015).

1.2.2 The Practical Motivations

Healthcare organisations are facing the challenge of reducing the cost of healthcare services, while sustaining or enhancing the level of quality that they provide. Several reports produced by healthcare institutes have recognised the need for improving the supply chain practices, aiming to minimise the waste generated throughout the PSC and the associated costs (e.g. WHO, 2004; Department of Health, 2012). This is a critical objective for healthcare organisations as, through optimising the PSC, they will not only address the described challenge, but also benefit wider society.

This research could assist the healthcare providers and, particularly, the hospital and community pharmacies to recognise the issues that prevent a robust and effective delivery system, and direct them on how best the root-cause problems can be overcome through implementing innovation. The potential benefits that can be claimed, such as cost-saving and service quality improvement, will be presented as an output of the study.

1.2.3 The Methodological Motivations

Finally, the methodological motivations are driven by the attempt to best evaluate the specific delivery process from an exploratory perspective. Borrowing a pragmatic worldview, where qualitative and quantitative data can be mixed, an in-depth understanding of the phenomenon under investigation can be achieved (Creswell & Plano Clark, 2011). In particular, a multiphase research approach, consisting of an exploratory sequential research design and an exploratory parallel/simultaneous research design, is materialised to address the research aims and objectives.

This section highlighted the research motivations that have inspired and shaped the research idea, and which are linked with the contributions of the current thesis. The following section will present and detail the research aims and objectives.

1.3 The Research Aims and Objectives

The researcher's interest has been to understand and evaluate the medicine delivery processes taking place within the downstream domain of the PSC in two specific European countries, the UK and Greece. Particularly, the aims of this investigation are:

i. The identification of the key issues related to the perceived inefficiency of this complex delivery system.
ii. The deployment of suitable innovative approaches that could enable the development of a fit-for-purpose downstream domain of the PSC.

This research, therefore, attemps to uncover the non-value added practices and establish how and to what extent innovation can be adopted to overcome the identified issues and, thus, support and improve the management of the system's complexity.

In order to address and satisfy the described research aims, a set of research objectives has been developed.

- The first objective is focused on critically reviewing the existing relevant literature on Operations and Supply Chain Management, innovation and healthcare environment in order for an in-depth understanding of the current and innovative practices to be achieved.
- The second objective is related to the evaluation of the current pharmaceutical delivery processes, taken place within the downstream domain of the PSC and employed within the selected European contexts, determining the similarities and differences.
- The third objective means to identify the issues associated with the downstream delivery system's inefficiency in both countries and these that are region-dependent.

- The fourth objective of this research considers the identification of factors that might influence the innovativeness of the British and Greek downstream delivery systems.
- Finally, the last objective concerns developing a conceptual framework, which could direct healthcare organisations in optimising the downstream domain in the pharmaceutical delivery process through adopting suitable innovative approaches.

1.4 The Research Questions

Two overarching research questions have been developed to structure the research study argumentation. Each consists of two sub-research questions, which are linked with the aims and objectives of the thesis. The two main research questions are presented below:

RQ 1: What are the issues associated with the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece?

RQ 2: How can the implementation of innovative programmes within the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece be promoted?

Figure 1.1 illustrates and establishes the boundaries of the thesis, which are built upon three major research foundations: i) Supply Chain Management (SCM); ii) Innovation; and iii) Healthcare sector. The SCM body of literature provides a theoretical perspective and innovation is considered as the phenomenon under investigation, while the healthcare sector and specifically the PSC is used as the context being assessed. The synthesis of these three fundamental bodies of knowledge under the lens of Operations Management (OM) sets the scene based upon which the research questions can be addressed and answered. In addition to this, the Resource-based View (RBV) has been adopted as the strategic management theory that assists in addressing the research scope. The interactions of these disciplines are presented in Figure 1.1. The way that they influence the research development will be discussed and linked with the sub-research questions.

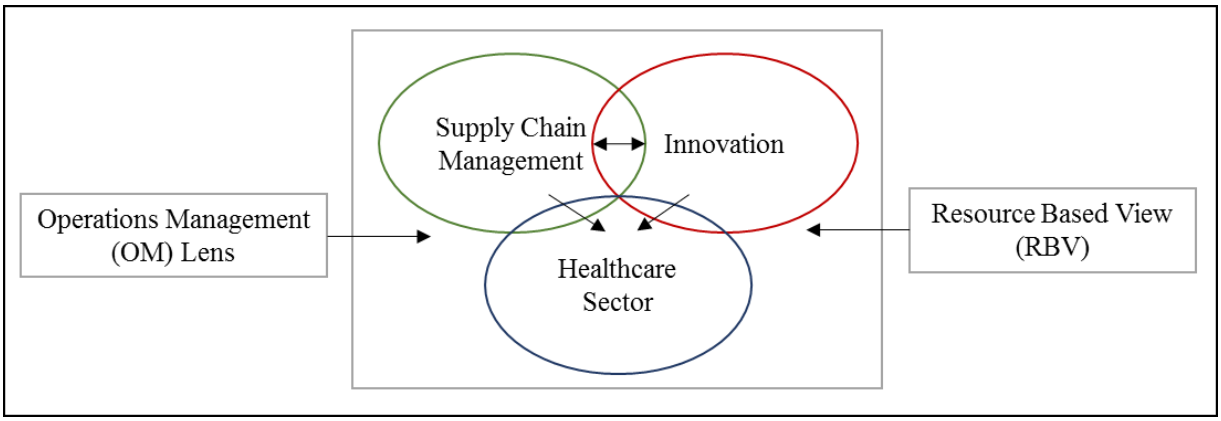


Figure 1.1: The Boundaries of the Thesis

As explained, each of the two overarching research questions consists of two sub-research questions. The four sub-research questions developed to structure the study focus on and provide insights into the interactions between the elements presented in Figure 1.1.

S-RQ1: What are the common factors observed within the downstream domain of the Pharmaceutical Supply Chains? This sub-research question can be justified and built upon the OM theory and the current pharmaceutical delivery practices applied within the two selected contexts. The Literature Review chapter will present and argue that complex systems, such as the PSC, require well-established strategies in order to be managed effectively. Subsequently, the Findings chapter will detail the root-cause problems that are associated with the weak performances in both countries, which is a prerequisite for optimising the downstream domain of the PSC. The identification of common factors that are responsible for the delivery system's inefficiency, within these theoretecally different countries, could imply that those factors are generic and could be applicable to other systems independently of their geographical context.

S-RQ 2: What are the region-dependent factors observed within the downstream domain of the Pharmaceutical Supply Chains? Similar to the first sub-research question, this second question relies on the interaction between the complex supply chains and the context. However, it is required to identify the specific region-dependent issues faced by the British and Greek pharmacies in order to address the question. It is assumed that, although the UK and Greece are members of the European Union and as a result they have to comply with same regulations,

particular context-dependent factors, such as differences in the structure of the healthcare system employed, could impact on the delivery of medicines.

S-RQ 3: What are the factors that influence the level of innovation within the downstream domain of the Pharmaceutical Supply Chains? This sub-research question represents the interconnections between the theoretical concepts of SCM, the aspects of innovation and the downstream delivery processes employed within the two selected contexts. The adoption of innovation is environmentally dependent and, thus, the identification of the factors that might influence the system's innovativeness can guide healthcare organisations in selecting the most suitable innovative approach.

S-RQ 4: What innovative programmes should be implemented to improve the downstream delivery of medicines? This sub-research question combines all the three bodies of knowledge as the researcher tests, the different innovative initiatives that have been successfully implemented and have improved the supply chain practices of other industries, in order to discover and establish the best practices that would be the most suitable and satisfactory for the specific contexts.

Figure 1.2 presents the structure of the research questions, explaining how the two main research questions and the four sub-research questions are linked.

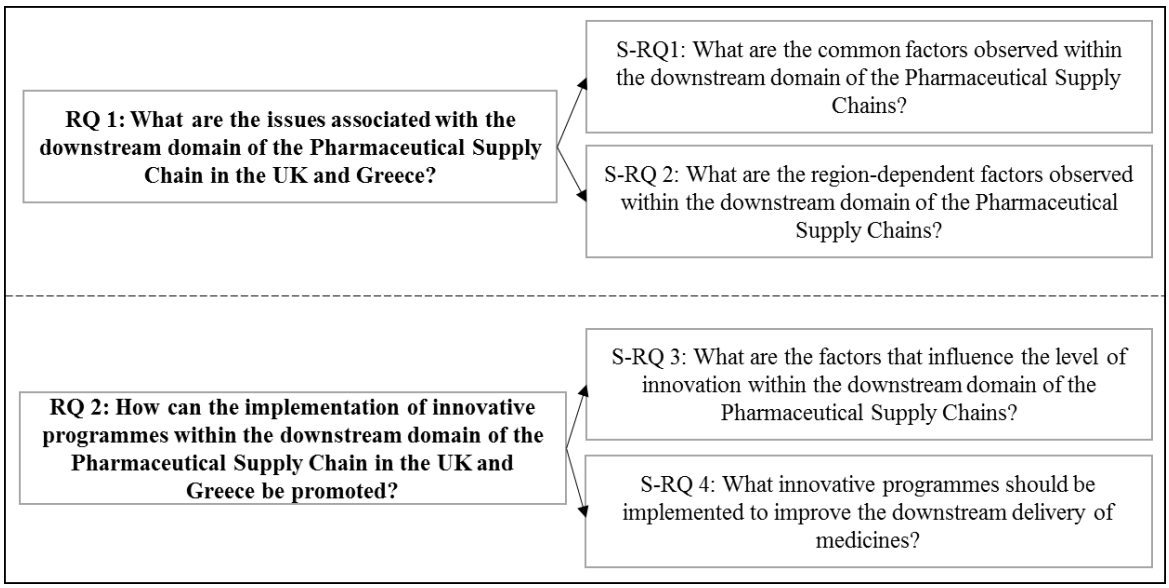


Figure 1.2: The Structure of the Research Questions

1.5 The Research Scope

This exploratory research, which has adopted a mixed-methods approach, aims to investigate aspects of innovation within the complex PSC environment. It examines the impact of innovation on the medicine delivery process employed within the downstream domain of the PSC in two European contexts: the UK and Greece. The selection of these particular countries was deliberate as it has been demonstrated that region-dependent environmental and organisational influences have affected the pharmaceutical delivery systems. For example, although the two selected countries have to follow the same European legislation regarding the management of pharmaceuticals, their different healthcare system structures impact upon the PSC's effectiveness. In addition to this, in the era of the global financial recession, the scars of the crisis are more prominent in Greece than in the UK, which might cause particular effects in terms of capacity and resources. The Methodology chapter presents and explains the reasons for the country selection.

As previously pointed out, healthcare organisations are facing the challenge of being more productive whilst using fewer resources. This study, therefore, attempts to assist healthcare

organisations in addressing this challenge, but also in improving the service quality that would benefit wider society. Particularly, the researcher assesses the downstream domain of the PSC performance from an OM perspective, through investigating the quality of the medicine delivery process in terms of cost, variation, variety, visibility and transparency. It is believed that the effective management of the PSC could minimise the perceived waste and the associated costs, as well as enhancing the service quality (Kim, 2005; Defee *et al*., 2009; Breen & Xie, 2015). Thus, developing knowledge, capabilities and skills that would enable healthcare organisations to optimise their supply chain practices is of paramount importance.

It will be assumed and justified that the adaption of moderate innovation, which includes best practices that are new to the organisation but not to the industry (Tidd *et al.,* 2005), can improve the organisations' infrastructural area, including delivery control systems, material flows and organisational culture and structure (Yamamoto & Bellgran, 2013). In particular, the adoption of management innovation (Camison & Lopez, 2010), such as Lean and RL practices, in conjunction with technical innovation (Lai *et al.,* 2008), such as integrated Information Systems (IS), could lead towards continuous improvements. A continuous improvement roadmap can be formed through undertaking incremental changes that are often considered small improvements (Hall, 2013). A series of small adjustments are more likely to be accepted and absorbed as they cause less disruption to the system (Waters, 2009). As a result, healthcare personnel may not perceive those changes as a threat (Burnes, 2014). Besides, managing the PSC resources and capabilities in an innovative and effective way it can contribute to the healthcare organisations' aim, which is to gain a competitive advantage over their competitors and subsequently become world-class organisations. Therefore, the use of the RBV theory provides a suitable theoretical concept to support and justify the need for optimising the PSC practices.

The scope of the current thesis, therefore, can be defined by the clear interaction and interface between the three bodies of knowledge, as presented in Figure 1.1. As Figure 1.3 illustrates, the SCM knowledge, aspect of innovation and the healthcare context are conceptualised under the lens of OM and RBV theory. Based on this concept, the research scope can be addressed, which is to investigate to what extent innovation can assist hospital and community pharmacies to improve the downstream domain of the PSC effectiveness.

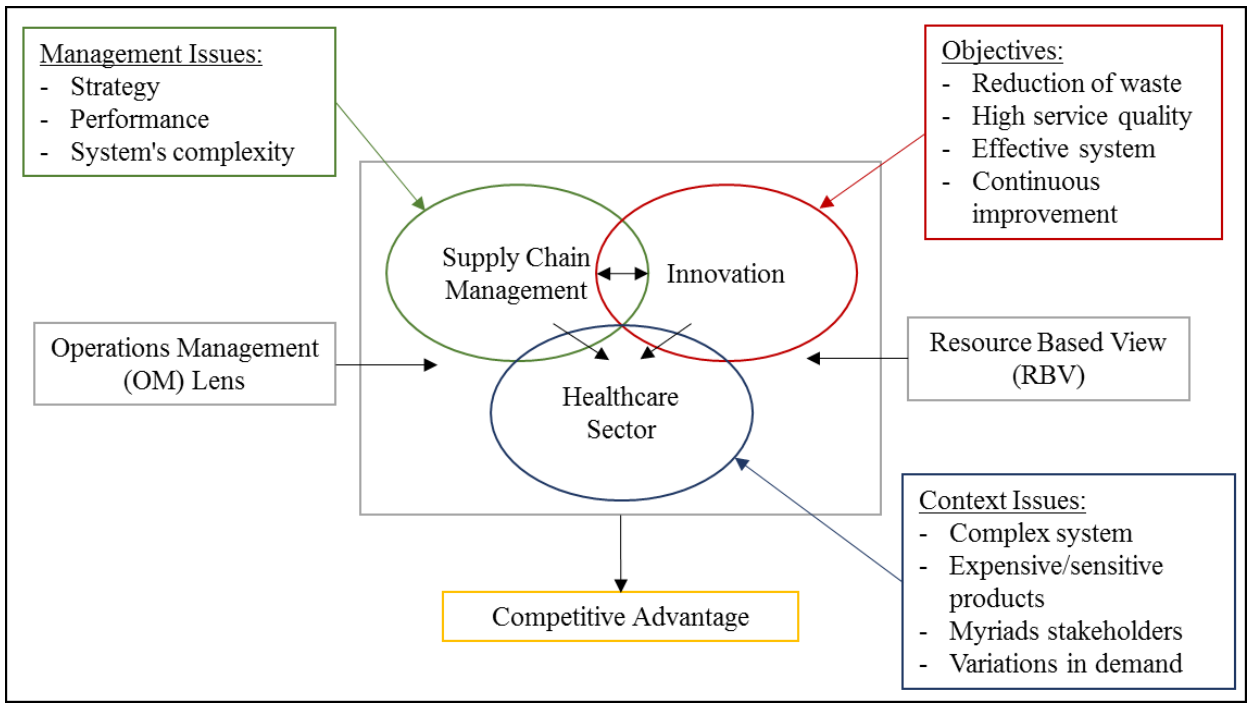


Figure 1.3: The Scope of the Research

1.6 The Research Approach and Process

To address the research scope and answer the research questions, an exploratory research, adopting a mixed-methods approach, has been designed. The collection of qualitative and quantitative data was necessary to understand the phenomenon under investigation and develop an innovative solution. This multiphase research has been conducted under the pragmatism paradigm, which supports that social reality can be explained based on information (Creswell & Plano Clark, 2011). Indeed, gathering relevant information enabled the researcher to evaluate the current PSC practices and suggest innovative approaches that could support and improve the delivery process.

Specifically, this exploratory research is composed of two different research approaches. Initially, an 'exploratory sequential' approach and subsequently an 'exploratory parallel/simultaneous' approach were adopted to address the specific research questions. The exploratory sequential design was used to collect some primary qualitative data through

unstructured interviews (N=8) with key professionals working within the downstream domain of the PSC in the selected European contexts. This approach was adopted, on one hand, in order to form a more comprehensive view of the phenomenon and, on the other hand, to inform and structure the following exploratory parallel/simultaneous design. The second approach was adopted to collect and analyse the required qualitative and quantitative data. Particularly, 22 semi-structured interviews were undertaken, aiming to assess the downstream domain of the PSC and identify the issues associated with the system's inefficiency. The quantitative data, collected through 130 questionnaires, had a complementary role, which was to provide indications about the factors that might affect the pharmacists' decision to innovate.

The Methodology chapter will provide further information regarding the research strategy and, the data and methodology triangulation. The diversity of the data has enabled the researcher to build the research's validity and develop innovative solutions that could enhance the effectiveness and efficiency of the PSC.

1.7 The Research Output

The analysis of the collected data demonstrates and confirms that there are a number of issues responsible for the inefficiency of medicine delivery systems. For the purpose of this research, the term 'issues' referes to as the multidimensional elements that define the quality and the structure of the downstream domain of the PSC. Within an accurate and robust PSC, the perceived waste and the associated costs can be minimised, while the quality of services will be increased. This research suggests that improvements can stem from the adoption and implementation of suitable innovative approaches. Small changes that will affect the infrastructure area of the healthcare organisations, inspired by Lean and RL practices, can generate substantial benefits; the organisations will not only deal with the pressures asking them to reduce their expenses, but will also satisfy the patients, which will lead to the development of a competitive advantage. However, the benefits for the organisations and the entire PSC will be greater if the innovative initiatives are supported by Information Technology (IT) systems and integrated into stakeholders' delivery practices, as illustrated in the Innovative Pharmaceutical Supply Chain Framework (IPSCF), presented in the Conclusion chapter. The IPSCF can act as a

guidance model to assist healthcare organisations to optimise their supply chain and improve service quality.

1.8 Thesis Overview and Outline

Table 1.1 represents the structure of the thesis, which is composed of six chapters. This section will outline the six chapters to guide the readers though this research study.

Chapter One: Introduction

The first chapter introduces the research study and provides information regarding the research background, boundaries and scope. It also presents the research aims and objectives, the research questions that structure the thesis and describes briefly the research methodology adopted. Finally, the chapter outlines some of the research findings.

Chapter Two: Literature Review

The second chapter provides the theoretical conceptions stremmed from reviewing the relevant literature. It discusses the three distinct bodies of knowledge, as well as the Operations Strategy and Operations Management literature, and the RBV theory that conceptualises and sets the boundaries of the research, as Figure 1.3 illustrates. Synthesising these elements provides an initial understanding of the research field and highlights the research gaps that could be addressed. Various definitions and perceptions of SCM and innovation are examined to enable the researcher to narrow the judgmental view of the subject under investigation. Accordingly, a description of the factors that make the PSC one of the most complex systems, when compared to different industries, and the innovative approaches that could reduce the system's complexity, are provided.

Chapter Three: Research Methods

The third chapter presents and discusses the philosophical background of the study and justifies the methodology adopted. Specifically, it explains the rationale behind conducting an exploratory research, utilising a mixed-methods approach, under a pragmatic paradigm. It also

demonstrates the alignment between the research methodology approach, the research aims and objectives and the research findings.

Chapter Four: Research Findings – Data Analysis

The fourth chapter presents the findings of the research derived from the analysis of the rich data collected. In particular, based on the qualitative data analysis, it describes and details the current medicines delivery process taking place within the British and Greek environment and analyses the identified issues that are responsible for the delivery system's inefficiency. Subsequently, the chapter provides an indication related to the factors that might affect the system's innovativeness, which is achieved by analysing the supportive quantitative data. It ends by presenting the research findings' conceptual model that integrates the two data sets, leading to the interpretation.

Chapter Five: Discussion

The fifth chapter synthesises certain parts of the relevant literature with the research findings in order to answer the specific research questions of the study. Particularly, it thoroughly discusses the research outputs, which are evaluated by the use of relevant literature, in the area of judgmental interpretation of the PSC and the impact of innovation on the effectiveness of the medicine delivery process. Finally, the chapter presents the conceptual model developed to overcome the identified issues and suggest how innovation could act as a catalyst, optimising the delivery system of pharmaceuticals.

Chapter Six: Conclusion

The final chapter provides the synopsis of the thesis. Specifically, it presents the Innovative Pharmaceutical Supply Chain Framework (IPSCF), which represents the main contributions of the research. This chapter also highlights the research recommendations and the study's limitations. It ends by suggesting potential future research opportunities.

1.9 Conclusion

This first chapter of the thesis introduced the research background and provided a brief description of the research scope, highlighting the research aims and objectives. It also presented a brief outline of the methodological approach adopted and the research findings. Finally, the Introduction chapter summarised the thesis structure illustrated in Table 1.1. The Literature Review chapter that follows will detail and analyse the relevant literature in order to frame the context of the study.

Chapter 1: Introduction	Chapter 2: Literature Review	Chapter 3: Research Methods	Chapter 4: Research Findings	Chapter 5: Discussion	Chapter 6: Conclusion
- Research background - Research motivations - Research aims and objectives - Research questions - Research scope - Conceptual Framework 1	- OM strategy and concepts - OM theories: RBV - SCM concepts - Aspects of Innovation - Innovation in the Healthcare Sector - Innovation within the PSC - Best innovative practices applied within the PSC - Reverse Logistics (RL) - Lean Thinking - Benchmarking - Inventory management approaches - Information Technology (IT) Systems - Conceptual Framework 2	- Research Paradigm: Pragmatism - Research strategy: Mixed-Methods - Research approach: Exploratory research - Research tools and techniques: Interviews/Survey - Data analysis - Conceptual Framework 3	- The current situation of the PSC - Background and delivery process in the UK/Greece - Qualitative data analysis: Thematic Analysis - Quantitative data analysis: Regression Analysis - Conceptual Framework 4	- Literature summary - Findings summary - Research questions addressed and discussed - Recommendations - Conceptual Framework 5	- Final Conceptual Framework 5 (IPSCF) - Review of the Research aims and objectives - Summary of the research questions addressed - Research contributions - Recommendations - Research Limitations - Opportunities for Future Research

Table 1.1: The Thesis Structure

2 Chapter Two: Literature Review

2.1 Introduction

This chapter reviews the literature of the main body of knowledge that has been considered necessary to develop this thesis. Reviewing the existing literature is one of the initial steps in research facilitating the acquisition of knowledge about the particular research subject and identifying the research gap based on previous scholars' work. Consequently, a wealth of ideas have emerged that act as guidelines aiming to structure further research. This section links the existing literature to the research topic through conducting three core bodies of literature: i) Supply Chain Management (SCM); ii) Innovation; and iii) the Healthcare sector.

Innovation is defined and explained from different perspectives through analysing its application in different contexts. Supply Chain Management (SCM) and in particular the aspects of the Pharmaceutical Supply Chain (PSC) are reviewed to understand the current delivery processes and evaluate the level of innovation implemented. Finally, a critical overview of management improvement methods and techniques is undertaken, intending to understand their benefits and their potential influence on the delivery of medicines.

However, the history and the foundation of the overarching disciplines: Operations Strategy (OS) and Operations Management (OM) upon which the research is based are reviewed at the beginning of this chapter. In addition, management theories and their contribution to the delimiting of the theoretical boundaries of this research are detailed.

2.2 Operations Strategy and Management

The aim of this section is to build the foundation of the overarching disciplines upon which this research has been developed. The concepts of Operations Strategy (OS), Operations Management (OM) and in particular Supply Chain Management (SCM) have been considered as the main pillars of the management research, which is the broader subject of this thesis. The predominant theory, Resource-Based View (RBV) is also defined, describing the reason for applying it to address the scope of the research.

2.2.1 Business strategy

The main scope of a strategy is to guide a firm in order to offer its services or products successfully against increasing levels of global competition (Eden & Ackermann, 2013; Hill *et al.*, 2014; Booth, 2015). In addition, a strategy should be developed to enable dealing with the current situation in the market in order to satisfy the customers' needs. However, research indicates that many managers have neither sufficient knowledge of how to articulate a strategy nor how to share and implement it with employees (Collins & Rukstad, 2008). As a consequence, the lack of experience deprives an organisation of the advantages of a clearly defined and implemented strategy (Brown *et al.*, 2007; Pfeffer & Sutton, 2013).

Business Strategy: Definitions and aims

Having a better understanding of strategy and why it is important for managing operations, its definition is required. Strategy derives from the Greek word "*strategos*", which, initially, was used in a military setting and implied facets of leadership or direction (Brown *et al.*, 2013). Later, strategy was adopted by the business sector to help organisations to survive within a highly competitive environment (Eden & Ackermann, 2013; Werbach, 2013). Regardless of the business sector in which a firm operates, it needs to identify its goals and position itself within the market formulated by the organisational strategy (De Wit & Meyer, 2010).

Many researchers argue about the definition of strategy (Johnson & Clark, 2008; Spender, 2014). Strategy is connected with meeting existing market needs and exploiting opportunities for potential market segments (Cousins *et al.*, 2008). A number of scholars have defined

strategy as a set of cross-functional decisions that enable organisations to achieve their goals, thus gaining a competitive advantage (Cousins *et al.*, 2008; Bamford & Forrester, 2010; Pfeffer & Sutton, 2013). Hamel and Prahalad (1994, p.78) explained how a company can become more competitive: "*to get to the future first, top management must either see opportunities not seen by other top teams or must be able to exploit opportunities, by virtue of pre-emptive and consistent capability-building, that other companies cannot*". Great attention needs to be paid to internal and external capabilities to identify these opportunities or threats that may influence organisations' future (Brown *et al*., 2013); especially in today's business world where capitalism is the dominant economic model. Recognising the correct timing and urgency in its implementation is also important for the strategy to be effective (De Wit & Meyer, 2010; Tushman & Anderson, 2004).

Christopher *et al.* (2006) and Slack, *et al.* (2006) highlighted that the processes of formulation and deployment are the key challenge for all organisations. Johnson *et al.* (2010) reported that there are some commonalities and success factors related to the development of strategy. According to them, an effective strategy should be associated with the organisation's vision and mission, which have been identified taking into account the whole firm's activities and operations, and the strategy should be translated and communicated throughout the organisation. Developing an effective strategy is paramount to all organisations regardless of their core businesses and sectors: manufacturing or service; private or public (Kaplan & Norton, 2008).

Based on the foregoing discussion, strategy's aim is to successfully deliver the corporate vision and mission through managing an organisation's operations and resources in order to produce the required products and services satisfying the stakeholders' requirements (Slack *et al*., 2006). For example, Qrunfleh and Tarafdar (2014, p. 341) stated that "*classifications of Supply Chains (SC) strategies suggest that supply chains can be predominantly focused on cost efficiencies and leanness, on flexibility and quick response, or on a contingent mix of both*". There are several distinct types of strategy having different focuses, such as supporting operational efficiency, developing new market opportunities through applying innovation (Chen *et al.,* 2010) and building long-term strategic relationships with stakeholders, which improves firm performance (Shah *et al.,* 2002; Rai *et al.,* 2006).

The definition and role of business strategy have been introduced in this section highlighting the benefits of developing and deploying a strategy. The strategy is responsible for fitting the

corporate vision and mission with the overall business activities. The use of performance measurement models and systems can assist and support the strategy by controlling any deviations between the targets and bottom-lines. In order for these initiatives to be successful, the process and the content of the strategy deployment must be considered. The following section details the role of Operations Strategy (OS) which is one of the main disciplines upon which this research is based.

2.2.2 Operations Strategy

Operations take place around the world, in various forms at every single moment. They can be found in manufacturing and services settings; in the public and private sector (Rudberg & West, 2008; Johnson *et al.,* 2010; Nahmias & Olsen, 2015). For example, they take place when a customer orders a meal in a restaurant or when a patient requires treatment in a healthcare organisation. There are various factors that can influence the capability of operations, such as customers' opinions and expectations; for this reason managing operations is vitally important to any organisation, under the umbrella of a well thought-out strategy. This can be associated with Roth and Menor (2003) and Voss *et al.*'s (2008, p. 250) perpective regarding Operations Strategy, which "*is needed to determine the theoretical and practical insights that will enable firms to effectively deploy their operations in order to provide the right offerings to the right customers at the right times*". Operations strategy aims at meeting the current and future challenges occurring due to the constantly changing competitive environment (Bettley *et al.,* 2005).

Although there is no universal agreement on the definition of Operations Strategy, the following perspectives represent the slightly different views (Slack & Lewis, 2011, p.11):

- Operations strategy is a top-down reflection of what the whole group or business wants to do.
- Operations strategy is a bottom-up activity where operations improvements cumulatively build strategy.
- Operations strategy involves translating market requirements into operations decisions.
- Operations strategy involves exploiting the capabilities of operations resources in chosen markets.

Figure 2.1 illustrates the content of Operations Strategy.

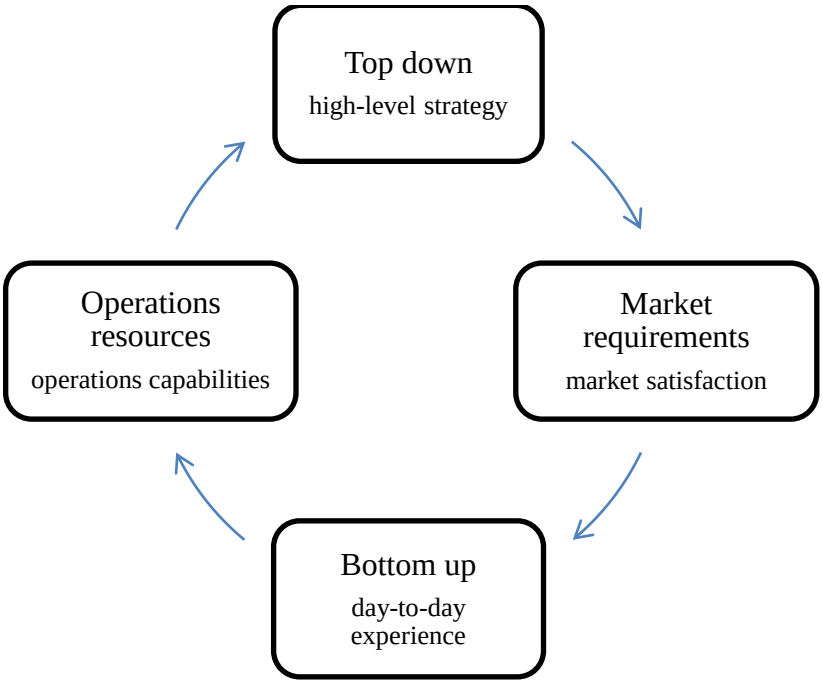


Figure 2.1: The Operations Strategy perspectives (adapted by Slack & Lewis, 2011)

These four perspectives need to be considered simultaneously as there is a direct connection between them. For example, it is obvious that the market requirements have to be satisfied in order for businesses to survive in the long term; to succeed in doing so, strategic support, day-to-day experience and operations capabilities are required. Those elements have different characteristics in each sector, which means that they have to be adapted; most of the time, they are unpredictable.

Operation Strategy Content and Process

The Operations Strategy needs to be conceptualised, taking into account two elements: the content and the process. Content is related to the decision made within the Operations Strategy domain in terms of creating a competitive advantage, whilst process refers to the way in which Operations Strategy can be developed (Martín-Peña & Díaz-Garrido, 2008; Rytter *et al.*, 2007). It is worth mentioning that literature indicates that the content aspect has been discussed more than the process. Rytter *et al.*, (2007) highlighted the need for research focused on Operations Strategy Process in order to increase the knowledge base.

Particularly, the content includes the interaction between the operation's performance objectives and the decisions made regarding the resource deployment (Slack & Lewis, 2011). The operation's performance objectives are associated with the competitive advantage; the five performance objectives (quality, speed, dependability, flexibility and cost) need to be considered to articulate the market requirements (Bamford & Forrester, 2010). On the other hand, the Operations Strategy decisions are related to the sets of actions needed to address the operations and corporate goals (Martín-Peña & Díaz-Garrido, 2008). Slack and Lewis (2011, p.25) classified those into four main groups: capacity strategy; supply network strategy purchasing and logistics; process technology strategy; development and organisation. Although researchers have created slightly different decision areas, referring to them in different ways, they agree that these decisions can be organised into structural and infrastructural decisions (Slack & Lewis, 2011).

The other element of Operations Strategy is the process, which has not received much attention by researchers. As mentioned previously, the process of operations strategy is related to the procedures required to formulate operations strategy. The process determines how organisations combine the market requirements with the operations resources in order to be successful. According to Slack and Lewis (2011, p. 32) in practice "*putting operations strategies together and making them happen is extremely complex and difficult to generalise*". Figure 2.2 represents the Operations Strategy conceptual framework including the content and process aspects. Although there are significant overlaps between these two elements, they have been treated separately (Slack & Lewis, 2011).

At this stage it is relevant to focus on the impact of strategy on the operations of an organisation. The following section analyses operations within a strategic context, focusing on the role of strategy both in manufacturing and service settings and highlighting the contribution of strategy to organisations' efficiency and effectiveness.

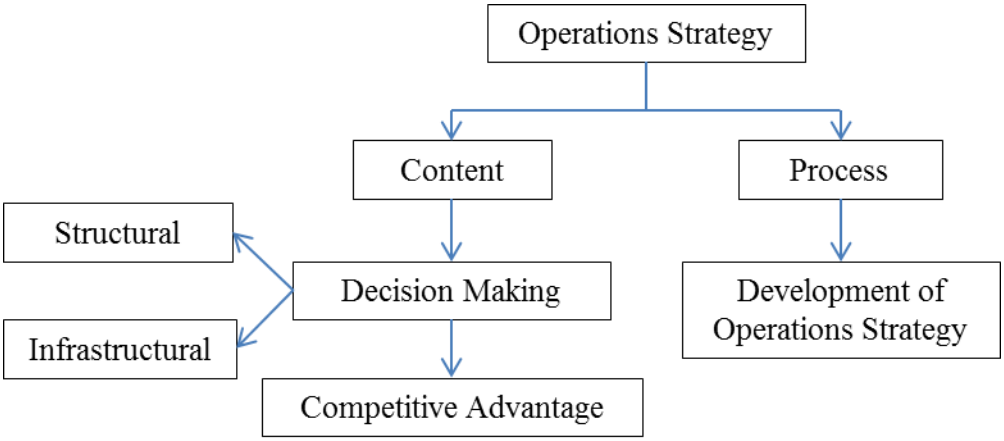


Figure 2.2: The Operations Strategy conceptual framework (adapted by Dehe, 2014)

2.2.2.1 Operations within a strategic context

Managing operations is important in order for products and services to be efficient for the end user. In organisations, there are not only operations at the point of production, but also various forms of operations taking place simultaneously across it, including supply and logistics, inventory management, quality control, information processing and others that are necessary for the production of the final product and service. Operations Management helps organisations in orchestrating all these different operations. Brown *et al*. (2013, p.4) indicate the simplistic definition of operations management: "*Operations Management is connected with those activities that enable an organisation (and not just one part of it) to transform a range of basic inputs (materials, energy, customers' requirements, information, skills, finance, etc.) into outputs for the end customer".* Hill and Hill (2012) and Sprague (2007) argued that Operations Management can be considered as the management of the design, planning and control, and the improvement of a production system that provides products and/or services to customers.

Bamford and Forrester (2010, p.2) highlighted that "*operations management covers decision making in the organisation, from top level management issues, such as developing an operations strategy congruent with the company's business and marketing strategies, to the immediate control of operations*". This is in line with Slack *et al.*'s (2006, p.38) four identified missions of Operations Strategy: i) to articulate a vision of how the business's processes can contribute to the overall strategy; ii) to translate the customer requirements into clear processes and defines the level of performance objectives; iii) to make decisions to

shape the operations capabilities, allowing long term development and sustaining a potential competitive edge; and, finally; iv) to reconcile market requirements, operations policy and capabilities (Dehe, 2014, p.47). In the modern era of operations management, organisations have to be keen to form strategic relationships with other firms operating in the same or similar sector, in order to be competitive.

Before the role of Operations Strategy in manufacturing and service sector is explored, a brief overview of the relevant history of Operations Management as a discipline would add value to this chapter discussion.

The history and the evolution of Operations Management: an industrial perspective

To provide a more parsimonious analysis of this discipline, reviewing its history from an industrial and academic perspective is necessary. Radnor & Barnes (2007, p.386) suggested that there were three distinctive periods, throughout the 20th century, related to the concepts of Operations and Process Management: 1) From the end of the ninetieth century to the Second World War; 2) From the Second World War to the mid-1980s; 3) From the 1980s to the Present.

Taylor in 1911 stated that management can be considered as a scientific problem and according to Bamford and Forrester (2010), Frederick Taylor (1911) is the father of Scientific Management; improving economic efficiency and workforce productivity was the main objective of Scientific Management theory. His theory "Taylorism" focused on the analysis of the existing processes based on data collected through observations, measurements and experiments. However, this theory was criticised because of the existence of de-humanisation aspect (Radnor & Barnes, 2007). During this period of time, Taylor's contribution to what is known today as Operations Management (OM) was not the only one; there were several other contributors: Henry Gantt (*i.e.:* Gantt chart); Frank and Lillian Gilbreth (*i.e.:* work studies); and Henry Ford (*i.e.:* Fordism) (Bamford & Forrester, 2010).

During the second period, the main incident was the quantitative development within the discipline. Voss (1995, p.17) reported that two factors were responsible for this development: i) the progress of Operational Research (OR); and ii) the application of statistical principles in the management of quality, based on the work from Shewhart and Deming. Besides the

expansion of the quantitative perspective throughout the discipline, there was also a human relations influence, according to Radnor and Barnes (2007). This fact changed firms' culture and enhanced employees' relationship by supporting teamwork.

From the 1980s the Japanese production model started to influence the Western way of production, emphasising mass-customisation. Mass-customisation was accompanied by the theory of Quality Management and Lean approaches (Goetsch & Davis, 2014; Lillrank, 1995). This emphasis promoted a strategic perpective of operations (Radnor & Barnes, 2007).

The history and the evolution of Operations Management: an academic perspective

The academic development of the discipline started in 1959, according to Singhal and Singhal (2007). Koskela and Ballard (2012, p.726) supported their statement and reported that "*the most important turn in the evolution of the science of management occurred in 1959 and was the switch from a production-centric view of management to a social science-oriented view*". Two influential books from Gordon and Howell (1959) and Pierson (1959) were published in that year; both of them focusing on the challenges of teaching and research management in American business schools. They concluded that there was the need for a different approach to the discipline and they suggested focusing on three branches: i) behavioural science; ii) neoclassical economics; and iii) quantitative modelling, supported by the technology development. As a result, teaching and research of management had begun to become more analytical, focusing more on understanding and analysing operations (Koskela & Ballard, 2012).

By the 1980s, the content of Operations Management (OM) was extensively conducted by researchers including Buffa (1982) and Voss (1984). Table 2.1 shows the outputs of their reviews, which reveal the evolution of OM. It also confirms the analytical and quantitative focus of the discipline (*i.e.:* critical path methods, linear programming and other relevant techniques) (Voss, 1995).

Research areas	Buffa (1980)	Voss (1984)
Production planning and control	X	X
Purchasing	X	X
Facilities	X	X
Process design	X	X
Process technology		X
Job design, work organisation	X	X
Organisation structure	X	
Management of technical change		X
Maintenance and reliability	X	X
Quality control	X	X
Work measurement	X	
Manufacturing policy		X
Cost estimation		X
Systems approaches		X
Physical distribution		X
Service operations		X

Table 2.1: Content of Operations Management in the 1980s (adapted from Voss, 1995)

During this period of time, the OM content had been established both in the USA and the UK; academic journals had been launched in both geographic areas (*i.e.:* the Journal of Operations Management in the USA and the International Journal of Operations and Production Management in the UK) (Voss, 1995). The debates related to OM's identity attracted a number of researchers to focus on developing the OM research agenda (Chase, 1980; Miller *et al.*, 1981; Voss, 1984; 1995). Miller in the USA and Voss in the UK identified five OM research areas: i) Operations Policy (OP); ii) Operations Planning and Control (OPC); iii) Service Operations (SO); iv) Productivity and Technology; v) Quality – Total Quality Management (TQM) (Voss, 1995). Having reviewed the key OM themes, Voss (1995) summarised and compared the research approaches undertaken both in the USA and the UK. The majority of the US publications (69% of papers) adopted modelling and simulations research; on the other hand, in the UK 80% of the publications adopted a conceptual, field and case-based research approach. As Voss (1995) explained, the US

researchers had been influenced by the quantitative aspects of the discipline, lacking empirical research which was the UK's research strength.

This differentiation in OM research approaches adopted can be explained in one sense by Slack *et al.* (2006, p.372) who stated that "*OM's underpinnings are fragmented*. *Indeed it could be argued that the specific genealogy of modern OM is a curious amalgam of very different academic disciplinary inputs, for example: systems theory, strategy theories and practical application*". This is supported by Godsell *et al.*'s, (2013) research related to the application of Management Theories (MT) within the Operations Management (OM) field. They listed MT applied in OM research, over a ten-year time period (2002-2011), by reviewing the top OM journals based on Barman *et al.*'s (1991) ranking. The findings of their research are presented in the table below (Table 2.2); they concluded that there is a great variation of Management Theories (MT) usage with the "*Transaction cost economics*" and "*Resource based View*" to be considered as the most popular applied MTs.

Ranking	Management Theory (MT)	No. of occurrences	% of occurrences
1	Transaction Cost Economics	73	26.84%
2	Resource Based View	65	23.90%
3	Contingency Theory	38	13.97%
4	Social Exchange Theory	15	5.51%
5	Institutional Theory	12	4.41%
6	Agency Theory	11	4.04%
7	Resource dependence theory	9	3.31%
8	Organisational Knowledge Creation (SECI Model)	6	2.21%
9	Evolutionary theory for economics and management	6	2.21%
10	Other MTs	37	13.60%

Table 2.2: The nine most popular management theories as used in OM Research 2002-2011 (adapted from Godsell et al., 2013)

Having reviewed the history related to Operations Management as a discipline, it is seems pertinent to analyse the practical role of OM within the organisation.

2.2.2.2 Operations Management within organisations

The main aim of Operations Management is to help organisations to produce value added services. In times of recession, value added activities become increasingly important because there is the need to make the very best use of limited resources (Brown *et al.,* 2013). Organisations have not only to be concerned with managing costs but managing of value is important as well in order to avoid incurring non-value added activities, such as slow delivery speed and lack of flexibility. According to Qrunfleh and Tarafdar (2014) the critical issue that organisations have to deal with is how to organise and fit together the different activities in order to produce efficiently. Therefore, the three dimensions of the OM function play a crucial role in organising the operations. Table 2.3 illustrates them briefly.

1	Design	The structure and configuration of supply chains
2	Planning and Control	The optimisation of the product and/or service delivery
3	Improvement	The sustainable competitive advantage

Table 2.3: The three dimensions of the OM function

The first dimension is the design, which is considered as the first step in achieving the competitive advantage. Design has been defined as a set of decisions made for structuring and configuring the supply chain (Chopra & Meindl, 2006). Hill and Hill (2012), and Slack *et al.* (2010) reported that there are numerous decisions related to design including location decisions, layout and capacity decisions and selection of suppliers. Having designed the supply chain, the next step is to optimise the product and/or service delivery according to customer demand. Therefore, the role of OM is to prevent any deviations by managing the designed capacities, inventories and quality (Bamford & Forrester, 2010). Finally, the third main dimension of the OM function and its role is to generate and sustain the competitive advantage. The literature is rich in improvement approaches, tools and techniques; the most popular are Total Quality Management (TQM), Lean thinking, Six-Sigma and Business

Process Re-engineering (BPR) (Antony *et al.*, 2007; Bamford & Forrester, 2010; Goetsch & Davis, 2014).

All the above elements demand Operations Management to be seen within a strategic context. This is necessary if organisations hope to compete in such volatile markets where key performance indicators for any operations system, such as speed, reliability, quality, inventory management and a range of other operations capabilities have to be in place (Bamford & Forrester, 2010). The following section analyses the role of Operations Strategy in manufacturing and service settings.

Strategy in manufacturing settings

As mentioned previously, operations take place in manufacturing and service settings. In a manufacturing setting perspective, strategy can be termed manufacturing strategy. Many researchers from all over the world established manufacturing strategy as a core topic in Operations Managements (Hill & Hill, 2012; Nahmias & Olsen, 2015). It has been estimated that, over the last 40 years, 250 scientific papers on this particular theme, have been published in over 30 major journals (Dangayach & Deshmukh, 2001). Hayes and Wheelwright (1984, p.30) explained the manufacturing strategy content: "*Manufactory strategy consists of a sequence of decisions that, over time, enables a business unit to achieve a desired manufacturing structure, infrastructure and set of specific capabilities*".

Werbach (2013) stated that an organisation has to be ready to meet future opportunities. By doing this, a well-established strategy is required in order to manage operations. Companies with a formulated operations strategy achieve higher business performance than those without it, and they have more opportunities to return on sales (Lechner & Gudmundsson, 2012). Not only can operations strategy be used to create new opportunities and target new areas but it can also be used to support the already-devised business strategy of gaining a competitive advantage (Spender, 2014).

Strategy in service settings

Similar to operations firms, operations strategy has a vital role for service organisations in terms of the strategic positioning of the offer to customers. For example, Singapore Airlines has been awarded for service excellence 'in an industry whose service standards are tumbling' (Heracleous & Wirtz, 2010). High-performing organisations have stronger relationships between their operations strategy and operations activities than low-performing ones (Brown *et al*., 2013). Operations strategy identifies a balance between quality of service and cost, where the most effort is required.

Heskett *et al*. (2008) found that there are major elements that make an organisation successful. Initially, satisfied employees produce and deliver quality services; for example in the Mexican-style restaurant chain, Taco Bell, it was found that the outlets with the highest rates of staff retention outperformed those with high staff turnover (Zornitsky, 1995). As a result, satisfied employees influence customer satisfaction by offering quality services. Heskett *et al*. (2008), in their research found this evidence in Chick-Fil-A, Bank of Ireland, MCI, Swedbank and AT &T Travel. Ultimately, satisfied employees achieve more profits and growth. In order to offer high quality services, an organisation, apart from keeping its employees satisfied, needs to consider what its competitors do well and which practices can be adopted. A good tool for achieving this is benchmarking against 'best practice' of its competitors or other companies that have dealt with similar difficulties (Wong & Wong, 2008). For example, the NHS in the UK used Benchmarking within transport companies in order to improve the movement of people with the service (Brown *et al*., 2013).

The following section will present one of the main aims of Operations Strategy, the competitive advantage, discussing how organisations can differentiate themselves from their competitors. Gaining a competitive advantage will be analysed through the lens of the Resource-based View (RBV), which is the strategic management theory adopted by this research.

2.2.3 The Competitive Advantage through Operations Strategy

The concept of competitive advantage has been extensively discussed within the business strategy. Porter (1980) established this notion, explaining that a firm has to focus on both its

capacity and customers' perception in order to differentiate itself from the competition. Barney (2002, p.9) stated that "*a firm experiences competitive advantages when its actions in an industry or market create economic value and when few competing firms are engaging in similar actions*". Similarly, Besanko *et al.* (2000, p.389) reported that "*when a firm earns a higher rate of economic profit than the average rate of economic profit of other firms competing within the same market, the firm has a competitive advantage in that market*". Saloner *et al.* (2001, p. 39) explained that "*most forms of competitive advantage mean either that a firm can produce some service or product that its customers value than those produced by competitors or that it can produce its service or product at a lower cost than its competitors*". Therefore, organisations gain an advantage over their competitors by offering their customers' better value. This value can be produced either through providing better products or services and/or by offering lower prices (Hill & Hill, 2012; Yoo *et al.*, 2006). Organisations have to establish their strategy according to their competitive advantage and sustain it through their operations.

The strategic literature has suggested that most industries are characterised by some degree of resource heterogeneity and immobility (Buckeley & Ghauri, 2015; Barney & Hoskisson, 1989). Implicitly, firms have to take into account those two elements and have insights about the opportunities associated with implementing an appropriate strategy (Barney, 2012). Therefore, gaining a competitive advantage is a complex and environmentally dependent process.

Barney (2001) suggested that sustained competitive advantages can be obtained through establishing strategies that not only exploit companies' internal strengths, but also deal with the external threats, avoiding internal weaknesses. According to Buckeley and Ghauri (2015), Porter (1980) suggested models attempting to understand the reasons why some firms are more successful than others. Porter's 'five forces model' describes the environmental conditions and their contribution to firms' performance. Figure 2.3 illustrates Porter's model, which assesses and analyses firms' competitive strength and position based on the elements that influence their advantage: competitors, potential entrants, substitutes and bargaining power.

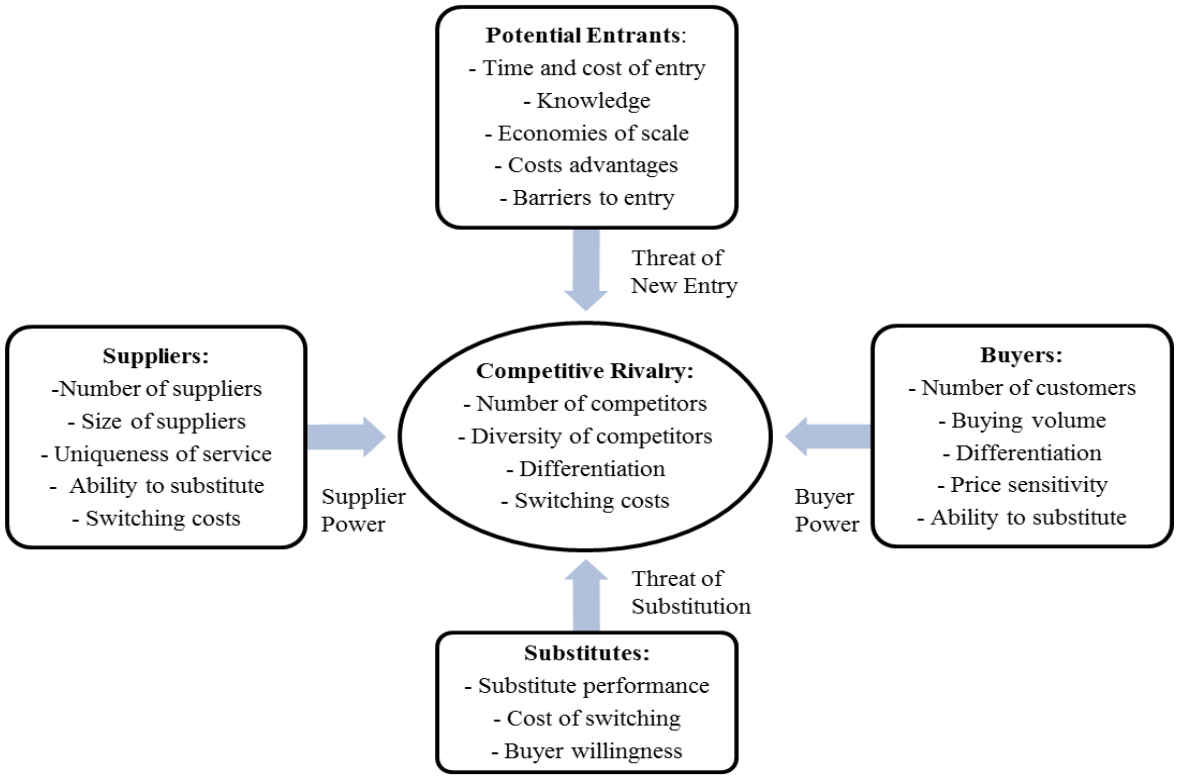


Figure 2.3: Porter's five forces model (adapted from Cockburn et al., 2000)

Cockburn *et al.* (2000) stated that there have been several powerful frameworks, such as the Porter's five forces framework, the resource-based view (RBV) and transaction-cost economics (TCE), which can assist firms to map and analyse the environmental signals in order to gain and sustain competitive advantages. Having presented and analysed the elements that allow organisations to develop their competitive advantage, the following section focuses on the Resource-based View (RBV), which is one of the strategic theories that can be used to sustain competitive advantages.

2.2.4 Sustaining a Competitive Advantage through RBV

The strategic literature indicates the importance of the resource-based view (RBV) as a strategic management theory and its rapid diffusion throughout it (Rumelt, 2003; Barney, 1991; 2012; Chaston, 2015; Ferlie *et al.*, 2016). In particular, Boyer *et al.* (2005, p.446) posited that "*RBV provides a solid theoretical foundation for understanding the role that Operations Strategy can play in creating and sustaining a competitive advantage*". According to Perunovic´ *et al.* (2012, p.353) "*RBV theory argues that the source of an organization's competitive advantage is based on its resources: its assets, competences, and*

capabilities". Assets refer to finantial, physical and intangible resources. Competences are bundle of knowledge, skills and technologies that are applied in the utilization of organisations' assets (Peppard & Ward, 2004). Those are the areas that organisations are competent and have the potential to generate an advantage (Gerbl *et al.*, 2016). Capabilities are related to organisations' ability to strategically implement that potential in the market (Priem & Swink, 2012) in order to satisfy customer needs such as cost, quality, flexibility, and on-time delivery (Golicic & Smith, 2013). From an Operations Management perspective, a competitive advantage can be achieved through developing strategies aiming to: i) reduce costs - cost advantage; ii) quickly respont to consumers' needs - speed and flexibility advantage, and; iii) implement innovative approaches to differentiate themselves from the competition - innovation advantage (Martín-Peña & Díaz-Garrido, 2008).

The founding idea of viewing organisations as a bundle of productive resources and capabilities that can be deployed was pioneered by Penrose in 1959. Penrose (1959) highlighted that the productive resources heterogeneity is the element that differentiates a firm. Barney (1991; 2001) developed this notion further by presenting his framework aiming at establishing strategies using the organisations' resources that enable them to generate a sustainable competitive advantage. Barney (2015) exemplified the main firm resources' attributes: i) it must be valuable, in the sense that it exploit opportunities and/or neutralises threats in a firm's environment; ii) it must be rare among a firm's current and potential competition; iii) it must be imperfectly imitable; and iv) there cannot be strategically equivalent substitutes for this resource that are valuable but neither rare nor imperfectly imitable; valuable, rare, inimitable and non-substitutable (VRIN) resources (Barney, 1986). Those attributes should be specified and considered as resources and then the resource-based model can use them to generate a sustained competitive advantage (Barney, 2015).

Figure 2.4 presents the relationship between organisation resource heterogeneity and immobility with value, rareness, imitability and substitutability (VRIS), and finally with a sustained competitive advantage. This describes the theoretical contributions under which a sustained competitive advantage can be achieved. These resources include all assets, capabilities, organisational processes, information, knowledge and organisational attributes (Buckeley & Ghauri, 2015). They can only be the source of a competitive advantage if they are valuable, efficient and effective. Obviously, as Barney (1991, p.103) pointed out, "*it*

cannot be expected to sustain competitive advantage if the superior resources are evenly distributed across all competing firms and highly mobile".

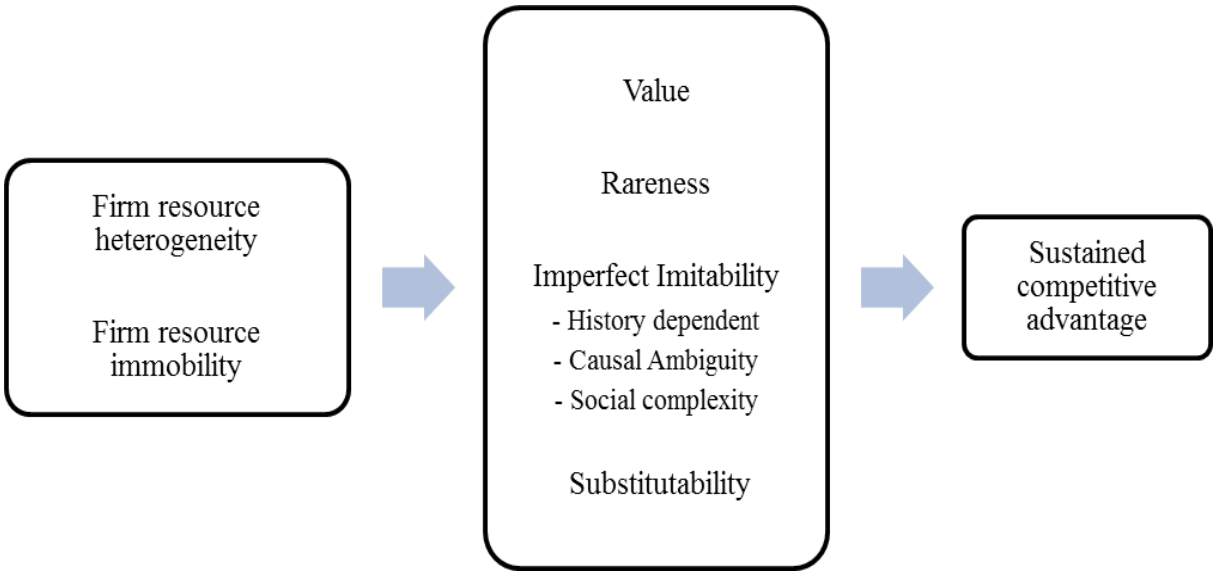


Figure 2.4: The main elements constituting competitive advantages according to RBV (adapted from Barney, 2001; Buckeley & Ghauri, 2015)

The literature is rich in articles focusing on information processing systems and sustained competitive advantage (Buckeley & Ghauri, 2015). Similarly to strategic planning, the type of information processing system analysed makes this source valuable; however, computers by themselves cannot be considered as a source of sustained competitive advantage (Hayes & Wheelwright, 1984). Information processing systems embedded in organisations' decision-making process may be a valuable source of this (Buckeley & Ghauri, 2015). In addition, a positive reputation of organisations among customers and suppliers might hold the potential for a sustained competitive advantage (Porter, 1980). According to Buckeley and Ghauri (2015) this element depends upon specific, difficult-to-duplicate historical settings. Klein *et al.* (1978) suggested that organisations can use guarantees and long-term contracts in order to improve their reputation.

It is generally assumed that organisations that exploit their resource advantages can increase their efficiency and effectiveness. Therefore, as Buckeley and Ghauri (2015, p. 297) reported, "*the strategic management research can be perfectly consistent with traditional social welfare concerns of economists*". A number of researchers have argued that a limitation of the RBV theory is that "*it assumes that resources are always applied to their best uses,*

saying little about how this is done" (Melville *et al.,* 2004 p. 289). In addition, the contributors to TCE (Transaction Cost Economics), attempting to explain the existence of firms, stated that the RBV theory does not consider the concept of opportunism. On the other hand, Cousins (2005) and Cousins *et al.,* (2008) posited that neither RBV nor TCE offer a complete theory set; both of them can be used to understand and analyse the fundamental Operations Strategy concept.

2.2.4.1 Aspects of Innovation and RBV

A number of researchers have reported that the RBV theory provides new insights to innovation management (IM) (Brown *et al.,* 2013; Wu & Chiu, 2015; Ferlie *et al.,* 2016). Kostopoulos *et al*. (2002, p.7) highlighted that "*the presence of different organisational resources and capabilities positively affects the outcome of the innovation process and, thus, can be used to extend the findings, gained by past research, on the firm's capacity to innovate*". The valuable organisational resources and capabilities can be used as inputs for producing innovative forms of competitive advantage. Figure 2.5 presents the resources that are critical for innovation.

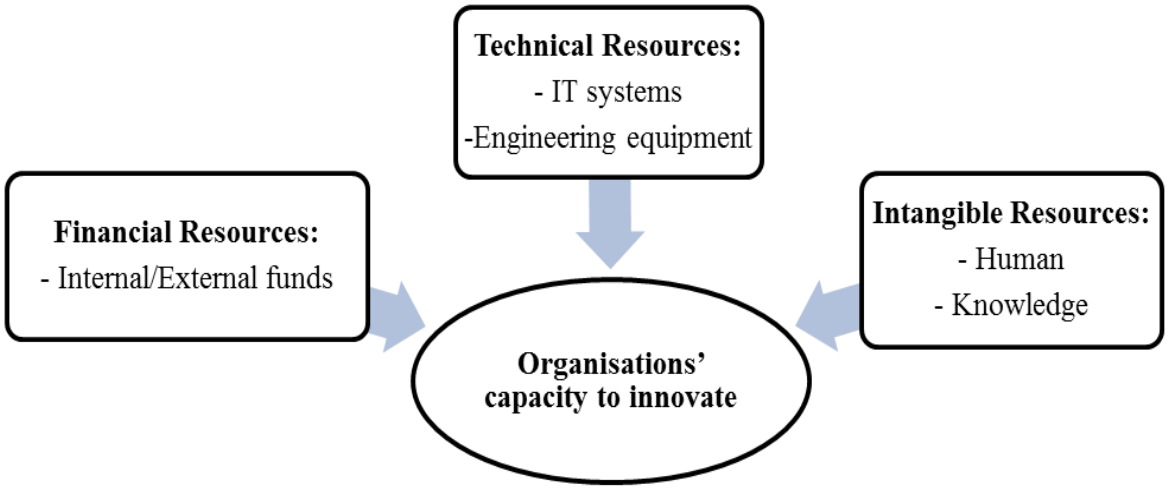


Figure 2.5: Resources determining organisations' capacity to innovate
(Adapted from Kostopoulos et al., 2002)

Organisations' innovative activities usually need to be supported by the available financial resources (Harris & Trainor 1995; Lee *et al.,* 2001; Davenport, 2013); and the lack of financial funds might prevent innovation (Helfat, 2000; Archibugi *et al.,* 2013). The

Transaction Cost Economics and Agency literature reports that organisations' internal funds are more conducive to innovative activities than external funds. The reason for this is the existence of information asymmetries between organisations and the market; for example there is the risk of losing control over innovation due to the risk of competitors obtaining relevant information.

On the other hand, technical resources have a positive impact upon innovation (Mitchell & Zmud 1999; Bloom *et al.*, 2015; Gatignon *et al.*, 2016). Investments in sophisticated technical equipment, such as Enterprise Resource Planning (ERP) software, increase the opportunity for organisations to produce innovative output, enhancing further their efficiency and effectiveness (Kong & Daud, 2013). Information systems (IS) are used for gathering and analysing information (Shapiro, 2001). They facilitate the communication between the stakeholders of a system, the data analysis processes, the dissemination of reports summarising those data, and they support supply chain decision-making (Chopra & Meindl, 2007). They are based on direst computer-to-computer communication in a predefined and standardised format, enabling the automatic generation, transfer and reception of information (Jonsson, 2008). Their fundamental use is related to the disclosure of historical information about business transactions, costs and financial performance (Chopra & Meindl, 2007). From implementing IS a wide range of effects can be expected, including: increased efficiency (Smith, 2006), enhanced scalability (Cederlund *et al.*, 2007) and sustained collaborations (Ireland & Crum, 2005).

The literature indicates that intangible resources influence the success rate of innovation (Barney, 1991; Anderson & Eshima, 2013; Drucker, 2014). Kostopoulos *et al.* (2002, p.9) highlighted that "*intangible assets may be more important from a strategic point of view, since they bring together more frequently the requirements necessary for producing sustainable advantage: to be valuable, rare and difficult to imitate and replace by competitors*". Innovative activities are effectively carried out when qualified human capital with advanced technical skills are involved in their production process (Drucker, 2014). According to Leonard-Barton (1995), organisations have to be able to create knowledge within their boundaries and also to adapt innovative ideas from their external environment in order to determine their competitive success against their competitors. Helfat and Raubitscek (2000) reported that new product lines could be generated by exploring market knowledge.

Similarly, Anderson and Eshima (2013) posited the importance of shared knowledge as a resource for developing new products and improving services.

Based on the previous discussion, tangible and intangible resources are considered as inputs that can be transformed into innovative outputs based on the organisations capabilities. The following figure (Figure 2.6) presents the fundamental Operations management model adapted to innovation achievement. The organisational capabilities included into the figure are the most strongly emphasised in the extant literature (Kostopoulos *et al.*, 2002).

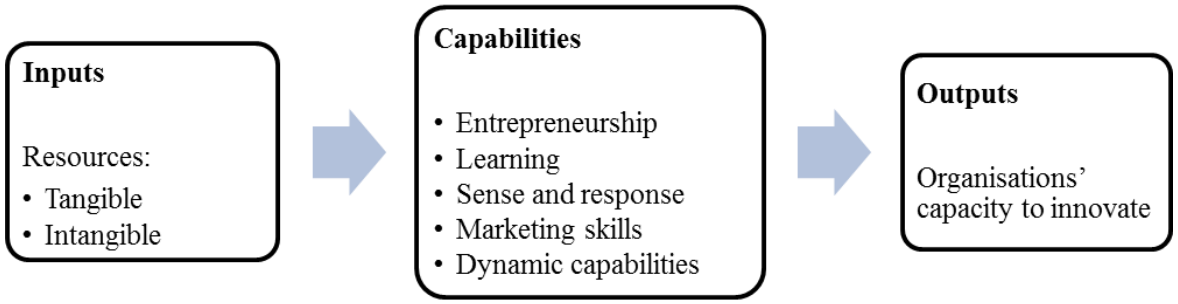


Figure 2.6: Capabilities determining organisations' capacity to innovate (Adapted from Kostopoulos et al., 2002)

Entrepreneurship is related to a long-term vision establishment for organisations, through the development of innovative products and services, aiming at higher growth. Numerous studies reveal a strong interrelationship between innovation and entrepreneurship (Anderson & Eshima, 2013; Davis *et al.,* 2013). Helfat and Raubitschek (2000) and Lynn *et al.* (1999) explained the positive relationship between learning and innovation; it enables organisations to generate and recombine knowledge and skills, adapting different market conditions. In the same vein, 'sense and response' capabilities are critical for continuous innovation (Quinn, 2000). Drucker (2014) exemplified that the integration and interaction between marketing and innovative activities is critical in order to exchange the required knowledge and information achieving successful innovation outputs. Finally, Teece *et al.,* (1997) focused on the impact of 'dynamic capabilities' on innovative practices. They found that 'dynamic capabilities' such as integration, learning and transformation can be considered as the mechanisms through which the available resources can be combined in order to produce innovative products and services.

From the Resource-based View perspective, innovative activities can be successfully developed by managing the resource endowment and core competencies of organisations. The aim of the RBV is to provide the fuel for innovation by exploiting the firms' resources heterogeneity, which offers the opportunity to increase the future value. Kostopoulos *et al.,* (2002, p.13) stated that "*while RBV expands the knowledge on the factors that determine the firm's capacity to innovate, at the same time innovation is one mechanism through which a firm can renew the value of its assets*".

2.2.4.2 Resource Based View (RBV) and Supply Chain (SC)

Hitt *et al.* (2016b, p. 75) stated that Resource-Based View theory have been extensively used in Operations Management (OM) research "*due to its ability to deconstruct the sources of a firm's competitive advantage both internally and across cooperative partnerships, such as in a supply chain*". They continued by explaining that "*Supply chain management introduces a new focus on the RBV by analysing the activities along the chain individually and collectively, and the extent to which those activities create resources for the focal firm*" (Hitt *et al.,* 2016b, p. 75). Barney (2012) reported that this theory suggests that the characteristics of Supply Chain Management (SCM) could be a source of a sustained competitive advantage for a firm. However, it is challenging to integrate and leverage the existing resources across a supply chain to create a competitive advantage (Brandon-Jones *et al.,* 2014). Orchestrating capabilities across a supply chain effectively produces greater value for customers and it is often difficult to replicate (Sirmon *et al.,* 2011).

The literature referring to Supply Chain Management (SCM) indicates that building supply chain collaborations and having access to suppliers' resources can enrich organisations' resource portfolios (Paulraj, 2011). Adopting RBV theory could provide new insights to studies on resources and capabilities across a supply chain answering the question of how organisations can manage them in order to develop new product and services, and enhance the buyer-supplier relationship, hence sustaining a competitive advantage (Ellram *et al.,* 2013).

In contrast to these assumptions, Hunt and Davis (2008) and Ramsay (2001) concluded that aspects of received Resource-based theory prevent Supply Chain Management (SCM) from

sustaining advantages; these aspects are derived by the strategic factor market theory (Barney, 1986). According to this theory, there are two market imperfections categories: i) uncertainties of resources future value and ii) aspects of luck. Barney (2012) countered the criticisms of the RBV highlighting that Supply Chain Management can be used as a capability to generate more accurate expectations of the future value of resources. Therefore, he concluded that heterogeneous Supply Chain Management capabilities can be used to create and sustain a competitive advantage (Barney, 2012).

To avoid possible confusion, it is necessary to signpost how Supply Chain Management fits with the content of this research. Therefore, the following section defines and analyses the characteristics of this principle. This is one of the main elements discussed in this thesis as it examines the impact of innovative programmes already applied or which could be applied within the Pharmaceutical Supply Chain (PSC).

2.2.5 Supply Chain Management

Introduction and definition of Supply Chain Management

Operations Management has been applied by organisations to enable the effective transformation of their inputs into outputs. However, it is vital for organisations to consider the notion of transactions. In other words, they have to manage their purchase orders and materials schedules in order to survive, prosper and be competitive. Managing the provision of the resources, necessary in order for the operations of an organisation to be delivered constitutes one of the main factors that influences the organisation's position in the market. There has been much investigation into developing systems approaches to ensure a smooth and controlled flow of information and material through Supply Chains (SC). Bamford and Forrester (2010, p.111) defined Supply Chain Management (SCM) as "*the set of activities concerned with the design, planning and control of the system which manages the transmission of materials, parts, products and services into, through and out of the organisation*". According to Hitt *et al.* (2016b, p.79) "*the goal of supply chain management is to realize the coordination of activities across the supply chain, create value for customers, and increase the profitability of every link in the chain*".

The complexity of the modern market, demands for products and services in combination with the continuing development of technology mean that Supply Chains in everyday business are investigated by an increasing number of researchers (Field & Meile, 2008; Johnsen, 2011; Fawcett *et al.*, 2014; Wisner *et al.*, 2015). The word 'chain' has been misused because it can easily be translated too simplistically; as it characterises actions that happen linearly. However, in practice, Supply Chains in business cannot rely on the neoclassical economist that recognises as the only necessity reducing the price of the item to its marginal cost and then its exchange without taking into account the relationships developed between companies (Brown *et al*., 2013). Williamson (1975) was the first who launched the concept of transaction cost economics in his book, focusing on 'dyadic' relationships rather than chains. Later, Houlihan (1987) was the first to explain the concept of Supply Chain Management (SCM), analysing the exaggerations in demand, studying a Supply Chain (SC) from end user to raw materials.

As Brown *et al.* (2013, p. 102) highlight, there have always been Supply Chains (SC); "*following the exploits of any military campaign, from Alexander the Great (356 – 323 BCE) to modern conflicts, many of the success and failures can be attributed as much too good and bad supply management as to strategy in battle*". Regarding business, an essential reference on Supply Chains (SC) occurred in the period of mass production where manufacturers began to assemble products. As a result, the existence of networked organisations was necessary in order to transport the right quantities of materials from suppliers to assembly plants on time and in the right place (Ford *et al*., 2011). In addition to this, there is evidence that many Supply Chains (SC) were well managed 1,000 years ago; for example Just In Time (JIT) systems observed this in Japan in the 1980s (Lamming, 2000).

2.2.5.1 The basic structure of a Supply Chain

The following figure (Figure 2.7) illustrates the basic structure of a Supply Chain (SC). The activities included in it can be divided into two groups: i) the upstream activities which are those taking place in front of the organisation and ii) the downstream activities, which are taking place after the organisation (Waters, 2009). The upstream activities move products, services, finances, and information inwards from the suppliers and on the other hand, the downstream activities move those outwards to the customers (Hitt *et al.*, 2016b).

Organisations receive materials from more than one supplier and offer services and/or products to more than one customer. Suppliers and customers are also divided into tiers based on the type of product/service they receive and sell. For example, suppliers who directly send the materials to the organisation are considered as first tier suppliers; conversely, customers who directly buy the product and/or service from the organisation are the first tier customers and so on.

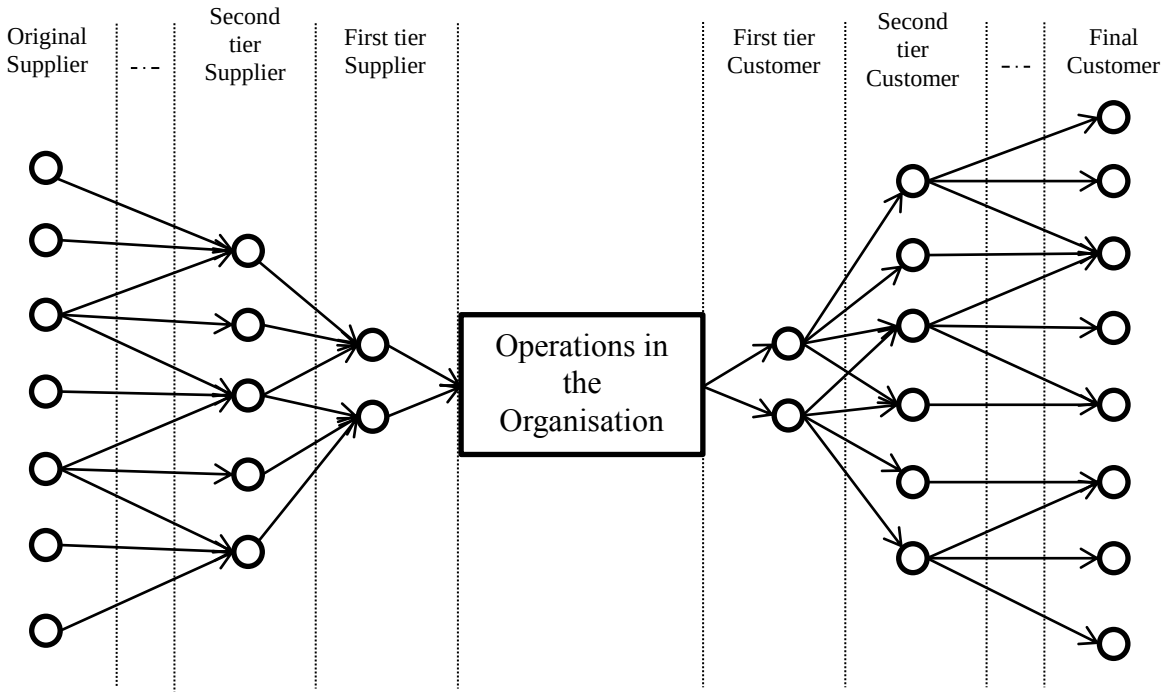


Figure 2.7: The basic structure of a Supply Chain (adapted from Waters, 2009)

There is a unique Supply Chain (SC) referring to every product which describes the production process and the complete journey of its materials (Cooper, *et al.,* 1997). Each part of the Supply Chain adds value to the final product. As Waters (2009, p.9) stated, "*materials may move through farmers, miners, processors, raw materials suppliers, agents, component markets, manufacturers, assemblers, finishers, packers logistics centres, warehouses, third-party operations, transport companies, wholesalers, retailers and whole range of other operations*".

In practice, Supply Chains are not as linear as Figure 2.7 describes. There are many variations related to the number of suppliers and customers and the flows of materials. As Waters (2009) reported, a number of factors determine the best Supply Chain structure, such as the complexity of products/services, number of components, value, capacity, technology and profitability. It is accepted that Supply Strategy (SS) is about synchronising different

organisations with different commercial motives, environments and national cultures in order to meet the market demand (Fawcett *et al.*, 2014). Therefore, a Supply Chain (SC) does not represent a simple linear chain but a network which is a complex system. Choi *et al.* (2001) referred to a concept of complex adaptive systems; in more detail, they explained that the 'operation fit' between the firms can be increased if they share their working norms in a Supply Network (SN).

Many researchers have tried to classify the different types of Supply Network (SN), but they struggled to develop models for controlling Supply Chains based upon the intervention of one organisation in the business activities of another (Lamiming *et al*., 2000; Christopher *et al*., 2006). Conversely, a group of academics, known as the Industrial Marketing and Purchasing group, highlighted that it is difficult to manage networks; however organisations can be managed within them (Hakansson *et al*., 2009). As a result, this assumption became the focus of the Supply Strategy (SS); managing the relationships between organisations and their influence on the delivering activities. It is very difficult for an organisation to remain independent of others operating in the same or similar sectors. In particular, a firm may not be able to produce each of the components for the final product well and has to find another in order to supply them. For example, in the early twentieth century, Henry Ford planned to produce every component for his famous Model T himself; however as the business grew, he realised that he could not be the best at everything, and as a result he created his Supply Network (SN) (Brown *et al*., 2013).

There is no a standard Supply Chain structure, as it depends on the factors described above. The following section analyses the challenges that the Supply Chain Management (SCM) has to deal with and the practices that can be applied to avoid adverse situations.

2.2.5.2 The SCM Challenges

There have been extensive discussions related to ways of simplifying SC, and hence improving its efficiency (Christopher *et al*., 2006, Field & Meile, 2008; Johnsen, 2011). Efficiency is directly related to customer satisfaction and as a result an efficient Supply Chain (SC) has to be able to overcome the existing gaps between suppliers and customers. Alderson (1954) and Waters (2009, p.16) suggested that there are five different kinds of gap that need to be overcome. The following table (Table 2.4) summarises those gaps.

1	Space Gap	Suppliers physically separate from customers
2	Time Gap	There is a difference between the time a product/service becomes available and the time when customers demand it
3	Quantity Gap	The amounts available from suppliers are different from the customers' demand
4	Variety Gap	Customers request a wider variety of products/services than is available from a single supplier
5	Information Gap	Customers do not know about the availability of products/services and suppliers do not know about potential customers

Table 2.4: The five different kinds of gap between suppliers and customers (adapted from Waters, 2009)

Despite the gaps that Supply Chain Management (SCM) needs to deal with, there are a number of pressures that make organisations look at ways of optimising their Supply Chain (SC) in order to survive and remain competitive. Waters (2007) categorised the changes that caused these pressures into five different groups: i) changes in management attitudes; ii) changes in the nature of markets; iii) changes in the nature of customers; iv) changes in business operations and; v) changes in the views of society. In more detail, organisations have realised the importance of Supply Chain Management (SCM) and its strategic role. As a result, they have been looking at cost reduction and efficiency improvement through managing their Supply Chain (SC) (Fawcett *et al.*, 2014; Wisner *et al.*, 2015).

Although organisations have focused on creating alliances, partnerships and collaborations, they acknowledge the risks and vulnerability existing in extended supply chains. There have been numerous reported articles analysing risk within different content (Waters, 2009; Vilko & Hallikas, 2012; Seuring & Gold, 2012). Risk has been defined as "*the threat of an event that might disrupt normal flows or materials or stop things happening as planned*" (Waters, 2009, p.474). As Vilko and Hallikas (2012, p. 587) highlighted "*Supply chains in the modern world are complicated networks that stretch over longer and longer distances, which makes them vulnerable to a variety of risks*". Risks can take a variety of forms but generally they can be categorised into two broad groups: i) external risks caused by influences outside the Supply Chain (SC), such as industrial action, wars, outbreaks of disease and price rises; and ii) internal risks that are generated within the Supply Chain Operations, such as poor management, poor forecasts, excess stock, limited financial resources, lack of information

and human errors (Al-Mudimigha *et al*., 2004; Blackhurst *et al.*, 2008; Knemeyer *et al.*, 2009; Waters, 2009).

Globalisation, use of technology and broad demand for faster deliveries generate numerous challenges for firms which have to adapt to the new situation. In addition, the increasing emphasis on customer satisfaction and the increasing number of demanding customers have raised the quality level of products and services. For these reasons, organisations have focused on new types of operation, such as lean operations, mass customisation and flexible manufacturing in order to deal with the described issues (Fogliatto *et al.*, 2012; Anderson, 2014). They have also placed attention on data analysis and decision making practices in order to be able to follow the new trends (Rostamy-Malkhalifeh & Mollaeian, 2012; Chauhan & Singh, 2013).

2.2.5.3 Managing of Change in Supply Chains

According to the previous discussion, there are a number of factors influencing organisations' Supply Chain. Those factors are gradually changing, which is something that affects SC structures. Therefore, the new situation has to be adapted such that the changes might occur. Although the aim of change is to create or maintain the competitive advantage, the adaptive period has never been easy. Carnall (1991) and Cubitt (2000) defined the stages usually followed during this period; Table 2.5 summarises them.

1	Denial	Where people deny that there is a need for change
2	Defence	Defending the current way of doing things and criticising new proposals
3	Discarding	Beginning to move away from the old ways and towards the new ones
4	Adoption	Using the new ways and accepting that they bring benefits
5	Integration	Assuming the new ways are normal and using them naturally

Table 2.5: The stages followed during an adaptive period (adapted from Waters, 2009)

Adapting to a change is not an easy process; the level of its difficulty varies based on the rate of change. As Waters (2009, p.124) stated "*major changes can be very disruptive, so*

organisations generally prefer a series of small adjustments". Incremental changes have been accepted and absorbed more easily. In addition, the benefit of this approach is that there is little disruption and risk of something going wrong; "*small changes can easily be reversed*" (Waters, 2009, p.124). Small adjustments are often translated as small improvements; therefore having adopted this approach, 'continuous improvement' can be achieved (Hall, 2013). This term, 'continuous improvement', is known as 'kaizen', which is a Japanese name. 'Kaizen' is an approach of improving operations (Pettersen, 2009; Brown *et al*., 2013). As improving operations is one of the main focuses of this research, 'kaizen' and other significant innovative approaches applied, such as Lean, Reverse Logistics (RL) and Radio Frequency Identification (RFID), will be analysed in one of the following sections.

Despite the innovative approaches adopted for improving operations, there have been other 'new' types of operations to produce and deliver products/services effectively. The traditional Supply Chain Strategy (SCS) moves finished products out of production, stores them and when orders are received it distributes them. On the other hand, there have been diverse Supply Chain Strategies (SCS) aiming at improving performance. For example, numerous researchers have focused on Postponement Strategy known as 'delayed differentiation' (Swafford *et al.*, 2006; Anand & Girota, 2007; Shao & Ji, 2008; Choi *et al*., 2012). "*Postponement Strategy delays product differentiation to a point closer to the customer*" (Choi *et al*., 2012, p.168). The literature indicates that the application of Postponement improves and simplifies the trade-off between cost and customer service considering the increasing product/service variety and the need for a quick response to customers' demand (Christopher *et al*., 2007; Yang & Yang, 2010). As Choi *et al*. (2012, p. 168) reported "*Postponement entails the implementation of specific inventory strategies for holding the right inventory at the right place and in the right form*".

The 'Direct Delivery' approach has also been adopted as an alternative strategy (Waters, 2009; Pålsson & Kovács, 2014). According to this strategy, customers buy products or services directly from the suppliers usually through online shopping. The benefits of this approach are related to reducing costs, reducing lead time and increasing the range of products and services. Other SCS focusing on improving deliveries are: Factory Gate Pricing; Cross-docking; Drop-shipping; and Vendor Managed Inventory (Droge *et al.*, 2012; Rushton *et al*. 2014).

Organisations have to choose and apply the Supply Chain Strategy (SCS) that fits with not only their mission and vision but also the specific market's characteristics in order to gain competitive advantage (Fayezi & Zomorrodi, 2015). The main objective of the SCS is to enhance SC's responsiveness with respect to its customers (Melnyk *et al.*, 2010; Qrunfleh & Tarafdar, 2013). By doing that, organisations have to identify which of the gaps presented in Table 2.4 need to be overcome and then adapt the appropriate strategy. For example, Postponement could be a business option when a firm has the opportunity to postpone the production of finished products and align their supplies to the end-demand without tremendously increasing their inventory; a representative example is that of Avon Cosmetics, which labels its finished products in the desired target language (Sehgal, 2010). On the other hand, Postponement is not an appropriate choice for a healthcare supplier because of the nature of products/services; medicines are characterised as costly, sensitive and hazardous products and they come in various forms and doses. The Pharmaceutical Supply Chain (PSC) and its specific characteristics are major elements for this research and they will be analysed in one of the following sections.

There is little doubt that the introduction and analysis of SCM has been very fruitful in understanding further the research scope; however this study focuses more on the analysis of the factors preventing the implementation of an effective SCM within the Pharmaceutical Supply Chain (PCS). Especially, it investigates how innovation could overcome these factors and assist in improving the delivery of medicines. The aspects of innovation and its particular impact upon SCM will be discussed in the following section.

2.3 Aspects of Innovation

Definition of Innovation

In order to be competitive and survive in the market, where customers know exactly what they are looking for and they are knowledgeable about the variety of available products that can meet their needs, organisations not only have to focus on the appropriate development of their strategy but also have to be innovative and deliver a continuing stream of improved or new products and services. Therefore, a key area of focus for strategic operations management is innovation. Brown *et al*. (2013, p.153) define innovation as "*the core business process associated with renewing what the organisation does and what it offers to*

the world". They also highlighted that enterprises should be capable of regular and focused change in order to survive and grow (Brown *et al*., 2013). Freeman *et al.* (2006a, p.2) suggested that innovation is *"a fundamental change in the characteristics of the organisation, its systems of production or market"*. Leadbeater (2003) characterised innovation as a lengthy and interactive process, which is based on knowledge, skills and resources. The economist William Baumol (2002) pointed out that innovation is also certainly associated with economic growth. Akenroye (2012, p.4) poited out that *"innovation is a multi-faceted phenomenon and cannot be explained with a common formula"*. Innovative approaches have been applied not only in a business marketplace, but also in the wider social context such as healthcare and literacy (Williams, 2011). However, the purpose of implementing such approaches within public services is not intended to generate profits, but is aimed at affecting the quality of services (Brandão de Souza, 2009; Young & McClean, 2009).

2.3.1 Developing Innovation

The literature indicates that manufacturing innovation focuses mainly on technological innovation, adopting new technologies and equipment (Yamamoto & Bellgran, 2013). However, some of these initiatives often concentrate on operational changes, including production processes, information and material flows or organisations' culture (Davenport & Short, 1990; Rowley *et al.*, 2011). Firms have adapted numerous diverse innovative approaches based on their strategic goals. Some of them are considered as an abrupt step change and on the other hand there are those suggesting a continuous improvement approach (Smeds, 2001). Typologies of innovation have been discussed by researchers (Cooper, 1998; Rowley *et al*., 2011), analysing the different techniques. They concluded that three main phases are involved in innovation: i) preparation, ii) design, and iii) implementation (Harrington, 1991; Guha, *et al*. 1993). Table 2.6 presents these steps.

1	Preparation	• Securing management commitment • Identifying processes to be improved • Aligning with corporate and business strategies • Establishing process vision • Setting stretched targets • Formulating projects • Providing education
2	Design	• Analysing focused processes • Exploring alternatives • Designing new processes • Prototyping and evaluating new processes
3	Implementation	• Implementing new processes • Training employees • Monitoring performance measures • Continuing improvements

Table 2.6: The phases in a process of innovation (adapted from Yamamoto & Bellgran, 2013)

Other scholars identified a more detailed development model (Greenhalgh *et al.*, 2004; Buchanan *et al.*, 2005; Rye *et al.*, 2007; Williams & Bryan, 2007; L. Sanders Jones & Linderman, 2014). They stated that the innovation pathway includes five different steps:

- Discovery: Innovation may be developed from external sources in processes such as 'opportunity identification', 'opportunity analysis', 'idea genesis', 'idea selection' and ' concept development'.
- Adoption: Adoption has been defined as the discrete organisational decision to accept or reject an innovation. The decision is based on the assessment of innovation's benefits, costs and risks. Moreover, the clarity of roles and functions play an essential role in this stage, but it is not always present.
- Diffusion: Diffusion is the process of adaptation required to accommodate the new product or practice within the particular environment.
- Routinisation: Routinisation can be defined as the process through which innovations are maintained for an appropriate period. In other words, routinisation requires the innovation to be made sustainable and become part of the corporate culture, by embedding into practice new ways of working, performance management regimes and cultural norms.

- Substitution: In order to maintain the improvement condition of a continually innovating service, the identification and replacement of products and practices that are no longer useful is deemed necessary.

The innovation literature classified changes or innovations into one or more of the following three dimensions: scale of change, subject of change, and innovativeness of change (Yamamoto & Bellgran, 2013). The first dimension, 'scale of change', refers to the system level where a change may occur: this can happen at the subsystem level or across the whole system (Tidd, *et al.*, 2005). The 'subject of change' involves the elements that are going to be changed; there have been different forms of innovations such as product, services or process innovation (Menor & Roth, 2008; Lewis *et al.*, 2010), technical innovation (Lai *et al.*, 2008), and organisational, management, production, or marketing innovation (Camison & Lopez, 2010). Regarding the third dimension, 'innovativeness of change', the degree of novelty involved in a change is examined. This dimension includes two categories: i) radical innovation: the development of new processes that are different from the existing ones (Dewar & Dutton, 1986); and ii) moderate innovation: the development of processes and systems that are new to the organisation but not new to the industry (Tidd *et al.*, 2005).

Yamamoto and Bellgran (2013) created a matrix that helped to define and categorise the different types of innovation. Figure 2.9 presents their model. The horizontal axis of the model refers to the classification of innovation in terms of its innovativeness and the vertical axis represents the classification of innovation in terms of area of focus. Hayes and Wheelwright (1984) defined two categories related to the focus area: i) structural, where innovation occurs in the structural area, such as production capacity, design and technology; and ii) infrastructural, where changes happen in the infrastructural area, such as production control systems, material flows, and organisational structure and culture.

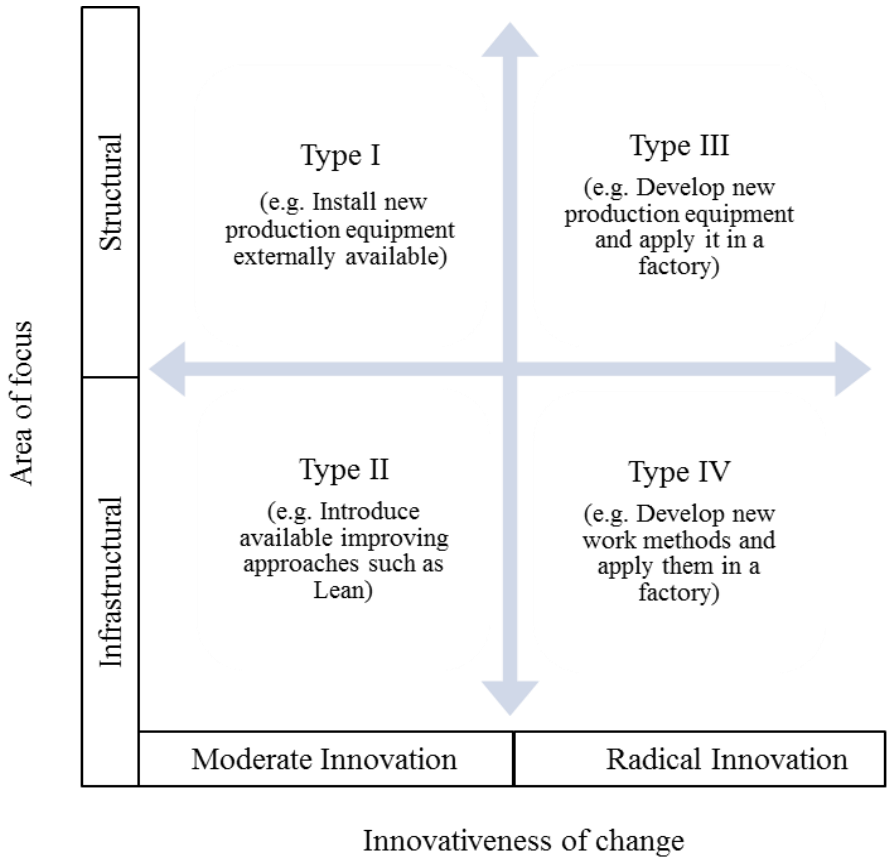


Figure 2.8: The four types of manufacturing innovation model (adapted from Yamamoto & Bellgran, 2013)

According to Hayes and Wheelwright (1984) the changes occurring in the structural area have long term impacts, are difficult to reverse and also tend to require substantial capital investment. On the other hand, changes in the infrastructural area require constant investments during the implementations, but it is hard to traditionally evaluate their cost and benefits (Alange *et al.* 1998) because of their focus upon intangible assets such as knowledge, skill, leadership, and alignment of people within the organisation (Teece, 1980). Yamamoto and Bellgran (2013) suggested the use of their model by organisations during the decision making process of strategic directions.

Rowley *et al.* (2011) mapped the different types of innovation by matching the definitions offered by previous authors (Damanpour, 1987; Cooper, 1998; Boer & During, 2001; Johannessen *et al.*, 2001; Hovgaard & Hansen, 2004; Francis & Bessant, 2005; Oke *et al.*, 2007; Velamuri *et al.*, 2008). Their classification includes four types of innovation which are summarised in the following table (Table 2.7). They concluded that "*there is an obvious overlap between different types of innovation such as administrative, organisational*

structure, and people; there is also no clear distinction between the wider categories of innovation, e.g. product and process, as a product innovation may involve a number of process innovations, or a position innovation might lead into product innovations" (Rowley *et al.*, 2011, p. 84).

1	Product innovation	Changes in the products/services that an organisation offers
2	Process innovation	Changes in the way in which products/services are created and delivered
3	Position innovation	Changes in the context in which products/services are introduced
4	Paradigm innovation	Changes in the underlying mental models which frame what the organisation does

Table 2.7: The different types of innovation (adapted from Rowley et al., 2011)

Tidd and Bessant (2009) created a framework that represents the ways innovation can contribute to strategic advantage. They concluded that the main way of gaining strategic advantages through innovation is by offering a product or service which competitors cannot provide due to some specific obstacles. For example, pharmaceutical companies are not able to produce blockbuster drugs such as Zantac, unless they pay a license or other fees (Tidd & Bessant, 2009). They analysed this assertion further, explaining that strategic advantages can also be achieved by offering products or services faster, at lower cost and of better quality or by adopting best practices from other sectors, as low-cost airlines have applied rapid changeover techniques used in manufacturing to facilitate fast turnaround times at airports (Tidd & Bessant, 2009). Furthermore, competitive advantage can undoubtedly come from offering a new product or service; a typical example would be the application of the first automated teller machine (ATM) service by Citibank which developed a strong market position by offering this service (Brown *et al*., 2013). Moreover, the establishment of a sophisticated IT-led production network led the Spanish firm Zara to become one of the world's most successful retailers (Tidd *et al*., 2005).

Researchers have extensively analysed and categorised the determinants of innovation that affect its creation, adaption and implementation. These are listed below, as they have been identified by reviews (Berwick, 2003; Greenhalgh *et al.*, 2004; Buchanan *et al.*, 2005; Rye & Kimberly, 2007; Williams & Dickinson, 2008; Kim *et al.*, 2012):

- Characteristics of the innovation
- Characteristics of the adopting individuals
- Characteristics of the adopting organisations
- Characteristics of the wider environment

There are some key characteristics of the innovation that influence its adoption by organisations. These include the following (Rogers, 2003; Helfrich *et al*., 2007; Rye & Kimberly, 2007; Kimberly & Cook, 2008):

- Relative advantage: The extent to which the innovation is better than current practice. This is linked to the extent to which the new way of working or the new philosophy has improved the production of services and has convinced end users.
- Compatibility: The extent to which the innovation fits with current beliefs, practices and cultures.
- Complexity: The extent to which an innovation is simple to be adopted.
- Trialability: The extent to which an innovation can be introduced initially on a small scale in order that its benefits can be observed prior to full implementation.

As is indicated, these characteristics of innovation can influence its adoption and they are connected with the approach to its introduction. In other words, they are shaped by the strategy adopted, the availability of information and the extent of support for implementation (Rye & Kimberly, 2007).

The role of individuals during the implementation of an innovative intervention represents another barrier to its success. The classic diffusion of the innovation model categorises individuals as (Rogers, 2003):

- Innovators: Their role is to create innovation.
- Early adopters: Their role is to facilitate introduction of new practices and products.
- The early majority: A group of individuals whose role is to adopt a new innovation.
- The late majority: A group of individuals whose role is to adopt an innovation when it appears to be the status quo.
- Laggards: A group of individuals who retains a preference for previous practices.

However, these categories have been developed in relation to products rather than process-based innovations (Buchanan *et al.,* 2007); therefore they are not applicable for every innovation in every context (Berwick, 2003). In addition, each adoption process is influenced by participants' characteristics, such as: individual cognitive capacities, knowledge, attitudes perceptions and behaviour patterns (Grol & Wensing, 2004; Williams & Dickinson, 2008). It is generally accepted that individuals should be engaged as active change agents and work together as a team in order to cross organisational and functional boundaries (Greenhalgh *et al*., 2004).

As mentioned previously, the adoption of innovation depends largely on organisational context (Helfrich *et al.,* 2007; Rye & Kimberly, 2007; Williams & Dickinson, 2008; Kim *et al.,* 2012; Burnes, 2014). There are some organisational characteristics that impact upon any adoption process. Initially, it has been observed that organisations, which are functionally differentiated, can assimilate an innovative intervention faster and more effective than those that are functionally centralised, with decision-making concentrated at the top of the hierarchy (Greenhalgh, 2004). In other words, innovative organisations prefer to have clear lines of responsibility, multifunctional networks of co-working and information exchange (Buchanan *et al.,* 2005).

Innovative programmes can only be successful if they lie at the heart of what organisations are willing to renew (Michel *et al.,* 2013). Conversely, organisations should consider the environment in which innovative programmes are to be applied, including structures, policies, procedures and techniques, in order to be able to manage those (Freeman *et al*., 2006b). Firms often face difficulties in changing their practices, core strengths or culture due to the fear of failure or the fear of the unknown. It has been claimed that approximately 70% of change initiatives fail (Senturia *et al.,* 2008; Burnes, 2011). There are many reasons behind this high level of failure (Burnes & Jackson, 2011); among them, the most frequently cited is employee resistance to change (Burnes, 2014). Research indicates key practices that improve innovation processes and those that are associated with failure (Adams, 2006; Tidd & Bessant, 2009). Many organisations such as Toyota, H-P, Apple and Google have reflected upon and codified their innovative approach (Brown *et al*., 2013).

It is worth mentioning that innovative practices cannot be copied easily; they have to be adopted through experience, trial and error (Augsdorfer, 1996). Thomas Edison, who is considered the godfather of successful innovators as he registered 1,000 patents during his

life, understood that having a good idea was not enough; 'it's 1 per cent inspiration and 99 per cent perspiration' as he is reputed to have said, in order for this idea to turn into successful reality (Bright, 1949). For example, organisations involved in science-based activities, such as pharmaceuticals and electronics, tend to manage innovation through patent protection and searching or internationalisation; by contrast, firms in the retail sector may focus on marketing, discovering new consumer trends (Brown *et al*., 2013).

Furthermore, Teece (1997) suggested that a successful innovative programme is associated fundamentally with knowledge; with managing the knowledge bases of a firm in order to be able to deploy in new products or processes (Leonard-Barton, 1995). Location, access to materials and the use of technology represent some of the advantages that characterise a successful organisation; however they are often not sustainable, a fact that renders knowledge one of the essential elements of innovation (Leonard-Barton, 1995). Innovation researchers Keith Goffin and Rick Mitchell invoke the metaphor of the pentathlon in athletics, where being good at one discipline is not enough, to explain that firms need to master many different skills in order to be successful (Goffin & Mitchell, 2005).

Innovative processes are not only associated with the creation of commercial value, but there is also evidence of the adoption innovative approaches in the public sector (Brandão de Souza, 2009; Young & McClean, 2009). Hospitals such as Leicester Royal Infirmary in the UK or the Karolinska Hospital in Stockholm, Sweden have improved the quality and effectiveness of care services; they have reduced waiting lists for elective surgery by 75% and cancellations by 80% (Brown *et al*., 2013). However, there are significant differences in organising and managing the process of innovation; public services, such as health, welfare and education, are characterised by high risk, therefore the possibility of failure is not acceptable (Brown *et al*., 2013). The following section will discuss how innovation can be adopted within the challenging healthcare environment, which is the focus context of this research.

2.3.2 Innovation in the Healthcare Sector

Healthcare has one of the most important roles in society and it requires great investments and constant improvement, because it is associated with human life. The proper functioning of this system has resulted in more patients being adequately taken care of and more lives

being saved (Department of Health, 2014). For this reason, the need for improving the production of healthcare services with respect to the quality of service, patient safety and satisfaction, and the cost of care is now widely accepted (Institute of Medicine, 2007; Smits *et al.*, 2009; Chassin, 2013; Page, 2014). The increased pressure on healthcare organisations to reduce their pharmaceutical spending converts this need into an urgent one (Lainez *et al.*, 2012; Al-Balushi *et al.*, 2014). Hoping to overcome the limitations of a function-based organisation, many healthcare organisations have adopted various improvement approaches and innovative interventions (Radnor & Boaden, 2008; Brandão de Souza, 2009; Ouma *et al.*, 2015). However, these approaches remain patchy and methodologically limited (Bamford *et al.*, 2015a).

Innovation is identified as a source of concern to the reform agenda in healthcare, both nationally and internationally (Williams, 2011). Rye *et al.* (2007) define innovation as any practice or product that represents a conscious and significant departure from current behaviour. There is also another definition by Omachonu and Einspruch (2010), who suggest that innovation can be considered as the intentional introduction of new or significantly improved services, processes or products within the organisation in order to benefit it and wider society. Consequently, it is generally agreed that the existence of innovation implies progress and improvement (Williams, 2011). Reviews of healthcare reforms and performance have confirmed that innovation in the healthcare sector is considered to lag behind that in non-healthcare sectors (Black, 2006; Liddell *et al,* 2008; Stirman *et al.*, 2012). There are a number of key reasons that impact this underperformance.

Fragmented – Centralised Environment

The implementation of innovative interventions depends on the organisational context (Williams & Dickinson, 2008; Bamford *et al.*, 2015a). Therefore, identifying and understanding the characteristics of the healthcare sector plays a crucial role in successful implementation of such applications. In particular, healthcare organisations are generally relatively centralised organisations (Bamford, 2011). Laws and regulations likely influence the adoption and diffusion of innovation or delay them.

At the same time, overall expansion and internal differentiation have increased without equivalent integration of constituent parts (Williams, 2011), which may be responsible for the

existence of fragmentation and duplication in services (Radnor & Boaden, 2008). A disconnection between evidence and practice and as a result a slow uptake of innovation has been observed within healthcare (Grol & Wensing, 2004). This delay may be driven by factors such as fragmentation in commissioning and procurement practices in healthcare (Williams, 2011); lack of interaction between industry and the public sector (HITF, 2007); and the sub-optional use of guidance (Liddell *et al*, 2008).

Considering that decision making processes and in particular inventory management decisions are influenced by myriad stakeholders such as pharmacists, physicians, suppliers, the government, and so on (de Vries, 2011), the need for a high level of trust between them is vital and is often difficult to achieve. Augulo *et al.* (2004) argued that this element is one of the main ingredients for applying innovation. On the other hand, sharing information regarding drug usage variables is considered ethically inappropriate because that would violate patient privacy (Bhakoo *et al.*, 2012). Therefore, the weak knowledge and information flow event between the physicians and the pharmacies cause considerable barriers to implementing innovation.

Cultural Inertia

Despite the lack of required data, another factor preventing innovation is cultural inertia. Healthcare personnel are rather sceptical of adopting innovation because they are afraid of losing control over the important clinical functions and also there is a fear of changing their role and responsibilities; they perceive changes in the way that they operate as a threat (Burnes & Jackson, 2011). They are not interested in using new technologies that might cause a number of glitches (Danese, 2006; Vigtil, 2007). Healthcare organisations often deal with difficulties in changing their practices, core strengths or culture due to fear of failure or fear of the unknown. As Brown *et al*. (2013) explained the level of risk in healthcare services is considerably high, as changes might impact patient safety; therefore the possibility of failure is not acceptable.

Organisations need to be ready to adopt innovation which, on the other hand, needs to be tailored to fit a specific process and environment to generate improvements (Bamford, 2011 Alves *et al.*, 2012). Innovative programmes are not always suitable; they need to be adapted to the specific environment (Bamford *et al.*, 2015a). This fact may explain why there is a low

level of applied innovation in the healthcare sector (Proudlove *et al.*, 2008; Al-Balushi *et al.*, 2014; Papalexi *et al.*, 2015).

High Cost of Innovation

D'Este *et al.*, (2012) found that among others, one of the main factors supporting successful innovation is the capacity to access finance. There have been numerous reported studies describing organisations' failed attempts to be innovative due to financial obstacles (Tiwari *et al.*, 2007; Savignac, 2008; Mancusi & Vezzulli, 2010). The presence of financial constraints significantly minimises the likelihood that organisations will implement innovative programmes (Savignac, 2006).

Considering that there has been pressure to minimise healthcare expenses, the cost of applying innovation could prevent healthcare organisations being innovative. Although theoretically innovative programmes such as Lean thinking or reverse logistics are not considered as expensive implementations, investments still need to be made in order to gain the required knowledge, information or experience (Weingart *et al.*, 2012). Conversely, the application of new technology, such as integrated software for managing the healthcare data, is a more expensive initiative because it requires the purchase of suitable equipment in addition to the described investments (Bubalo *et al.*, 2013).

Awareness of Innovations

Another factor that affects the effective launch of innovative interventions in the healthcare sector is the low awareness of innovations. In other words, it is observed that healthcare professionals have limited knowledge of innovation and the existing information on this is not always accessible, especially in the area of organisational and process innovations (Grol & Wensing, 2004; Greenhalgh *et al.*, 2012). As a result, there is a shortage of expertise and methods, which means that healthcare professionals find it difficult to support such implementations. The lack of experience might lead to adoption of incorrect methods or the sub-optional use of the existing guidance (Department of Health, 2012), which explains why this sector is behind in adopting and implementing effective Supply Chain management (SCM) approaches (Baltacioglu *et al.*, 2007; Bhakoo *et al.*, 2012). In addition to this, relying

on external change agents to achieve continual improvement is insufficient (Greenhalgh *et al.*, 2004).

Complexity of the Healthcare Sector

Numerous researchers focusing on the healthcare sector have characterised the Healthcare Supply Chains (HSC) as more complex compared to SCs in other industries (Scheller & Smeltzer, 2006; Liddell *et al.*, 2008; Papalexi *et al.*, 2015) because of the impact on patient's health requiring an adequate and accurate medical supply (Mustaffa & Potter, 2009). Specifically, Plsek & Greenhalgh, (2001, p.627) defined a complex system as "*a collection of individual agents with freedom to act in ways that are not always totally predictable, and whose actions are interconnected so that one agent's actions changes the context for other agents*". The healthcare context sensitivity is the main factor that generates the complexity of the system (Kannampallil *et al.,* 2011). The behaviour of the healthcare complex system is often unpredictable because it includes a number of diverse elements, whose relationships are not linear (Wilson & Holt, 2001). The specific products and services delivered by healthcare organisations and the diversity of people working within this sector, their roles and actions are some of the reasons responsible for the high complexity of the system (Bar-Yam, 2006). In addition, the complexity of healthcare organisations, which classifies them as high cost institutions, can itself prevent innovation (Greenhalgh *et al.,* 2012). According to Davies and Edwards (2013) lack of long-term research funding programmes has been considered a main factor for the implementation of sustaining innovative healthcare initiatives.

It has been observed that many implementations of innovative interventions have failed due to adoption of incorrect methods or inappropriate design of an innovative project (Stirman *et al.,* 2012). For this reason, there is a need for a clear understanding of how organisations operate and how they respond to new practices (Leeman *et al,* 2007). The following figure (Figure 2.9) represents the healthcare organisations' characteristics which attract or prevent the implementation of innovative interventions in this sector.

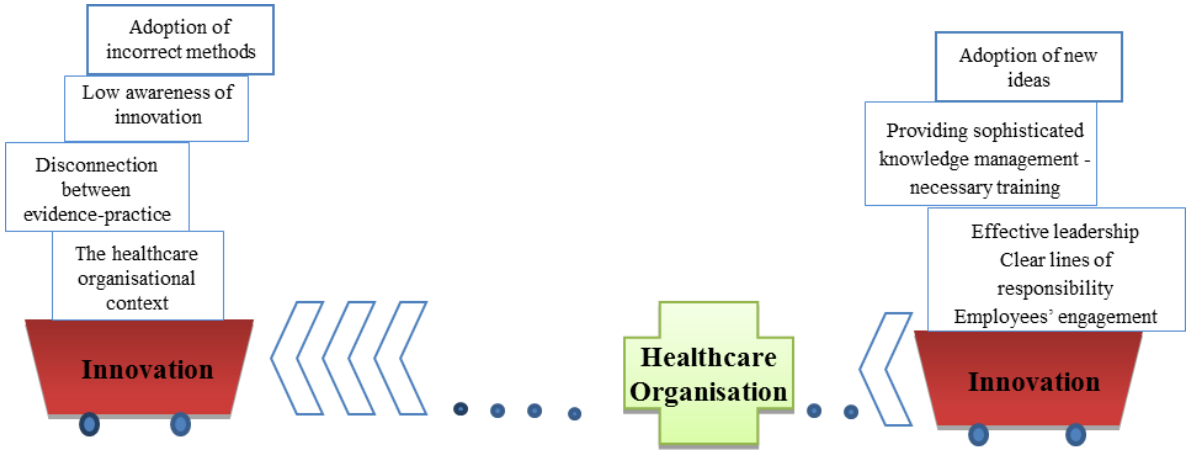


Figure 2.9: Factors that attract/prevent Innovation within the Healthcare sector

2.3.2.1 Innovation within the Pharmaceutical Supply Chain (PSC)

Globally, healthcare costs are growing rapidly; "*supply-related costs constitute approximately 30 per cent of hospital expenditure*" (Bhakoo *et al.*, 2012, p.217). In particular, total spending on medicine was $1,069 billion in 2015, with an estimate of $1.4 trillion to be spent on medicines worldwide in 2020 (Statista, 2016a). The literature indicates that implementing effective Supply Chain Management (SCM) raises the opportunity of reducing the expenditure, hence improving services' effectiveness (Kearney, 2009; Jamali *et al.*, 2010; de Vries, 2011; Xie & Breen, 2012). However, due to the lack of experience, compared with other industry sectors, this sector is behind in adopting and implementing effective Supply Chain management (SCM) approaches (Baltacıoğlu *et al.*, 2007; Bhakoo *et al.*, 2012). Many researchers have analysed this issue concluding that the healthcare SC's complexity is the reason for the sector's difficulties in adopting best practises (Scheller & Smeltzer, 2006; Liddell *et al.*, 2008; Williams, 2011).

The literature reveals that the supply chain associated with pharmaceutical products is vital in providing adequate supplies of medicine due to its impact upon people's health and wellbeing (Mustaffa & Potter, 2009). For a better understanding of the PSC, a description of its typical structure is considered necessary. The description focuses only on the distribution of finished products where there are a number of different channels:

- The dominant intermediary is the wholesaler; approximately 80% of pharmaceutical items flows through this channel (Shah, 2004)

- Pharmacies receive an amount of products directly from the manufacturer's distribution centre
- In some cases, Group Purchasing Organisations may have the responsibility for supplying pharmacies with the required products (Roark, 2005)

Healthcare Supply Chains (HSC) have been characterised as more complex when compared to SCs in other industries (Shah, 2004; Black, 2006; Scheller & Smeltzer, 2006; Liddell *et al.*, 2008; Papalexi *et al.,* 2015). In addition, Mustaffa and Potter (2009) state that supply chain management is more complex in healthcare than in other industries because of the impact on patient's health, requiring an adequate and accurate medical supply. A number of researchers have examined the healthcare supply chains, concluding that there are several factors contributing to their complexity (Steelfisher, 2005; Buchanan *et al.*, 2007; Bhakoo *et al.*, 2012; Xie & Breen, 2012). Table 2.8 summaries those factors.

1	Significant number of stakeholders
2	Limited understanding of OM and SCM
3	The institutional and regulatory pressures
4	Long development cycles
5	The particular characteristics of medicines
6	Difficulties in predicting the exact demand for medicines
7	Difficulties in predicting the patient mix

Table 2.8: The factors of PSC complexity

Numerous stakeholders involved within the PSC, such as suppliers, pharmacists, physicians and management and clinical staff, increase the complexity of the delivery system (de Vries, 2011). The reason for this is that those stakeholders have different roles and responsibilities within the PSC and sometimes act as independent parties without sharing the required information for producing healthcare services; for example, weak information flow has been reported between the physicians and the pharmacy departments (Bhakoo *et al.*, 2012). The involvement of a significant number of stakeholders having their own agenda influences the innovative approaches. For example, physicians often blame technology-driven products or processes for the complexity of the system and its high cost (Herzlinger, 2006).

The role of physicians, who have not possessed an extensive knowledge of operations management and SCM practices and techniques, as the key decision-makers regarding the procurement of prescription medicines, is one of the main issues of this system (Scheller & Smeltzer, 2006; Bhakoo *et al.,* 2012). Richardson and Pollock (2010) referred to a pharmacist as 'a dispenser of pills and potions'. Breen *et al.* (2015) focused on the role of pharmacists by exploring their critical management skills needed in order to perform effectively. Davies *et al.* (2013) highlighted that the continuous growth of the pharmacy sector requires more qualified pharmacists, without taking into account the lack of management modules during their degree. SCM skills are required when pharmacists are looking to improve the service quality through applying innovation (Uthayakumar & Priyan, 2013).

Another factor that makes the PSC more complex is related to the institutional and regulatory pressures (Shah, 2004) which cause problems in determining accurate sales forecasts (Bhakoo *et al.,* 2012). For example, there is an issue with the mainstay drugs that are ending their patent protection tenure and the competition this may bring about, that generics may enter the marketplace (Kiely, 2004; Shah, 2004). Furthermore, restrictive polices often prevent or delay the innovative interventions (Herzlinger, 2006).

Similarly, long developmental cycles of pharmaceutical products cause difficulties in applying Supply Chain Strategies (SCS) (Bhakoo *et al.,* 2012). The pharmaceutical supply chain is characterised by long lead times; products need between 1,000 and 8,000 hours to pass through the whole supply chain (Mustaffa & Potter, 2009). Forecasting is one of the main issues that have been observed during the distribution of medicines from the wholesaler to pharmacies (Mckone-Sweet *et al.*, 2005). There is difficulty in predicting the exact demand for medicines, partially due to the lack of standard nomenclature and partially due to the fact that medicines are stored in several areas of a healthcare organisation (Mustaffa & Potter, 2009). The unpredictable demand might prevent innovative initiative such as Just In Time (JIT), which requires a balance between the capacity and the demand of care (Kollberg *et al.,* 2006).

One of the other increasing concerns in the pharmaceutical industry is related to particular characteristics of medicines. In other words, pharmaceuticals, on the one hand, are expensive products and, on the other hand, can be converted into dangerous or useless products for consumers due to their short expiration dates (Cherrett *et al.*, 2012). Globally, the total size of the pharmaceutical market, in 2013, was estimated at $870,200 million, with North America

being the world's largest market with a 41.0% share following by Europe with a 27.4% share (IMS Health, 2013). In Europe, pharmaceutical constituted 16.5% of total health expenditure, in 2013 (OECD Health Data, 2013). In 2012, the global medical waste management market was estimated $14.5 billion and is expected to increase by 4.8% during the forecast period of 2013 to 2019 (Transparency Market Research, 2014).

Besides the actual economic impact on the market, disposal of expired/unwanted medication can be very costly and harmful to health and the environment. In particular, there is an emerging concern about the potential impact of pharmaceuticals that reach lakes and rivers via sewage plants and other sources (New Hampshire Department of Environmental Services, 2009). A report published by the Department of Health (2012) highlighted this issue, emphasising that a series of actions needs to be undertaken, aiming to address medicines wastage (DoH, 2012). Therefore, it has been apparent that the implementation of any innovative initiative that could minimise pharmaceutical waste is an urgent for healthcare organisation and wider society.

Aside from the difficulties in predicting the exact demand for drugs, there are difficulties in predicting the patient mix, understanding their needs and ultimately their supply consumption (Jarrett, 1998; Scheller & Smeltzer, 2006), specifically in emergency interventions. This unpredictable demand is one of the elements that force healthcare organisations to carry high levels of safety stock, avoiding uncertainties such as daily demand fluctuations and supply bottlenecks (Danas *et al.,* 2006; Bhakoo *et al.,* 2012). However, these practices could increase the level of waste observed within the PSC, which means that more expired or unwanted medication would have to be disposed of, raising the threat to the environment and human health (Wang *et al.,* 2015).

The above factors could either prevent or support innovation (Herzlinger, 2006). Healthcare organisations need to acknowledge them in order to avoid them or turn them to their advantage. Especially, the healthcare sector, where there is an increasing demand for not only new therapies and new medicines but also new service delivery models, has to deal with and adapt the new trends. For example, Daly *et al.* (2015) proposed that the pharmaceutical sector should adopt approaches that enable late-stage customisation and manage multiple co-existing agile supply chains to be able to deal with future trends; sustaining a broader range of more specialised products at lower volumes (Voura *et al.,* 2011) and satisfying current market and volume demands (Daly *et al.,* 2015). As Harrington and Srai (2012) highlighted,

there is a need for healthcare organisations to shift from a traditional 'batch' mode of processing towards a more 'continuous' model.

It is generally agreed that, in the Pharmaceutical Supply Chain (PSC), the majority of the initiatives have concentrated more in reducing the Pharmaceutical Inventory (PI) and consequently the Supply Chain Costs (SCC). However, Hendricks and Singhal (2005) believe that Supply Chain Strategies (SCS) that focus on cost reduction are ineffective because they have ignored the risks from supply chain disruptions. In addition to this, they identify a number of consequences of a failure to manage risks effectively, which include financial losses, negative impact on product quality and an organisation's reputation, and also conflict amongst the organisation's stakeholders (Hendricks & Singhal, 2005). Moreover, economic, political, and social developments increase the risk of supply chain disruptions, as supply chains are gradually becoming longer and more complex (Khan & Burnes, 2007).

Aiming to overcome the described issues and help healthcare organisation to adopt innovation effectively, healthcare institutions, such as NHS in the UK and the Veteran's Affairs health system in the USA, have outlined key elements of an innovation infrastructure and strategy in a number of publications based on their experience of innovation and improvement (Modernisation Agency, 2004; Buchanan *et al,* 2005; Maher *et al,* 2008; Doyle *et al.,* 2013). These elements can be used by other institutes as guidelines in order to adopt best practices and improve the production of their services. The next section discusses those initiatives and analyses some of the innovative programmes that have been or could be applied within the PSC according to the literature. The best practices and the benefits that an organisation can claim are highlighted and analysed.

2.3.2.2 Best practices of applied innovation within the PSC

A number of initiatives have been undertaken with the aim to improve Healthcare Services (HS) whilst reducing Supply Chain Costs (SCC) (Kearney, 2009; Jamali *et al.,* 2010). The NHS Modernisation Agency found sustaining and spreading innovations a key challenge, particularly those involving changes to service delivery (Buchanan *et al.,* 2007). To counter this, the National Institute for Health and Clinical Excellence (NICE) was established to supervise and evaluate the progress of institutions to improve their services, providing evidence-based practice guidelines (WHO, 2004). A key aim of NICE is to engender

innovation through the rapid dissemination of new cost-effective interventions (Steelfisher, 2005). For example, Cooksey (2006) recommended increased funding to introduce evidence-based technology adoption within the NHS.

The UK Department of Health produced a series of guidelines on best practice waste management; for example, in December 2012 an action plan to reduce medicines waste was launched, aiming to determine how best practice can be shared to improve the use of medicines and address medicine wastage within the NHS (Department of Health, 2012). In a similar vein, the National Organisation for Medicines in Greece provides useful information regarding the best use of medicines, aiming to inform healthcare organisation about the rational use of pharmaceutical products, taking into account their social and economic dimensions (National Organisation for Medicines, 2016).

Kim (2005) developed an integrated Supply Chain Management System (SCMS) for improving inventory control and reducing the corresponding cost of pharmaceutical products in the healthcare sector. The author found that the developed Supply Chain Management System (SCMS) can decrease the total pharmaceutical inventory by more than 30%. In addition, Xie and Breen (2012), in their research, designed a green community Pharmaceutical Supply Chain (PSC) that reduces preventable pharmaceutical waste and effectively disposes of inevitable pharmaceutical waste, using a cross-boundary green PSC approach that requires every actor in the PSC to participate in environmentally-friendly practices.

Theoretical innovations such as Lean thinking (Burgess & Radnor, 2013; Baker, 2014), along with technological innovations such as 'Radio Frequency Identification' (RFID) (Wamba *et al.,* 2013) and the development of information technology (IT) (Cranfield *et al.,* 2015) are being increasingly adopted and implemented throughout the Pharmaceutical Supply Chain (PSC). Initial interventions have focused on applying Just-In-Time (JIT) approaches (Ndubisi *et al.,* 2005; Braga *et al.,* 2015) and inventory control systems such as Vendor Managed Inventory (VMI) (Mustaffa & Potter, 2009). Kim (2005) stated that improved information reliability, fewer errors and a 30% reduction in the inventory were some of the benefits recorded by applying VMI. The application of Lean Philosophy and Reverse Logistics (RL) has been suggested as a solution in order to reduce preventable pharmaceutical waste and increase the quality of healthcare services (Defee *et al*., 2009; Kumar *et al*., 2009; Breen & Xie, 2015). The following sub-sections present and discuss those innovative approaches.

Reverse Logistics (RL)

There have been many initiatives regarding the improvement of Supply Chain Management (SCM), however, the challenge for those involved in managing Supply Chain (SC) is not only to manage the forward components of the logistics process in order to minimise waste and maximise consumer satisfaction and wellbeing but, increasingly, to manage and improve the reverse components as well (Christopher *et al.,* 2005; Cardoso *et al.,* 2013; Xie & Breen, 2014). In other words, the need for the re-use or recycling of unwanted stock has become a major issue in many industries (Rupnow, 2007), such as: computers (Kumar & Putnam, 2008); automobiles (Lebreton & Tuma, 2006); electronic waste (Lau & Wang, 2009); packaging material (González-Torre *et al.,* 2004); paper (Pati *et al.,* 2008); batteries (Zhou *et al.,* 2007) and bottling or glass (González-Torre & Adenso-Díaz, 2006).

Reverse Supply Chain Management (RSCM) is defined as the effective and efficient management of the series of activities required to retrieve a product from a customer in order to either dispose of it or recover value (Prahinki & Kocobasoglu, 2006; Defee *et al.,* 2009). The literature indicates that the benefits resulting the implementation of RSCM are related to reduced investment in resources (Andel, 1997), reduced material cost (South, 1998), and enhanced customer satisfaction through providing high quality products and services (Blumberg, 1999).

The research on reverse logistics has tended to focus on automobiles, scrap metal, sales packaging material and waste paper recycling (Kumar & Putnam, 2008; Skinner *et al.,* 2008). For example, Philips Global reduced the number of returns from 1.2 to 1.3 million per year to less than 500,000 (Sciarrotta, 2003). Moreover, the Waste Electrical and Electronic Equipment (WEEE) recovery systems of many countries have been studied, examining their impact on environmental and economic sustainability (Georgiadis & Besiou, 2010). Erol *et al.* (2010) examined the current state of reverse supply chain management (RSCM) initiatives in several Turkish industries. Their research shows that the RSCM initiatives in the considered industries are still at a very early stage; Companies' involvement in product returns is mostly due to the legislative liabilities (Erol *et al.,* 2010). It is worth mentioning that laws regarding end-of-life and take-back products have been enacted both in the European Union (EU) and the United States (Prahinski & Kocabasoglu, 2006).

There is an increasing awareness regarding fitness for intended use and safety of a product which is associated with any type of product, whether it is produced by children's toy industry, food/produce industry or pharmaceutical industry (Kumar *et al.,* 2009). Therefore, research on reverse logistics in the pharmaceutical industry has begun to be reported. The medical industry respects that pharmaceutical returns management is a $2.5 billion dollar business with an estimated $5 billion dollars of expired products, recycled, damaged packaging and incorrect deliveries (Kabir, 2013). A representative example of reverse logistics application is that of Aurora Health Care Pharmacy, which keeps returns at less than 2% of its total inventory despite stringent regulations related to expiration dates, manufacturer recalls and proper disposal of drugs (Morton, 2006).

Kumar *et al.* (2009) analysed the pharmaceutical supply chain using the Define, Measure, Analyse, Improve and Control (DMAIC) process for improvement of reverse logistics. They found that specific information on the Pharmaceutical Supply Chain was limited due to the fact that the majority of the reverse logistics for pharmaceuticals is handled through third-party providers (Kumar *et al.,* 2009). There were also a few pilot programmes being conducted such as Pfizer using an RFID approach on Viagra to secure the supply chain (Xtalks, 2007). Nevertheless, academic researchers and practitioners believe that pharmaceuticals are different and they cannot be treated like other commodities (Savage *et al*, 2006). The reasons for this sentiment are the level of regulation in the production, storage, distribution and consumption and the complexity of the fabric of this supply chain (Porter & Teisberg, 2006; Knight, 2005). Therefore one of the other increasing concerns in the pharmaceutical industry today is the adoption of approaches for managing sustainability (Cherrett *et al.,* 2012).

Sustainability

A challenge for every organisation, especially for healthcare organisations, is the implementation of projects supporting organisational sustainability to reverse the logistic supply chain (Closs *et al.,* 2011). Sustainability has been recognised as an increasingly important strategic goal by global organisations (Siegel, 2009). Sustainability has been categorised into three primary components, often referred to as the 'triple-bottom-line': economic, social, and environmental components (Robins, 2006).

- Economic factors: Focusing on the pharmaceutical industry, the benefits of applying return policies will be the reduction of expired drugs and storage space. It is worth mentioning that medication retrieved from patients cannot be re-used, as with other products, and must be disposed of or sold at a lower price in other markets (De Brito & Dekker, 2003). However, this information can be used to assess the efficiency of the prescribing process (Breen & Xie, 2009).

- Environmental factors: The strategic aim of a returns service for medication is to facilitate safe disposal, remove excessive storage of medicines in the home and to reduce the environmental damage from inappropriate disposal methods (Department of Health, 2008). However, research shows that customer compliance in returning the medicines is low, which becomes an obstacle to developing effective healthcare waste management (Xie & Breen, 2012). For example, research commissioned by the Department of Health (DoH) has found that about £90 million worth of medicines are stored in people's homes at any one time (DoH, 2012).

- Social factors: The pharmaceutical industry has to focus on the dimensions of sustainability due to the particular characteristics of medicines; drugs are considered as dangerous or useless products when they reach their expiration date (Cherrett *et al.*, 2012). Expired or unwanted medication can be very harmful to the consumers and the environment. Therefore, hospital pharmacies concentrate on innovative programmes to reduce waste and costs, while improving the quality of services (Odier, 2010).

Lean Thinking

Lean is defined as an improvement philosophy that focuses on continuous improvement of a process by removing waste, increasing efficiency and providing a higher quality product or service (Brandão de Souza, 2009; Martínez-Jurado & Moyano-Fuentes, 2014; Govindan *et al.*, 2015). Lean was originally applied in the industrial sector; however in recent years there have been significant interventions in other areas including healthcare (Lodge & Bamford, 2008; Cheng *et al.*, 2015). In particular, Lean in healthcare is defined by the Scottish Government as supporting tool redesign across the patient journey for the improvement of whole processes through the reduction of waste (Scottish Government, 2010). The

elimination of waste (muda) has been considered as the primary Lean foundation; Hines and Rich (1997) and Womack and Jones (1997) stated that Lean is "*the antidote to muda*". Table 2.9 contains the seven types of waste classified in the Toyota Production System (Ohno, 1988). This classification enables the process owners to recognise problems, identify the causes that generated them and finally to achieve perfection of the process (Jones *et al.,* 1997).

1	Waste of overproduction
2	Waste of waiting
3	Waste of transportation
4	Waste of inappropriate processing
5	Waste of unnecessary inventory
6	Waste of unnecessary motion
7	Cost of defects

Table 2.9: The types of waste classified by Taiichi Ohno

To provide a more parsimonious analysis, Womack and Jones (1997) identified and developed the five principles of this philosophy. These principles are summarised in Table 2.10 (Ben-Tovim *et al.*, 2007; Brandão de Souza, 2009). Lean is designed to eliminate waste; the philosophy's scope is to incorporate "*less time to develop services, less human effort, less inventory, and less space to become highly responsive to customer demand while producing top quality products in the most efficient and economic manner possible*" (Karim & Arif-Uz-Zaman, 2013, p.170).

It has met with great success in healthcare organisations across the world from hospitals in the USA (Savary & Crawford-Mason, 2006), Australia (Bem-Tovim *et al.,* 2007) and the UK (Fillingham, 2007; Jones *et al.,* 2010), in both the acute (Radnor *et al.*, 2006; Joosten *et al.,* 2009) and community settings (Grove *et al.,* 2010a, b). For example, Virginia Mason Medical Centre in Seattle created enough capacity through waste reduction to improve patient safety (Furman & Caplan, 2007); costs and quality were the focus at Thedacare in Wisconsin (Toussaint, 2009) and the service capacity was the driver of Lean in mental health in Denver

(LaGanga, 2011). The application of Lean is considered necessary to improve clinical processes for the benefit of patients by increasing quality, safety and efficiency (Radnor & Boaden, 2008; Baker, 2014; Wood, 2014; Lindsey, 2015).

1	Define the value desired by the customer
2	Identify the value stream for each product or service
3	Create flow: The product or service should flow continuously
4	Establish pull: The flow should be based on the pull system
5	Pursuit of perfection and elimination of waste

Table 2.10: Five Principles of Lean Thinking

In order for organisations to be able to implement Lean successfully, they need to use the tools, techniques and systems that are in place to facilitate such continuous improvement approaches. Lean philosophy is associated with quality improvement techniques as Bamford and Greatbanks (2005) and Baczewski (2005) have highlighted. It is established that the primary Lean tool is the process mapping which focuses on creating the value chain by identifying and removing the non-added value activities (Brandão de Souza, 2009). Bamford and Greatbanks (2005) stated that the seven quality tools (Q7) are included within the traditional Lean thinking tool box: check sheet, histogram, graphs, pareto analysis, fishbone diagram, control chart and scatter diagram. The use of these tools enhances the data analysis by visualising their relationships and supporting planning and control activities (Dehe, 2014).

Similarly, techniques such as: Work standardisation, Value Stream Mapping (VSM), Just-In-Time (JIT), Kanban, 5S, A3 report, Poka-Yoke and PDSA cycles, support the implementation of a pulling system, producing a product or service just at the time it is required. This system is contrary to the traditional mass-production process (Shingo, 1986) of pushing the product flow, aiming at eliminating any type of waste described above. Table 2.11 represents the Lean tools and techniques that have been used in order to create a value production process, hence increasing the quality of the required services.

Lean Tools and Techniques	Primary Objectives
Seven Quality Tools	Data collection and presentation
Value Stream Mapping (VSM)	Visualising a process in detail
Just-In-Time (JIT)	Supplying materials to each stage of production only when required
Kanban	Optimise the capacity, increase the utilisation and smooth the process
A3 report	Provide structure to problem-solving
5S	Sorting, straighten, sweeping, standardizing, sustaining
Poka-Yoke	Prevent error to be passed onto the customer and becoming defect
PDCA cycles	Support continuous improvement of services, processes and products

Table 2.11: Main Lean tools and techniques (adapted from Dehe, 2014)

The literature is rich with reported Lean implementations demonstrating the benefits of adopting this approach. Holden's (2011) review of Lean applications in Accident and Emergency department shows that lean can contribute to decreases in waiting times, length of stay, and the proportion of patients leaving without being seen. Lummus *et al.* (2006) and Chan (2014) used Lean tools in a physician's clinic and significantly improve the patient flow and administrative processes. Similar results have been reported by (Vermeulen *et al.*, 2014), in their project, where an emergency department was analysed and redesigned using lean principles. Moreover, research indicates that Lean implementation resulted in reduced lead-time (Al-Araidah *et al.*, 2010), clinical errors (Raab *et al.*, 2006), inappropriate procedures (Van Lent *et al.*, 2009) and enhanced patient and staff satisfaction (Dickson *et al.*, 2009).

There has been some active research related to the reduction of waste within the Pharmaceutical Supply Chain (PSC) using improvement tools and methods; Lean thinking and the Kanban system can be used to help pharmacies manage their inventory, eliminate the waste and reduce costs. Papalexi *et al.* (2015) focused on the implementation of the kanban system on the supply chain for a group of cooperative pharmacists proposing that the organisation can store 56.8% fewer products and spend 71.8% less money, by adopting the kanban system.

The literature has revealed that Lean applications have been more applied in physical health service settings, focusing on the improvement of patients flow. There are few researches regarding pharmacies and their effort to reduce medicines waste and costs, while improving

quality of services by adopting best practices, green supply chain practices and improvement tools such as the kanban system (Xie & Breen, 2012; Papalexi *et al.*, 2015). Therefore, there is the need for further research to be undertaken in identifying the root causes of waste in the PSC. Consequently, the overall aim of this research is to gain a better understanding of wastage in PSC and to assess how innovative programmes such as Lean and Reverse Logistics (RL) can improve the distribution of medicine.

Apart from the traditional Lean tools and techniques, it is established that a number of different systems and approaches support the Lean philosophy such as: Kaizen, Six Sigma and Radio Frequency Identification (RFID). Reported example and, the benefits and challenges occurred by applying those approaches are represented in the following sub-section.

Benchmarking

Benchmarking has been concentred as a top management technique (Wong & Wong, 2008), aiming at improving firm productivity, hence reducing cost (Talluri & Sarkis, 2001; Zhang *et al.*, 2012). There is not a unique definition of this technique; Nandi and Banwet (2000) found 50 different reported definitions. The commonalities between them are: i) the search process of best practices that lead to superior performance (Freytag & Hollensen, 2001); ii) the activities facilitating the organisation learning and understanding (Adebanjo *et al.*, 2010, p.1143); and iii) the strategy deployed for implementing change and driving improvement (Marwa & Zairi, 2008, p.59).

In particular, Forker and Mendez (2001, p.195) stated that "*Benchmarking is usually triggered by a company's need for information that arises due to: i) internal problems, ii) the need for cost reduction, iii) improve firm productivity, iv) changes in management, processes or products and, v) competitive assaults that require reconsidering the strategies*". Researchers focused on this subject suggested that "*Benchmarking falls naturally under the Lean thinking umbrella*" (Voss *et al.* 1997; Dehe, 2014, p.73) based on its effectiveness in improving organisations processes' performances (Talluri & Sarkis, 2001). By doing this, several models have been suggested; the main stages of these models include: i) data analysis ii) review of best practices and, iii) development of suggestions" (Marwa & Zairi, 2008).

There is the need of holistic understanding of the process in order for Benchmarking activities to be successfully achieved.

The implementation of Benchmarking has been reported within different sectors, such as: automotive industry (Delbridge *et al.,* 1995); finance (Vermeulen, 2003); food industry (Adebanjo & Mann, 2000) and healthcare (Fowler & Campbell, 2001). Specifically, the National Institute for Health and Clinical Excellence (NICE) have announced a series of evidence-based practice guidelines (WHO, 2004) to help healthcare organisations to ameliorate their services. Similarly the UK Department of Health has developed guidelines on best practice waste management (DoH, 2012); for example an action plan to reduce medicines waste was launched, in December 2012, suggested the use of best practices to minimise medicine wastage and enhance healthcare services (Xie & Breen, 2012; 2014).

The application of Benchmarking can be beneficial for organisations because it provides new ideas and experiences of best improvement tools that can be used (Perez-Araos *et al.,* 2006). This fact has made a great contribution to organisational learning and knowledge management (Voss *et al.,* 1997). On the other hand, Benchmarking initiatives have been criticised for focusing primarily on the financial performance improvement (Maiga & Jacobs, 2004) without taking into account other important measurement and without involving employees and associates in the accrual process (Bhutta & Huq, 1999; Davies & Kochhar, 1999). In addition, under specific situations, the application of Benchmarking is considered difficult due to the need of a significant amount of information; sometimes this information is not available or there are difficulties in collecting them (Adebanjo *et al.,* 2010).

Inventory Management Approaches

Literature reveals that there have been numerous of reported innovative applications within the PSC. A virtual hospital pharmacy has been suggested in order for the required information to be available so a hospital pharmacy to be able to manage and control the different pharmaceutical stock-keeping units stored in the clinics of hospitals in the same geographical area (Danas *et al.,* 2002). This idea could result in minimising the amount of stock and cost hence producing higher quality services. In a subsequent study, the development of a classification framework for drugs was recommended (Danas *et al.,* 2006). This framework categorised the drugs into four different groups on a scale of A to D. A

category referred to ‘very important’ drugs and the D category to those that were less or ‘not important’. The aim of this approach was to control and reduce the stock level hence minimising any potential risk. A similar technique suggesting in a group of community pharmacies where the medicines classified based on their demand and cost (Papalexi *et al.,* 2015).

The use of a Just-In-Time (JIT) system suggested by Whitson (1997) who believed that the materials managed by the pharmacy departments are ideal candidates for this system. He argued that pharmacies’ operations are quite repetitive and manage high volume products. However, he did not make any explicit distinctions of how JIT could be applied under emergency situation or how JIT can deal with the expensive and rare medicines. Apparently, in a sensitive hospital environment, stock-outs of critical products could have catastrophic consequences (Jarrett, 1998; Persona *et al.,* 2008).

Simulation modelling and outsourcing of noncritical medical supplies were examined by scholars such as Nicholson *et al.* (2004); Samuel *et al.* (2010); and Battini *et al.* (2013). Similarly, those approaches aiming at reducing inventory costs without influencing the quality of services. In a Canadian hospital, a ‘stockless system’ was implemented (Rivard-Royer *et al.,* 2002). This system used a hospital’s central store for distributing the low-volume product, while the high-volume products delivered directly to the point of each patient care unit. This pilot project succeeded in improving the stock monitoring and reducing the cost but on the other hand an increase in the distributors’ workload was noticed.

A number of researchers suggested the adoption of the Vendor Managed Inventory (VMI) system for improving the PSC (Kim, 2005; Simchi-Levi *et al.,* 2008 and Bhakoo *et al.,* 2012). This system originated in the USA in the 1980s and initially it applied in manufacturing firms and retailers (Claassen *et al.,* 2008; Kauremaa *et al.,* 2009). Bhakoo *et al.* (2012, p. 219) defined VMI as “*a system whereby the supplier takes responsibility for monitoring the retailer’s inventory levels and makes periodic replenishment decisions regarding order quantities, delivery mode and timing of replenishments*”. There are two factors associated with the successful VMI implementation: i) the access, availability, collection and appropriate use of the required data, and ii) the need of high level of trust between the partners who are involved in these type of arrangements (Claassen *et al.,* 2008; Simchi-Levi *et al.,* 2008).

Although little attention has been put in the adoption of VMI in the healthcare sector, Kim (2005) suggested its application for managing for pharmaceutical products in South Korea. He concluded that, by implementing the VMI system between a wholesaler and a hospital warehouse, a 30% reduction in inventory levels and a decrease of the pharmacy staff's workload can be achieved. Danese (2006) went further by examining the applicability of VMI at a network level, within a large pharmaceutical manufacturer (GlaxoSmithKline). He suggested the use of Information Technology (IT) across the network for sharing and exchanging information and highlighted the significance of trust within it. In a similar vein, Mustaffa & Potter (2009) reported a number of significant benefits are derived by the VMI application: increase service quality; decrease stock-outs; and elimination of the bullwhip effect.

Besides the theoretical innovations discussed within this sections, there have been a number of reported initiatives focusing on developing the technological innovations. Although healthcare organisations generated large amounts of data which used to be stored in hard copy form, the current trend is to digitalise them, fact that might enables healthcare organisation to be more productive (Raghupathi & Raghupathi, 2014). These large amount of data provide significant information and support the healthcare functions such as population health management (Burghard, 2012; Fernandes et al., 2012).

Information Technology (IT) Systems

Health data sets are considered as large and complex, mainly due to their diversity and importance, that makes them difficult to manage without an integrated software and/or hardware (Frost & Sullivan, 2013). According to Raghupathi and Raghupathi (2014), there is a potential to improve care, save lives and lower costs through identifying associations and understanding patterns and trends within the healthcare data. Information Technology (IT) Systems are able to create and develop platforms in order for the large volumes of data and information to be captured, stored and manipulated effectively (Feldman *et al.*, 2012). Real-time data are crucial within the healthcare sector because allows the right treatments to be applied as early as possible and sometimes they can mean the difference between life and death (Raghupathi & Raghupathi, 2014).

According to Wu and Chiu (2015, p. 25) "*Information technology (IT) has been widely applied to support important business functions both internally and externally, such as customer relationships and the supply chain*". The innovative use of IT has been considered as a source of organisations' competitive performance as it can improve the organisational performance (Ashurst *et al.*, 2012; Zhu *et al.,* 2012). Examples of IT innovations include knowledge management systems (KMS), enterprise resource planning systems (ERP), and work flow systems (Wu & Chiu, 2015). Those systems enable organisation to build long-term customer and suppliers relationships using the Internet.

Poba-Nzaou *et al.* (2012, p.591) stated that IT systems development is a necessity for healthcare organisations considering that "*they seek greater flexibility, rapidity and integration to improve their overall performance*". Literature reveals that the use of integrated IT system, such as ERP, improves the quality, accessibility and continuity of patient care, hence reducing the healthcare costs and minimising duplications in service production (Goroll *et al.* 2009; Tsiknakis & Kouroubali, 2009). Those systems benefit organisation by providing greater quality of information available for decision-making (Scavo *et al*. 2011). However, healthcare organisations have been characterised as 'early adopters' of IT systems (Poba-Nzaou *et al.,* 2012), which is relevant considering the mature of healthcare data and information; there have been debates related to the ethical use of these data as they are associated with patients' personal details (Jaana *et al.,* 2011).

Radio Frequency Identification (RFID) technology

Organisations have increasingly attempted to develop new strategies in order to ensure that customers' demands can be satisfied by offering highest quality and lowest cost services. They are looking for adapting new approaches to enhance their supply chain and simultaneously reduce their operational costs (Chen *et al.,* 2013). Literature reveals that a number of organisations are willing to or have already applied RFID to enhance their business efficiency (Sarac *et al.,* 2010; Sheng *et al.,* 2011). RFID is an automatic identification and data capture technology, which is composed of three elements: a tag formed by a chip connected with an antenna; a reader that emits radio signals and receives in return answers from tags, and finally a middleware that bridges RFID hardware and enterprise applications (McFarlane *et al.,* 2003). This technique has been adopted in different types of supply chains, such as: inventory management, warehouse management and

transportation management (Banks *et al.*, 2007). Its application provides unique identification of products and services, easiness of communication and, real-time information (Sarac *et al.*, 2010). More accurate data ameliorate the supply chain planning, control and management.

Ferrer *et al.* (2010) reviewed 21 RFID applications across a wide variety of industries. The results of their study shows that four benefits were common in all of these examples: process improvement, quality service improvement, cost reduction and increased revenue (Lee *et al.*, 2011). Lao *et al.* (2012) suggested a RFID-based system to a distribution centre in order to improve their food safety control activities. Chen *et al.* (2013)'s study shows that the total operation time of a three-tier spare parts supply chain can be reduced by 81% by adopted the integration of RFID and Lean.

Research indicates that RFID has operational and informational effects, improving inventory control and efficiency as well as allowing improved decision quality, production control and improving the effectiveness of retail sales and promotions coordination (Visich *et al.*, 2009). The healthcare industry, particularly pharmaceuticals and diagnostic processes, has an on-going need to improve item tracking and data collection to enhance the quality of care while reducing cost (Jones *et al.*, 2009).

Although some applications of RFID in the healthcare sector (Fosso Wamba *et al.*, 2013) already show the potential of this system, Cakici *et al.* (2011) stated that RFID cannot be as effective without operational redesign as the old operations could not be as effective without redesigning operations to suit the technology. There are also other potential problems with RFID, such as privacy, data security and trust issues as well as very high costs for implementation (Kuo & Cehn, 2008). However, despite this, with a need to push for sustainability RFID is a good way of reducing costs in the long run and improving efficiency.

2.4 Conclusion

This chapter presented and analysed the key elements that are important for justifying the purpose of the thesis. The literature review started by exploring the aspects of strategy and the role of Operations Management (OM) in it. Then, it continued by analysing the significance of Supply Chain Management (SCM) within organisations, focusing on the challenges that healthcare organisations are facing. As the Pharmaceutical Supply Chain

(PSC) is the core subject of this research, its particular characteristics were highlighted associated with the reasons of their existence. The final focus of this chapter was the aspects of innovation and how innovation could be implemented within the PSC. The main innovative programmes aiming at improving services and the factors that prevent them were identified; moreover best practices or previous attempts on understanding this subject were underlined.

The management theory used to facilitate the logical understanding of the Supply Chain phenomenon within a challenging and sensitive environment such as the healthcare domain. The RBV theory focuses on managing organisations' resources and capabilities for sustaining competitive advantages (Ferlie *et al.,* 2016). This is direct related to the main objective of this research which is to understand how the application of innovative programmes can improve the internal factors of the PSC and create of sustain a competitive advantage. Martín-Peña & Díaz-Garrido, (2008) stated that implementing innovative operations processes could be a way for organisations to differentiate themselves from the competition. Kostopoulos *et al.,* (2002) characterised RBV theory as the fuel for innovation.

The literature review's conceptual model (Figure 2.10) represents the input-transformation-output process. It considers the healthcare organisation and, in particular, the inflexible environment as the production operation area that needs to be improved. This could be achieved by optimising the PSC though implementing innovation. However, as Figure 2.10 illustrates, a number of elements associated with the PSC in conjunction with particular aspects of innovation influence the system's innovativeness. The following model visualises the interactions of the main research subjects.

The following chapter will present and analyse the methodology adapted from the researcher in order to best capture the research subject. An explanation of the paradigm borrowed to undertake the mixed-method approach will follow.

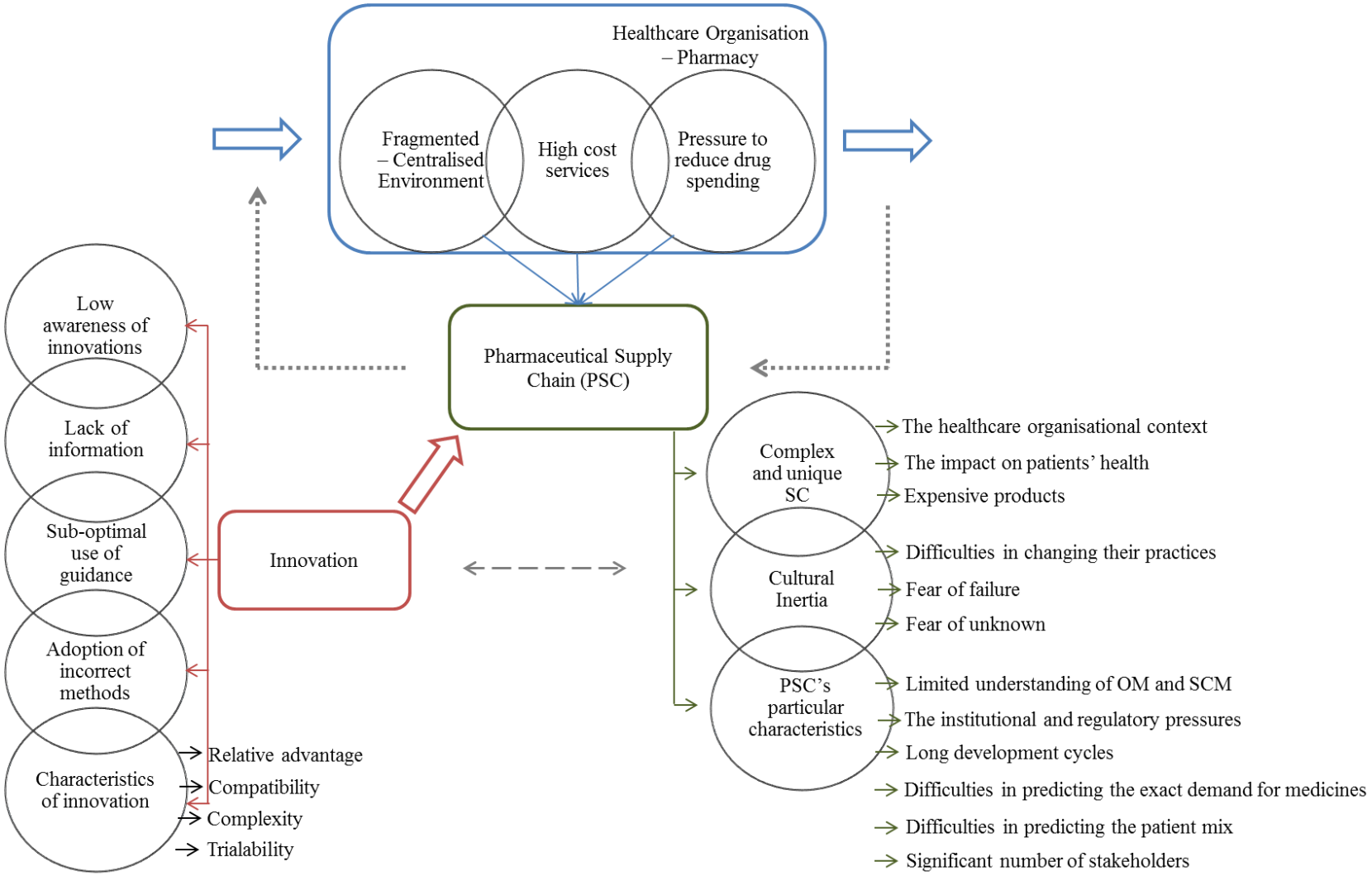


Figure 2.10: The Conceptual Framework of the literature themes

3 Chapter Three: Research Methods

In this chapter, the literature and the research aims/objectives will be linked with the research methodology. After the explanation of the different research philosophies and the associated assumptions, the suitable research methods that were adopted to fulfil the research aim and objectives will be discussed and presented through rationalisation of certain methodological approaches.

In particular, this chapter will provide a brief overview of the research paradigms and methodologies, and consequently it will explain the rationale behind selecting the current research approach. The research design and strategy will be detailed in depth, justifying the chosen research philosophy. Before analysing the adopted research approach, the research aim and objectives will be re-established, something of critical importance for later developing the discussion into a meaningful research context.

3.1 Introduction

There have been debates in social science regarding the relationship between the view of the researchers and the research methodologies applied (Morgan & Smircich, 1980; Johnson & Clark, 2006; Saunders *et al.*, 2012). In particular, this deliberation is related to the connection between the type of research questions and objectives developed and the methodological approach used to achieve them. The different paradigms or research philosophies have to be considered in order to choose the appropriate research methodology (Kirkwood & Campbell-Hunt, 2007; Bryman, 2012). Researchers have to develop a particular research design based on its three components: the research philosophy, the research methodology and the research methods (Birks & Mills, 2011). The first component of the research design, the research philosophy, is related to the relationship between the knowledge and the process by which it is developed; the second one, the research methodology, describes the set of principles that connect the research philosophy with the research methods, the third component of research design includes the procedures used to generate and analyse the data. The following figure 3.1 illustrates the components of the research design.

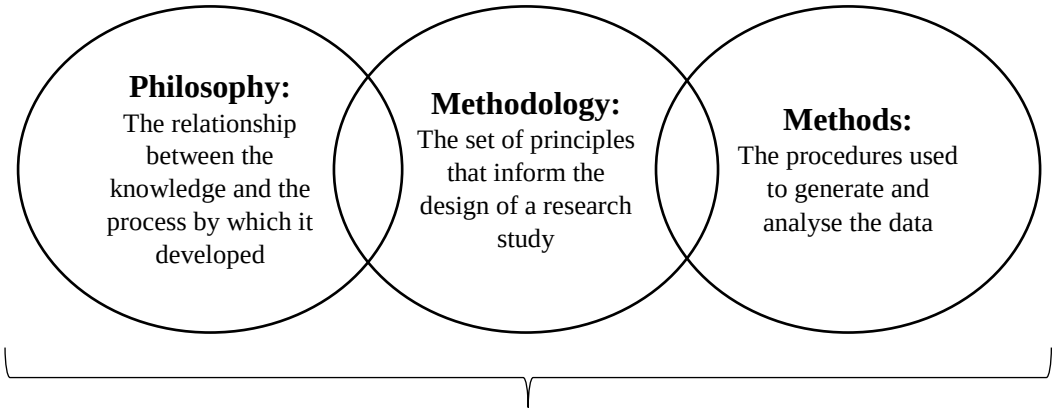


Figure 3.1: The components of the Research Design (adapted from Birks & Mills, 2011)

Tomkins and Groves (1983) and Guba and Lincoln (1994) pointed out that different research topics have to adopt different research approaches and methodologies. In this section, the selected research philosophy will be presented, analysing the exact reasons for choosing it and how it suits the research theme. However, before evaluating further the research strategy developed to structure this research, it is critical to re-establish the research aim and objectives in a way that will allow the reader to link them with the selected paradigm.

3.1.1 Research Context

As has been explained and demonstrated in Chapter Two, healthcare organisations are responsible for providing patient-centred services that improve and maintain the health and well-being of the population (Smits *et al.,* 2009; Davis, 2010; Dahlgaard *et al.,* 2011). However, there have been numerous debates related to the quality and cost of healthcare services (Shih *et al.,* 2009; Castano, 2014; Xie & Breen, 2014). With increasing pressure on healthcare organisations to keep a tight rein on their drugs spending, whilst still delivering suitable levels of service, coupled with the recent economic recessions and the rapid growth of the health sector, it is critical that pharmaceutical companies make their supply chains as efficient and innovative as possible (Smits *et al.,* 2009; Lainez *et al.,* 2012; Al-Balushi *et al.,* 2014). According to White and Mohdzain (2009), effective supply chain management (SCM) could improve organisational performance and enhance organisations' competitive advantage. Moreover, innovation has been considered as an imperative tool used by organisations in order to improve their effectiveness and efficiency (Sang *et al.,* 2011; Williams, 2011).

Taking into account that supply chains in the healthcare sector have been characterised as more complex compared to those in other sectors (Sang *et al*., 2011; Mustaffa & Potter, 2009) and the fact that innovative approaches adopted in this sector remain patchy and methodologically limited (Rye & Kimberly, 2007; Bamford *et al.,* 2014), this research was designed to study this complex phenomenon. In particular, the study focus is to explore the downstream domains of the Pharmaceutical Supply Chain (PSC), indicating the areas that could be improved by applying innovation. The aim of this research is to investigate the delivery process of pharmaceutical products in two geographical areas, the UK and Greece, identifying the main issues preventing the production of effective and efficient services and the factors that inspire or influence pharmacies' innovativeness. This will enable the researcher to suggest strategies to facilitate adoption and diffusion of innovative programmes in hospital and community pharmacies.

The two selected European contexts

As mentioned previously, this research focuses on investigating the current delivery practices taking place throughout the downstream domains of the PSC in two specific geographical areas: the UK and Greece. These two countries are members of the European Union (EU); as a result, both countries have to follow a large body of legislation that has been developed and supported by the 31

European Economic Area (EEA) Member States, the European Commission and the European Medicines Agency (EMA) (European Medicines Agency, 2014). These regulations are intended to ensure the quality, safety and efficacy of pharmaceutical products, and promote the good functioning of the internal market (European Commission, 2015). Although the PSC in the UK and Greece operate under the same general regulations, there are some significant differences between them.

First of all, the two selected countries are different in size; the UK's population totalled 64.96 million people and the gross domestic product (GDP) was $2.989 trillion in 2015 (World Bank, 2016a), while Greece's population equalled 10.84 million and the GDP was $235.6 billion in 2015 (World Bank, 2016b). In addition, there is a difference in the total expenditure on healthcare between the two countries; in 2013, the UK spent 8.5% of GDP on healthcare ($3,235 per person) (OECD Health Statistics, 2015a) while a 9.2% of GDP was allocated to healthcare spending in Greece ($2,366 per person) (OECD Health Statistics, 2015b). OECD Health Data (2010) suggested a positive relationship between GDP per capita and pharmaceutical expenditure per capita. However, Greece spent proportionally more on pharmaceuticals in per capita terms as a share of GDP ($599 per capita, in 2012) than the UK ($367 per capita, in 2012) (OECD Health Statistics, 2014a, 2014b). Finally, the current and ongoing economic recession, which has affected the EU but especially Greece, was the reason for a 2% reduction in pharmaceutical spending across OECD countries including the UK between 2009 and 2013 (OECD Health Statistics, 2015c). Apparently, the effect was greater in Greece, where a 6% (€1.8 billion) cut in pharmaceutical expenditure was reported between 2009 and 2013 (OECD Health Statistics, 2015b).

Besides, the healthcare system applied in the two selected contexts is different. The UK healthcare system places more emphasis on developing the primary healthcare settings to promote health and deal with disease at an early stage (Lionis *et al.*, 2009). On the other hand, the Greek healthcare system focuses more on curative services (Souliotis & Lionis, 2005). This is supported by the fact that the share of public resource that are spent on healthcare in the UK (83% of overall health spending) is greater than that in Greece (66% of overall health spending) (OECD Health Statistics, 2015a, 2015b). In addition to this, the Greek healthcare system involves a higher ratio of physicians (6.2 per 1000 inhabitants, in 2012) and a lower ratio of nurses (3.3 per 1000 inhabitants, in 2012) that the UK healthcare system (2.8 physicians per 1000 inhabitants; 8.2 nurses per 1000 inhabitants) (OECD Health Statistics, 2014a, 2014b).

Therefore, the striking differences between the two locations are the reasons for selecting them. The researcher was interested in investigating the complex pharmaceutical delivery process adopted and applied within the two diverse selected contexts. This exploration has enabled the researcher to identify the similarities and differences between the two delivery systems and gain a better understanding of the downstream domains of the PSC in the European context. As a result, this study could contribute to developing a theoretical and empirical understanding of the broader perspective of the PSC norms that exist in the EU.

3.1.2 Research Questions

In order to investigate the defined problems described in the previous section, two overarching research questions have been developed:

RQ 1: What are the issues associated with the downsteam domain of the Pharmaceutical Supply Chain in the UK and Greece?

RQ 2: How can the implementation of innovative programmes within the downsteam domain of the Pharmaceutical Supply Chain in the UK and Greece be promoted?

To achieve a more focused analysis, sub-research questions were developed that are related to the domain of one of the main research questions:

S-RQ1: What are the common factors observed within the downsteam domain of the Pharmaceutical Supply Chains?

S-RQ 2: What are the region-dependent factors observed within the downsteam domain of the Pharmaceutical Supply Chains?

S-RQ 3: What are the factors that influence the level of innovation within the downsteam domain of the Pharmaceutical Supply Chains?

S-RQ 4: What innovative programmes should be implemented to improve the downstream delivery of medicines?

It was considered necessary to re-establish the foundation of this thesis which will be linked with the research strategy analysed in the following sections of this chapter.

3.1.3 The Research Strategy

The research strategy is influenced by the nature of the phenomenon being researched and a set of assumptions that link with the three components of the research paradigm: the ontology, epistemology and axiology. For example, researchers who are focusing on analysing facts have different views from those who are more concerned with attitudes. Although the research methodologies cannot provide a definitive answer, they can guide researchers in order to develop their research strategy, deciding the type of required evidence, the manner and location of data collection and how they are going to be analysed to address the research aim and objectives (Easterby *et al.*, 1991; Easton, 2002).

The conceptual framework of the research is discussed throughout this chapter, analysing the research philosophies and the associated assumptions. In addition, this section explains the existing research paradigms suitable for this study and consequently it focuses more on describing the rationale behind selecting the current research paradigm. Therefore, the aim of this chapter is to justify the elements described in the previous section. More explicitly, the chosen research philosophy will be described; the reason for selecting a mixed-methodology approach under a pragmatic paradigm will be justified, including the mechanisms used to gather the qualitative and quantitative data (interviews and survey questionnaire) as well as the data analysis (thematic analysis, statistical analysis). Easton (2002) highlighted that it is critically important to explain the reasons for selecting a certain research philosophy that fits with the research scope.

3.2 Research Philosophy

As has been explained in one of the previous sections in this chapter, there have been debates in social science regarding the research strategies adopted by researchers in order to effectively approach the subject under investigation. A paradigm has been defined as the basic belief system or theory that guides researchers' actions by providing lenses and frames through which investigation is accomplished (Weaver & Olson, 2006, p. 460). The paradigm concerns three components: the ontological, epistemological and methodological assumptions of research (Kirkwood & Campbell-Hunt, 2007). More explicitly, the first component is the researcher's assumptions regarding the nature of reality (what the world is); the second is related to the nature of knowledge (how we can learn about the world) and the third is concerned with studying judgments about value (Guba & Lincoln, 1994). It is important to explain the reasons for choosing a certain research philosophy and

why this fits with the subject under investigation (Ryan *et al.*, 2002). The following section presents the paradigm's components analysing the research approaches that the researcher could adopt in order to best explore the selected research subject.

3.2.1 The Ontological Assumptions of Research

Ontology is concerned with the way researchers perceive reality. According to Guba and Lincoln (1994, p.108), "*the ontology assumption conceptualises the form and the nature of the reality*". As Saunders *et al.* (2012, p. 130) explained, "*this raises questions of the assumptions researchers have about the way the world operates and the commitment of particular views*". As a result, researchers need to consider the way they view social entities to identify their world perspective (Bryman, 2012). There are two main aspects of ontology that have been adopted by business and management researchers as both are likely to produce valid knowledge: objectivism and subjectivism (Saunders *et al.*, 2012). Objectivism represents "*the position that social entities exist in reality external to and independent of social actors*" (Saunders *et al.*, 2012, p.131). It is assumed that there is one objective reality, which is not influenced by human perception; *"inquiry takes place as through a one way mirror"* (Guba and Lincoln, 1994, p. 110). On the other hand, subjectivism ontology assumes that subjects and objects are dependent on one another and as a result social phenomena are influenced by social actions (Ittelson, 1973). Sale *et al.* (2002, p. 45) stated that *"there are multiple realities or multiple truths based on one's construction of reality"*. These two main aspects stand at the two ends of the ontological continuum.

As mentioned previously, researchers select their ontology assumptions based on their world perspective which, according to Creswell and Plano Clark (2011), has to be coherent with the research questions. Therefore, in this research, in order to explore the phenomenon of how innovation can be adopted within the PSC enhancing the delivery of medicines and answering the research questions, the assumption that considers truth to be *'what works'* based on information instead of searching for metaphysical truths (Plano Clark & Creswell, 2008, p.16) has been considered as the most suitable one.

As discussed in the Literature Review chapter, the PSC cannot be treated similarly to other supply chains in different sectors because of the specific characteristics of medicines (Liddell *et al*, 2008; Williams, 2011). Therefore, this system can be modelled and mapped only based on the available information which could lead to a number of improvements. Ryan *et al.* (2002, p.10) suggested that

"*human beings and organisations are continually processing information, learning, and adapting to their environment"*. The author's aim is to collect the required information related to the current situation and the way pharmacists operate in both countries, the UK and Greece. The analysis of these data will enable the researcher to identify the issues and suggest solutions that fit with the study environment and practices. The following section presents and analyses epistemological assumptions, hence determining the epistemological stance that fits with the selected ontological assumption.

3.2.2 The Epistemological Assumptions of Research

Saunders *et al.* (2012, p.132) explained that "*epistemology concerns what constitutes acceptable knowledge in the field of study*". As discussed in the previous section, researchers have different views of reality; there are those who perceive reality though objects assumed to be 'real' and those who have a more subjective view of reality focusing on feelings and attitudes (Bryman, 2012). As one can appreciate, there are close links between ontological and epistemological assumptions. According to Ryan *et al.* (2002), researchers who perceive reality 'as a concrete structure' are more likely to adopt a positivism epistemological position, and on the other hand, those who understand reality 'as a protection of human imagination' using a 'naturalistic' approach are more likely to follow the interpretivism epistemological position. Positivism and interpretivism are the main philosophical approaches that stand at the two extreme ends of the philosophical continuum. However, variations in the philosophical approaches have been identified enabling researchers to adopt a multi-dimensional set of continua (Niglas, 2010).

Many scholars including William James, Charles Sanders Peirce and John Dewey have suggested another major worldview formally known as pragmatism (Creswell & Plano Clark, 2011). Pragmatists argue that there are different ways of perceiving reality and one single point of view cannot provide the entire picture (Kelemen & Rumens, 2008). The following sections analyse and further discuss the epistemological assumptions of research and how they have influenced the design and structure of the current research strategy.

Positivist position

A positivist paradigm supports the philosophical position of natural scientists where the social reality can be explained through the lenses of objective judgements (Saunders *et al.*, 2012). Positivism's ontology suggests that knowledge about reality is out in the world driven by immutable natural laws (Kirkwood & Campbell-Hunt, 2007). The objectivistic ontological approach has been considered as the most suitable to be adopted as it supports that theories refer to real features of the world (Schwandt, 2001). Researchers adopting this position aim at exploring a social phenomenon using statistical techniques (Gartrell & Gartrell, 2002). They are willing to collect data about an observable reality through well-attested facts and analyse those data identifying the relationships between them to create a law-like statement (Gill & Johnson, 2010).

As Morgan and Smircich (1980, p.493) explained, "*the Positivist position emphasises the importance of studying the nature of relationships among the elements constituting the structure*". To achieve this, researchers usually develop hypotheses based on a set of variables related to the subject under investigation (Saunders *et al.*, 2012). The methodology is experimental and manipulative, thus the collection and analysis of the data can be conducted by adopting quantitative methods such as survey instruments (Kirkwood & Campbell-Hunt, 2007). As a ground rule, this type of research usually adopts a deductive research approach, which allows researchers to test the theory "*explaining causal relationships between concepts and variables*" (Saunders *et al.*, 2012, p.145).

Interpretivism position

An interpretivist paradigm's ontology suggests that knowledge about reality can be gained gradually based on individuals' constructions of experience in the world (Easton, 2002). An interpretivist position supports that there is no single reality but it can be confirmed only by understanding those individuals or phenomena that are being studied (Kirkwood & Campbell-Hunt, 2007). Therefore, this position suits researchers who are interested in studying the social world where assessment of human interactions, actions and behaviours is required (Saunders *et al.*, 2012).

Qualitative research would be appropriate based on the analysis of data collected mainly through observations and in-depth interviews (Bryman, 2004). This would enable researchers to understand the study area and generate findings and as a result to build a theoretical contribution (Sayer, 1992). In addition, the subjectivist ontological approach is the most suitable approach when studies focus

on multiple realities influenced by social actors rather than being constructed or interpreted (Maylor & Blackmon, 2005). Finally, interpretive studies usually adopt an inductive research approach (Crowther & Lancaster, 2008); an inductive approach enables researchers to "*explore a phenomenon and generate or build theory often in the form of a conceptual framework*" (Saunders *et al.,* 2012, p.145).

Pragmatism position

Pragmatism has been seen as a philosophical position that distinguishes the approaches based on positivist and interpretivism position (Maxcy, 2003; Johnson *et al*., 2007). According to Johnson and Onwuegbuzie (2004, p. 17), *"Peirce, James, and Dewey were all interested in examining practical consequences and empirical findings to help in understanding the import of philosophical positions and, importantly, to help in deciding which action to take next as one attempts to better understand real-world phenomena"*. Particularly, James (1995, p. 18) stated that *"The pragmatic method is primarily a method of settling metaphysical disputes that otherwise might be interminable [...]. The pragmatic method in such cases is to try to interpret each notion by tracing its respective practical consequences"*, as cited by Johnson and Onwuegbuzie (2004).

Researchers who adopt the pragmatism philosophical position concentrate on the research problem and subsequently adopt pluralistic approaches to derive knowledge and information about the problem (Tashakkori & Creswell, 2007a; 2007b; Morgan, 2007). In addition, Shewhart (1939) suggested that knowledge is developed through interpretation. He continued by explaining that knowledge cannot be perceived as "*objective and absolute, but as depending upon a specific conceptual frame used by the investigator*" (Sliwa & Wilcox, 2008, p.100).

A more integrated methodological approach including both qualitative and quantitative methods has been suggested (Teddlie & Tashakkori, 2009); researchers have supported the idea that these two methods are compatible (Howe 1988; Tashakkori & Teddlie, 1998). The combination of the research methods is acceptable in order to best address the research questions. Sale *et al.* (2002, p.46) suggested that *"combining research methods is useful in some areas of research, such as nursing, because the complexity of phenomena requires data from a large number of perspectives"*. By conducting mixed methods research, it is possible to adopt different cycles of deductive and inductive research approaches (Feilzer, 2010).

The adopted paradigm

Considering the aims and objectives of the current research, a pragmatism approach was adopted where the researcher explains the social reality based on the information collected about the issues associated with the medicine downstream delivery system in the UK and Greece and the factors that affect the system's innovativeness. The main reason for selecting this approach is illustrated in the nature of the phenomenon under investigation and especially the research intentions. To study this phenomenon through understanding the current situation of the PSC in both countries and the ways innovative programmes should be implemented to support this process, relative information was the main source of data. This intention is supported by the pragmatism position, which provides an alternative worldview to those of positivism and constructivism, focusing on the problem to be researched and the consequences of the study (Plano Clark & Creswell, 2008).

To capture the general pattern of regularities and collect the required data, it is possible to use both qualitative and quantitative methods. A mixed methods approach can be utilised under a pragmatic paradigm, which has the ability to exploit the inherent duality of the data analysed (Feilzer, 2010). In particular, adopting a mixed method approach, in this study, will enable the researcher, on one hand, to explore the subject under investigation by understanding the delivery process and the associated issues, and, on the other hand, to subjectively identify the reasons that influence the application of innovation within this particular context. By doing this, both an inductive approach, aiming at exploring the phenomenon, and a deductive approach, aiming at explaining causal relationships between and among the study variables, will be adopted. Those elements will be discussed further in one of the following sections of this chapter.

The three main paradigms - positivism, interpretivism and pragmatism - were analysed, highlighting their differences and implications in conducting research. Consequently, the pragmatism position borrowed was introduced and its selection was justified. The following section analyses the research strategies and methodologies, concentrating on the research design of the current study.

3.2.3 The Methodological Assumptions of Research

In order to be able to undertake a valid investigation hence exploring and understanding complex problems or situations, researchers need to develop their research design including the techniques used to collect and analyse the data; research methodologies guide the researchers' choice regarding these techniques (Easterby *et al.*, 2008). This decision needs to be part of the research strategy and

fit with the research purpose. According to Christensen *et al.* (2011), there are three different research forms that need to be based on different research approaches: i) exploratory research which is undertaken to explore complex problems or situation identifying underlined principles; ii) descriptive research which is utilised for describing a specific problem or situation; and iii) explanatory/confirmatory/causal research which is employed for understanding casual relationships through testing hypotheses. Based on Christensen *et al.*'s theoretical research classification and considering that the purpose of this research is to explore whether innovation can support and perhaps improve the delivery of medicines which, based on the literature, has been considered as a complex system, this thesis is comprised of an exploratory research. To conduct this exploratory research, diverse methodological techniques are taken into account. The two core types of research in social science, namely quantitative and qualitative, are considered (Saunders *et al.*, 2012).

Qualitative methods

By adopting a qualitative research approach, researchers are willing to capture human behaviours based on the informants' perspectives and assume reality to be dynamic and negotiated (Minichiello *et al.*, 1990). They attempt to explore social phenomena based on individuals' experience, in their natural context (Malterud, 2001). As a result, those researchers have a subjective worldview which is well-suited in the interpretivism position (Newman, 2014). Qualitative methodologies are more often used in an inductive research strategy (theory generation) where data are collected to develop a theory which might be used as a potential hypothesis for future research investigations (Cooper & Schindler, 2011).

Qualitative research has been defined as "*an umbrella term encompassing a wide range of methods, such as interviews, case studies, ethnographic research and discourse analysis*" (Muijs, 2010, p.3). It uses non-numerical data, which are usually collected through conducting research interviews and/or observations (Teddlie & Tashakkori, 2009). According to Silverman (2011), qualitative research approaches have specific characteristics: i) a deeper research relying on selective/small samples is required; ii) non-numerical observational data are often collected to measure social realities; iii) the researcher's involvement is often required during the data collection process; iv) thematic analysis is conducted to analyse the collected data; and v) difficulties in construing and generalising the research outcome as they refer to specific cases.

Quantitative methods

On the contrary, when researchers adopt a quantitative research approach, they focus on discovering facts about social phenomena and consider reality to be fixed and measurable (Minichiello *et al.*, 1990). They therefore view the world objectively, which is well-suited to a positivist position (Saunders *et al.*, 2012). The research strategy adopted is deductive (theory testing) where data are collected to test hypotheses based on an existing theory and its applicability on practice (Bryman, 2012). Quantitative research uses numerical data analysed statistically to explain a particular phenomenon (Muijs, 2010). According to Balnaves and Caputi (2001), quantitative research approaches are characterised by: i) a wider research relying on broad/large research sample groups; ii) the collection of numerical data to measure objects/facts; iii) the researcher's involvement is not required during the data collection process; iv) numerical comparisons and statistical inference are often used to analyse the collected data; and v) the research outputs are easy to construe and it is possible to generalise them.

Mixed methods

Having discussed the qualitative and quantitative research approaches, it is critical to mention that both research approaches can be compatible. According to Johnson *et al.* (2007, p.17) 'mixed methods' describes "*the class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study*". This decision is driven by the research aims and objectives, and the research questions under investigation. Researchers often adopt both research approaches when they are willing to gain the best understanding of the research problem (Tashakkori & Teddlie, 1998) which is well-suited to a pragmatism position (Saunders *et al.*, 2012). Creswell and Plano Clark (2007, p.5) stated that "*the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone*". The research strategy adopted, when research decides to use mixed methods, includes both deductive and inductive approaches.

There have been debates related to mixed research methods and how researchers can best design their research strategy by including both the qualitative and quantitative approach (Teddlie & Tashakkori, 2009). Creswell (2013, p.15) summarised the three main designs that exist in the mixed methods field and have been adopted in the social sciences: i) convergent parallel mixed methods is one form of mixed methods design where researchers provide a comprehensive analysis of the

research problem by converging the qualitative and quantitative data. The collection of qualitative and quantitative data takes place at roughly the same time and their analysis equally contributes to the interpretation of the research outcome. ii) Explanatory sequential mixed methods is the model where researchers initially use the quantitative approach; the quantitative data are analysed and then a qualitative approach is adopted in order to explain the results in more detail. This is a sequential approach of mixed methods because the quantitative phase is followed by the qualitative one. iii) Exploratory sequential mixed methods are the last mixed methods model where researchers initially conduct a qualitative approach, exploring the participants' views on the study subject. The result based on the qualitative data is used in order to develop the quantitative phase of research. For example, researchers might use the qualitative phase in order to understand the context and identify variables that need to be examined through a quantitative approach.

As presented in the previous section, there are three main diverse models explaining how to mix research methods. The researchers' decision on which will be adopted is based on the research aim, context and the research questions that need to be addressed (Teddlie & Tashakkori, 2009). The following section presents the research design of this particular study and the reasons for initially adopting an 'exploratory sequential mixed methods' approach and subsequently a 'convergent parallel mixed methods' approach in order to understand the current pharmaceutical delivery practices and whether innovation could improve the effectiveness and efficiency of the PSC in both countries: the UK and Greece.

3.3 The Research Design of this Study

The research design of this thesis involves two different parts: A and B, Part B includes two diverse phases, which are represented in Figure 3.2. Figure 3.2 is adapted from Creswell and Plano Clark (2011), who analysed the diverse research design when the mixed methods approach is conducted. As Figure 3.2 illustrates, this research has adopted initially an exploratory sequential design and, subsequently, an exploratory parallel/simultaneous design to address the main and sub-research questions. Creswell (2013) stated that these research processes involve two different phases combining the qualitative and quantitative approach. Part A is an exploratory sequential design where the qualitative data collected through the unstructured interviews were analysed to inform the survey questionnaire, which facilitated the selection of the quantitative data. As Figure 3.2 illustrates, initially, qualitative data were collected through unstructured interviews with key professionals working within the downstream domain of the PSC in both European contexts. These

actions enabled the researcher to form a more comprehensive view regarding the phenomenon under investigation and as a result to inform and better structure the following two phases, qualitative and quantitative, involved in the current research design.

Part B is an exploratory parallel/simultaneous design where the qualitative data derived from the semi-structured interviews and quantitative data were collected and analysed separately enabling the researcher to best explore the subject under investigation (Teddlie & Tashakkori, 2009). In particular, in the first phase of the exploratory parallel/simultaneous design, a qualitative approach has been adopted to answer the first research question RQ1 and the associated sub-research questions S-RQ1 and S-RQ 2; whereas in the second phase, a quantitative approach was used to partially address the second research question RQ2, answering the associated sub-research questions S-RQ3 and proving a direction for structuring S-RQ 4. In phase 1, an inductive approach was conducted, aiming at identifying the main issues related to the drug delivery process, and on the other hand, a deductive approach was adopted in phase 2 in order to identify the factors that influence the implementation of innovative programmes within the downstream domain of the PSC and examine the relationship between the study variables. Subsequently, the two data sets are integrated during the analysis, leading to the interpretation. In the interpretation, the researcher will compare or relate the results, looking for convergence, divergence, contradictions or relationships in the two sources of data (Creswell & Plano Clark, 2011).

This research has adopted a mixed methods approach to examine the particularity of the phenomenon based on multiple perspectives; a choice that is in line with multiple other studies (Malterud, 2001; Simons, 2009; Creswell & Plano Clark, 2011). There are studies focusing on the healthcare sector that have adopted a similar research design (Wittink *et al.,* 2006; Feldon & Kafai, 2008). A representative example is that of Schadewaldt *et al.*'s (2014) research, where it was attempted to identify the characteristics of collaboration between nurse practitioners and medical practitioners in the primary healthcare sector. In a similar vein, Classen *et al.* (2008) conducted a mixed methods approach in order to test the public health interventions to promote older driver safety. To achieve that, they compared and integrated possible causative factors (quantitative approach) with perspectives of stakeholders (qualitative approach). Focusing on this research, the following sub-sections analyse the research design in detail.

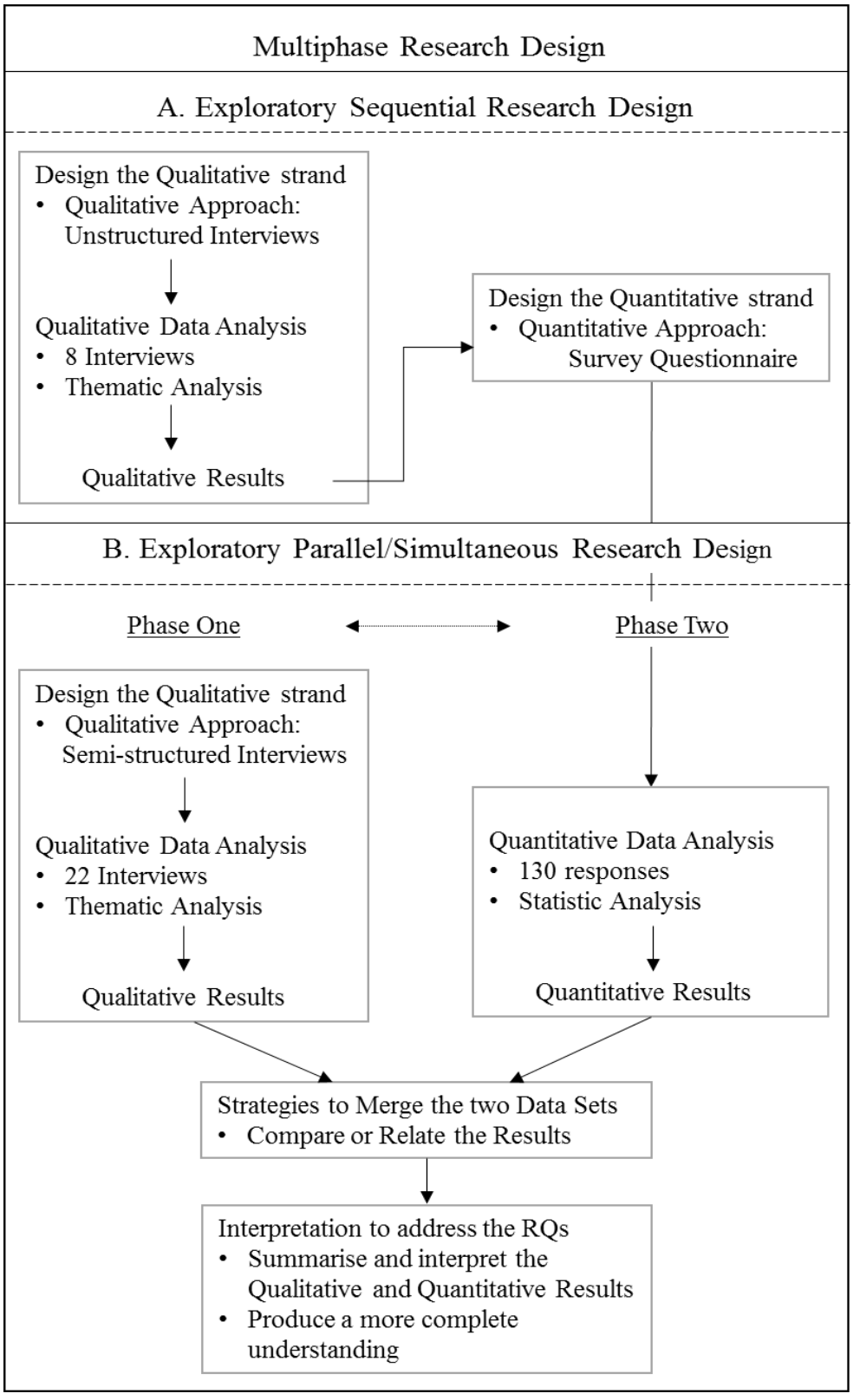


Figure 3.2: The Research Design

Part A: Exploratory Sequential Design

The exploratory sequential design starts off with the qualitative strand, which aims to appreciate the context and its singularities. This was achieved by analysing the data collected via the 8 unstructured interviews. The professionals' views and experiences were vital for developing an initial understanding of the current pharmaceutical delivery system applied in the UK and Greece. They also facilitated the development of the survey questionnaire, which was the tool used to collect the required quantitative data. These primary qualitative data in conjunction with the existing literature were informed and built the instrument, as the variables were unknown. This exploratory research design has been supported by multiple worldviews including pragmatism (Creswell & Plano Clark, 2011). Figure 3.3 illustrates the sequence of activities involved in the discussed exploratory sequential design.

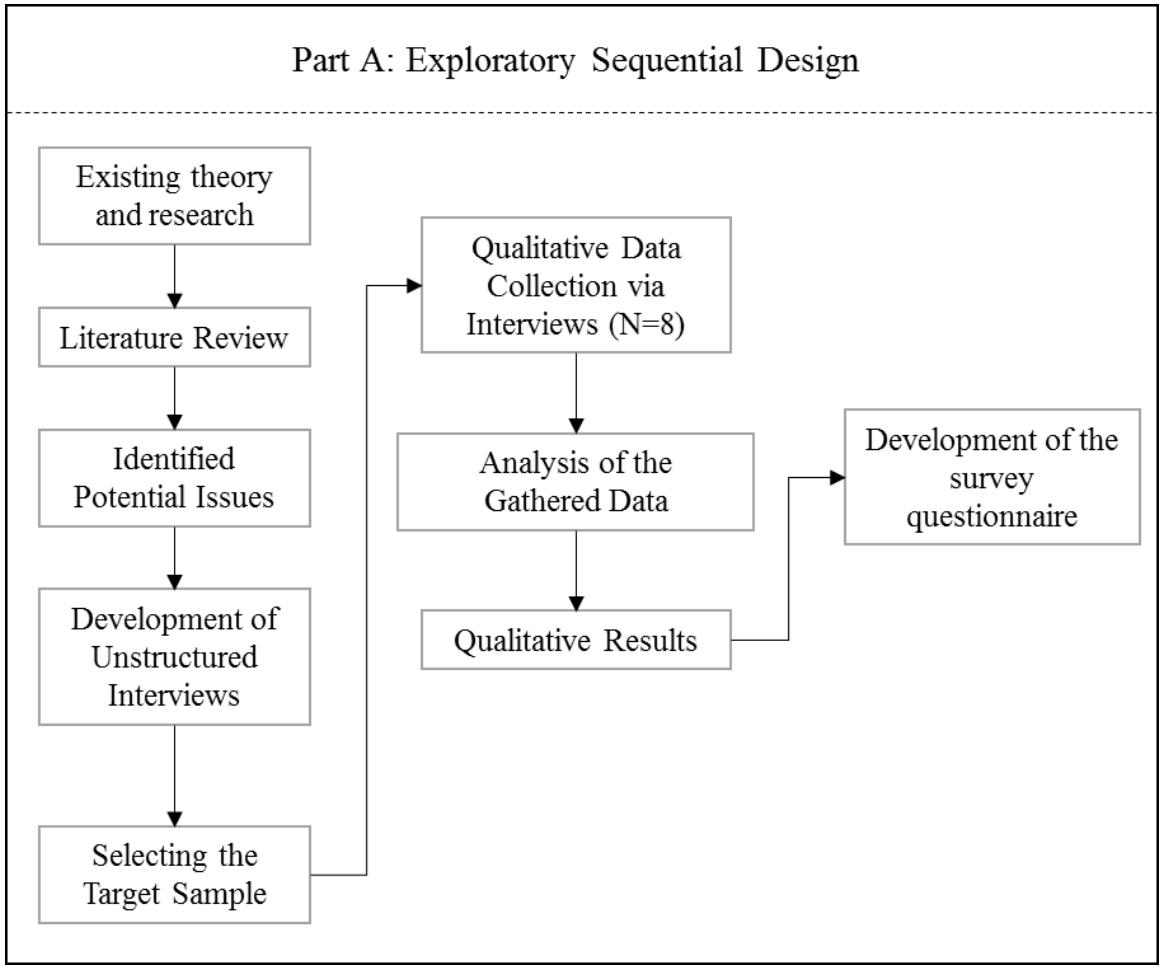


Figure 3.3: The sequence of activities involved in the exploratory sequential design

Part B: Exploratory Parallel/Simultaneous Design

As mentioned previously, part B of the research design is an exploratory parallel/simultaneous design, involving two diverse phases: 1) a qualitative approach and 2) a supportive quantitative approach. The following sub-sections analyse these two phases in detail.

Phase 1: Qualitative Approach

The qualitative strand aims to gain a better understanding and in particular explore the issues related to the drug delivery process. This has been achieved by undertaking semi-structured research interviews (N=22) with key pharmacy professionals within hospital and community pharmacies in two geographical areas: the UK and Greece. The coding and data analysis, using Thematic Analysis, conclude that there are four themes which are presented in the following analysis chapter (Chapter 4). The data analysis and its interpretation aims not only to address the research question (RQ1) and the sub-research questions (S-RQ1, S-RQ 2), but also to suggest improvements in order to overcome the identified issues. The following figure (Figure 3.4) presents in detail the sequence of activities undertaken to achieve the collection and analysis of the qualitative data.

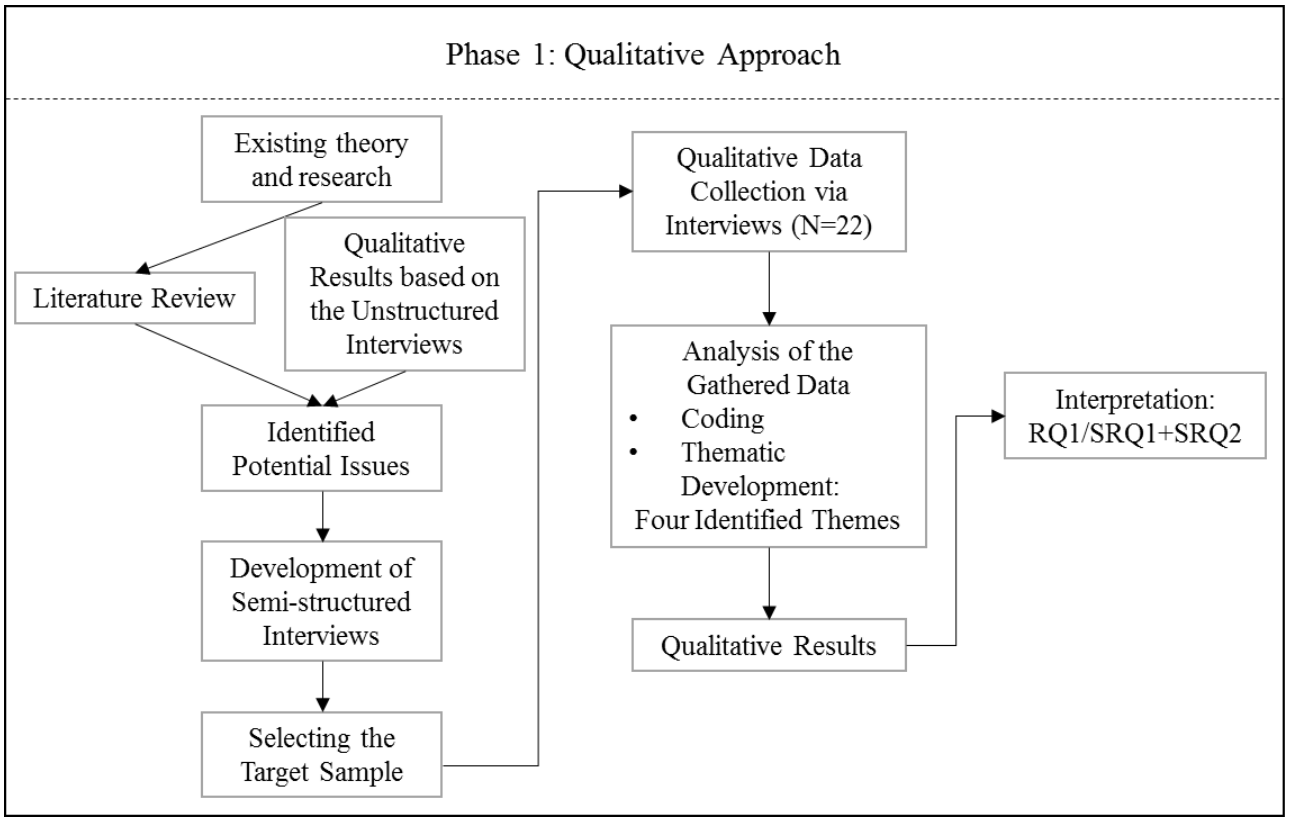


Figure 3.4: The sequence of activities within the Qualitative Approach

Phase 2: Quantitative Approach

In Addition to the qualitative approach, a quantitative approach was adopted to gain a better understanding of the phenomenon under investigation. However, the quantitative data act as a supportive source that mainly addresses one of the four sub-research questions (S-RQ 3). Creswell and Plano Clark (2011, p.71) explained that "*the embedded research design occurs when the researcher collects and analyses both quantitative and qualitative data*". A survey questionnaire was therefore created based on previous studies focusing on the same research area and the analysis of the qualitative data was collected via the unstructured interviews. The researcher distributed the questionnaire to hospital and community pharmacy professionals working within the downstream domain of PSC in the UK and Greece. Particularly, the total sample (N=130) consisted of 81 hospital and community pharmacies working within the PSC in Greece and 49 pharmacy specialists who operate in the UK.

The collection of the quantitative data enabled the researcher to identify the factors that influence the innovation level of the current delivery process and to suggest alternative solutions to improve this process for the benefit of stakeholders and patients. The following figure (Figure 3.5) illustrates the steps undertaken to collect and analyse the quantitative data. The details of the data analysis will be provided in Chapter Four.

Having presented and justified the research design of this study, the following section will focus on the research tools and techniques used in order to gather and analyse the required data. As mentioned previously, a collection of qualitative and quantitative data was considered necessary to best explore the subject under investigation. Therefore, the different tools that have been used in line with the mixed-methodology research approach will be described in the following section.

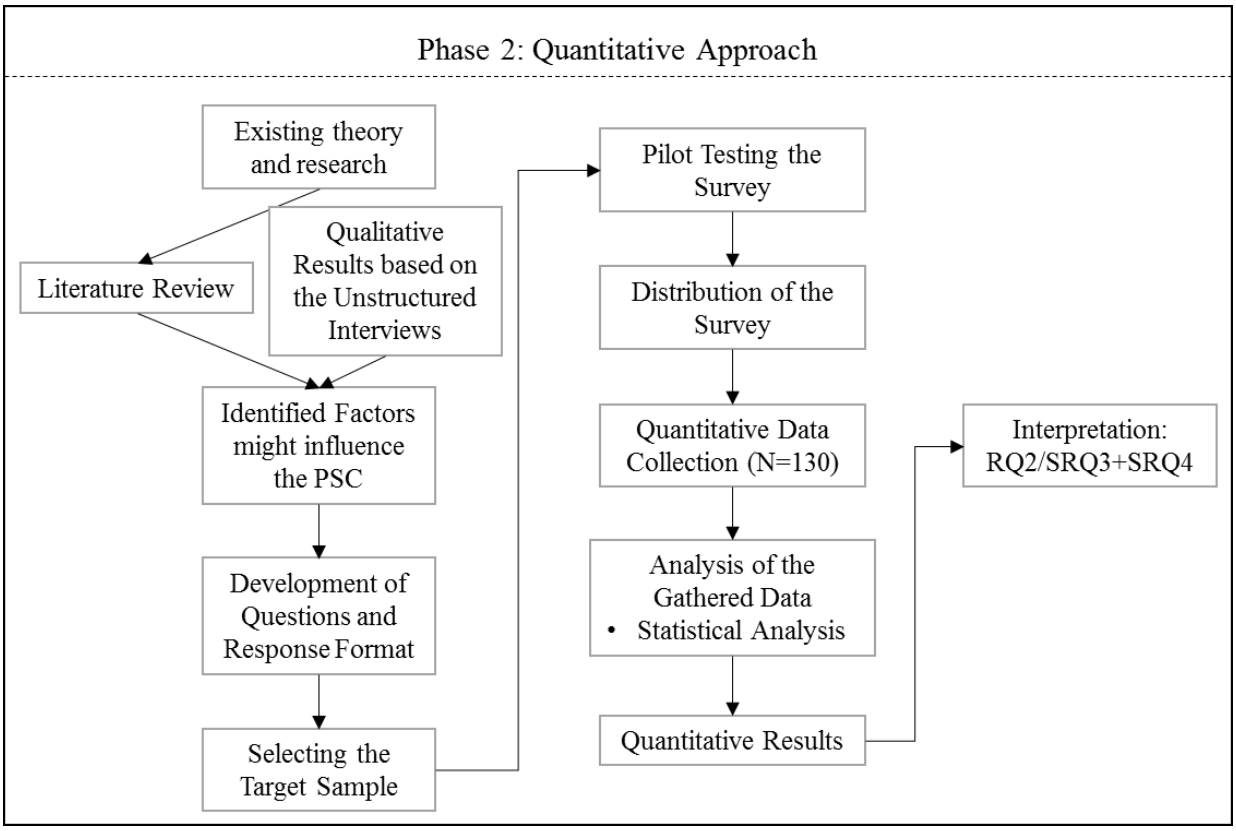


Figure 3.5: The sequence of activities within the Quantitative Approach

3.4 Research Tools and Techniques

3.4.1 Data collection

The data collection has been considered one of the critical processes in Operations Management (OM) research (Deming, 1986) as it enables researchers to appropriately determine and generalise the research outputs. Therefore, the researcher needs to judiciously design the collection process in order to gather the required qualitative and quantitative data. Initially, the information was retrieved from a state-of-the-art literature review referring to the delivery process of medicines and the issues that have been observed within the downstream domain of the PSC that prevent effective delivery. Subsequently, this preliminary analysis supported the design of unstructured/semi-structured interviews and the survey questionnaire. As mentioned previously, the qualitative data were collected via a series of site visits and one-to-one interviews with key pharmacy professionals working in hospital and community pharmacies in two different European contexts: the UK and Greece. The target sample was the same for gathering the required quantitative data but further expanded; the sample expansion aims to assure the validity of the quantitative results.

The researcher faced difficulties during the data collection process because the population that met the specific research participation criteria contained very few members and it was hard to find them. For this reason, the research adopted diverse approaches to gather an adequate number of responses, such as a snowball sampling technique. The following section considers the research tool and techniques used to gather and analyse the received data.

3.4.2 Interview approach

Interviews are conducted by researchers in order to gather exhaustive and comprehensive information to explore the experiences, views and beliefs or motivations of individuals on the phenomenon under investigation (Gill *et al.,* 2008; Rowley, 2012). Qualitative methods, such as interviews are considered as the most appropriate tool for exploring sensitive topics (e.g. ineffectiveness of the drug delivery process) where detailed participants' insights are required or little is known about specific matters (Holloway & Wheeler, 2013). A representative example is the study conducted by Rossetti *et al.,* (2011); they adopted an interview approach to collect data in order to identify the major forces that impact upon the biopharmaceutical supply chain. Similarly, Bhakoo and Choi (2013) used a semi-structured interview protocol to gather data related to healthcare personnel's reaction to institutional and endogenous pressures for technology implementation. Kay and Blinkhorn (1996) used interviews as research methods in order to collect information about the factors that influenced GPs' decision on treatment choices.

The fundamental purpose of the research interview is to ask questions related to the study phenomenon that are likely to yield as much information as possible and address the research aims and objectives (Roulston, 2010). This can be achieved by choosing the appropriate interview form; there are three fundamental diverse forms of research interview classified based on their level of 'structure': unstructured, semi-structured and structured (Rowley, 2012).

Unstructured interviews are used when researchers attempt to encourage participants to talk around a theme; during the natural flow of communication, questions are spontaneously generated. This type of interview might start with an opening question such as 'what is your role within the PSC?' and then the discussion will develop from the initial response. Their use is generally considered where little is known about the subject area and it might generate more structured questions (Bryman, 2001). Unstructured interviews are usually time-consuming and their management and guidance require skill and experience (Roulston, 2010).

Conversely, structured interviews are considered as verbally administered questionnaires that include a list of well-structured questions (Silverman, 2010). This list of questions is used with every interviewee with little or no variation. The answers expected are usually short and as a result, structured interviews are often less time-consuming than unstructured interviews. In addition, this type of interview is easier to administer and facilitate.

In the middle of the spectrum stands the semi-structured form of interviews. This is the most common form of interview as it can be designed in a more flexible manner, enabling the researcher to drive the discussion in order to gather the required data (Mason, 2002). Although this interview format consists of several key questions aiming to define and gain a better understanding of the study context, it also allows the interviewees to focus on and analyse a specific subject, generating new views and topics (Rowley, 2012). Excessive interactivities are developed between the interviewees and the researcher, which allows the interviewer to extract more information (Kvale & Brinkmann, 2008).

In this thesis, unstructured and semi-structured research interviews were conducted in order to understand the drug delivery process in both Greece and the UK through the participants' experiences, opinions, views and values. The interview approach was adopted because it is considered the most appropriate research tool for data gathering where there is insufficient knowledge about the study subject and the potential participants might be more familiar with this approach. The following sub-sections discuss in detail the interviews design and the sample approach which are core factors in the success of a data collection approach.

Interviews' design

In this research, the qualitative data were collected by conducting unstructured and semi-structured research interviews with key professionals working within the downstream domain of the PSC in Greece and the UK. The initial interviews (N=8) were unstructured, including more general themes derived from the literature review, focusing on understanding the delivery process and the pharmacies' role in it. Subsequently, those interviews were analysed, which enabled the researcher to further develop the following semi-structured interviews; this set of initial interviews had an exploratory character informing the following diverse data collection procedures: semi-structured interviews and survey questionnaire. Therefore, the following semi-structured interviews (N=22) involved well-structured themes that helped the researcher to drive the discussion and gather the

required information. In-depth interviews provide comprehensive and exhaustive data, which can generate new directions in social sciences (Denscombe, 2007; Reige, 2003).

The research interviews included a list of open-ended questions which enabled interviewees to discuss and analyse the research topic based on their knowledge, experience and beliefs (Silverman, 2010). The list of questions was divided into three parts: i) the first part referred to general questions about the study phenomenon and the role of the interviewee therein; ii) the second part included specific questions regarding themes (e.g. the factors preventing an effective delivery process) identified by reviewing reports and previous research; iii) finally, the third part focused on the interviewees' personal views and beliefs on whether the drug delivery process could be improved through innovation. Each of the interviews was informed by the existing literature and the analysis of the previous interviews, which enabled the data to evolve over time in a direction that addressed the research aims and objectives.

Before conducting the semi-structured interviews, the researcher created a list of potential participants and restructured the questions, included in the interviews based upon their particular expertise. Pilot testing of the interview questions was essential to ensure that the questions were clearly stated and understandable (Rowley, 2012). The interview questions used in this thesis were developed and the pilot tested by five academics related to the study subject. Their main suggestions were related to the terminology used; for example they pointed out that, terms such as: Lean, supply chain or reverse logistics might not be familiar to the participants. Therefore, the questions were changed accordingly to minimise the risk of misunderstanding. Subsequently, the researcher initially contacted the potential participants through emails or phone calls to introduce herself and the research project and check their willingness and availability. Ethical principles such as anonymity and confidentiality were also explained, as these might have increased the likelihood of participation and openness of the interviewees.

Sample population

Sampling techniques are used by researchers in order to collect the required data focusing only on a specific group of cases (Saunders *et al.*, 2009). Researchers select the sample that matches a number of criteria and best answers the research questions, meeting the research aims and objectives (Matthews & Ross, 2010). In this thesis, the target sample involves professionals working in hospital and community pharmacies in two diverse geographical areas: Greece and the UK. This

research aims to explore how innovative programmes could improve the downstream domain of the PSC which is directly related to patients, identifying the related issues. Therefore, only those specialists who work within this domain could be considered as potential participants.

In particular, in 2013, approximately 410,000 pharmacists were operating in the EU; the number of professionally active pharmacists reported in the majority of the EU member states was 50-106 per 100,000 inhabitants (Eurostat, 2015b). Greece recorded a high number of professionally active pharmacists, at 106 per 100,000 inhabitants in 2013 (approximately 11,600 pharmacists) (Eurostat, 2015b); the vast majority of them, about 80%, were working in independent-community pharmacies (Vozikis *et al.*, 2015). On the other hand, this number in the UK, in 2013, was 80 per 100,000 inhabitants (approximately 51,600 pharmacists) (Eurostat, 2015b), with approximately 70% of those operating as independent-community pharmacists (NHS England, 2013). From these pharmacists only those working within the particular study area, the downstream domain of the PSC, could be considered as potential participants in the current study. Unfortunately, the exact number of the potential participants is not available.

As previously mentioned, during the qualitative data collection, the researcher faced difficulties in approaching the potential interviewees. They were very cautious about being involved in this research, mainly because they thought that their role was not related with Operations Management (OM) and Supply Chain Management (SCM) practices. They were therefore excluded due to concerns related to the minimum knowledge about these particular practices and organisational performance (e.g. Nulty, 2008). In addition to this, some of the potential participants were reluctant to take part in this study because of their heavy work load. The researcher approached only those specialists that could be reached in terms of geographical distance. Although the described issues illustrate the magnitude of the challenge faced by the researcher, finally, 8 unstructured and 22 semi-structured interviews were undertaken. Particularly, 5 unstructured and 16 semi-structured interviews were conducted in the UK, and 3 unstructured and 6 semi-structured interviews took place in Greece. Those interviews provided enough data to generalise the qualitative research outputs, as the last interview did not add any consequential data. This ensured that the main research content was covered and, thus the saturation level was reached (O'Reilly & Parker, 2012; Walker, 2012)

A snowball sampling technique or a network referral sampling was conducted to approach the target sample; it is an efficient technique for accessing hard-to-reach segments of the population (Atkinson & Flint, 2001). This technique enabled the researcher to approach potential interviewees

through colleagues or friends, a fact that, on one hand, might have increased the trust between the researcher and the interviewees and on the other hand might have affected the participants' opinion of the research subject due to the exchange of knowledge. However, the existence of bias in the results is limited because every single interview was developed differently based on the interviewees' expertise and experience. In addition, at the end of each interview, the researcher asked the interviewees to recommend some of their contacts who could potentially agree to be interviewed as well; this was another dimension of the snowball sampling approach that was equally important for increasing the access to data.

After creating a list of potential participants, the researcher contacted them through email or phone calls to provide a brief about the current research and arrange a meeting with them. Aiming to motivate respondents, a report of the future research outputs was offered. The 30 unstructured and semi-structured interviews undertaken varied in their length; the minimum length of interviews was 30 minutes and the maximum length was 90 minutes. Table 3.1 provides an overview of the conducted unstructured interviews and Table 3.2 presents a summary of the conducted semi-structured interviews. Each interview was audio-taped and transcribed verbatim before the data analysis took place.

#	Date	Reference	Position	Interview Type
1	25/10/2013	1/UK	Lead Pharmacist	Unstructured
2	08/11/2013	2/UK	Chief Pharmacist	Unstructured
3	21/11/2013	3/UK	LPC Secretary	Unstructured
4	12/03/2014	4/UK	Procurement and Homecare Manager	Unstructured
5	12/03/2014	5/UK	Chief Pharmacy Technician	Unstructured
6	12/02/2015	15/Gr	Hospital Pharmacist	Unstructured
7	16/02/2015	17/Gr	Community Pharmacist	Unstructured
8	17/02/2015	18/Gr	Hospital Pharmacist	Unstructured

Table 3.1: The overview of the conducted unstructured interviews

#	Date	Reference	Position	Interview Type
1	15/03/2014	6/UK	Acting Chief Pharmacist	Semi-structured
2	24/03/2014	7/UK	Chief Pharmacy Technician	Semi-structured
3	02/04/2014	8/UK	Lead Pharmacist	Semi-structured
4	04/04/2014	9/UK	Community Pharmacist	Semi-structured
5	04/07/2014	10/UK	Chief Pharmacist	Semi-structured
6	09/09/2014	4/UK	Procurement and Homecare Manager	Semi-structured
7	09/09/2014	5/UK	Chief Pharmacy Technician	Semi-structured
8	04/11/2014	11/UK	Lead Pharmacist	Semi-structured
9	03/02/2015	12/UK	Reader Advancing Clinical Practice	Semi-structured
10	09/02/2015	13/UK	Senior Lecturer, Nursing & Health Studies	Semi-structured
11	12/02/2015	14/Gr	Hospital Pharmacist	Semi-structured
12	12/02/2015	15/Gr	Hospital Pharmacist	Semi-structured
13	13/02/2015	16/Gr	Community Pharmacist	Semi-structured
14	20/02/2015	18/Gr	Hospital Pharmacist	Semi-structured
15	21/02/2015	17/Gr	Community Pharmacist	Semi-structured
16	21/02/2015	19/Gr	Community Pharmacist	Semi-structured
17	09/03/2015	20/UK	Community Pharmacist	Semi-structured
18	18/03/2015	21/UK	Community Pharmacist	Semi-structured
19	23/03/2015	22/UK	Community Pharmacist	Semi-structured
20	17/04/2015	1/UK	Lead Pharmacist	Semi-structured
21	05/05/2015	2/UK	Chief Pharmacist	Semi-structured
22	19/05/2015	23/UK	Community Pharmacist	Semi-structured

Table 3.2: The overview of the conducted semi-structured interviews

Data analysis

Cresswell (2007) characterised qualitative data analysis as a spiral because the researcher might need to go through the data more than once before they reach the research output. There is no universal recipe for analysing the data; the method adopted is dependent upon the data collected and

the research aims and objectives (Saunders *et al.*, 2015). Rowley (2012, p. 268) stated that "*there are a number of key components of data analysis, including: organising the data set; getting acquainted with the data; classifying, coding, and interpreting the data; and, presenting and writing up the data*". In order for this analysis process to be achieved, researchers focus on the meaning of collecting data, trying to identify the key themes.

Thematic analysis has been widely used as a foundational method for analysing qualitative data (Guest *et al.*, 2012). Braun and Clarke (2006, p. 82) highlighted that "*thematic analysis provides a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex account of data*". This tool enables researchers to identify, report and analyse themes within the collected data. Boyatzis (1998, p.63) defined themes as "*the most basic segment, or element, of the raw data or information that can be assessed in a meaningful way regarding the phenomenon*". Themes organise a group of repeating ideas which allows researchers to answer the research questions (Vaismoradi *et al.*, 2016).

There are numerous reported articles referring to thematic analysis agreeing that there is no right or wrong way to conduct it (Tuckett, 2005; Saldaña, 2013; Vaismoradi *et al.*, 2016). In this research, the analysis of the research interviews was conducted using Braun and Clarke's (2006; 2013) linear model for carrying out thematic analysis. Their model includes six procedures: i) Familiarisation with the data; ii) Generation of initial codes; iii) Searching for themes; iv) Reviewing themes; v) Defining and naming themes; and vi) Producing the final report. In particular, having transcribed the recordings, a list of thematic codes was generated; this process was influenced by the conceptual framework, deductively informed by the literature review and the author's research interest. Basit (2003, p. 144) highlighted the importance of the coding process by stating that "*codes or categories are tags or labels for allocating units of meaning to the descriptive or inferential information compiled during a study*".

Researchers can develop a thematic analysis by either using computer software, such as NVivo or analysing the qualitative data manually using Word documents (Rowley, 2012). Although the use of computer software packages could facilitate the qualitative data analysis (Basit, 2003), in this thesis, the thematic analysis was undertaken using MS Excel. The use of computer software saves time, avoiding the tedious and frustrating process of manual analysis (Winsome & Johnson, 2000). However, the risk associated with these packages relates to their effects on research. Winsome and Johnson (2000, p.395) listed the concerns of using these packages: "*a focus on quantity instead of meaning, homogenisation of qualitative data analysis approaches, a privileging of coding and*

retrieval methods, distancing of the researcher from the data, inappropriate use of technology, time consumed in learning to use computer packages, pressures or expectations that all qualitative researchers will use them, and increased commercialism". Computer software packages have been developed under a certain epistemology (Coffey *et al.*, 1996), which does not necessarily fit with the purposes of the study (Petty *et al.*, 2012). In light of this and avoiding losing control of the data, the thematic analysis has been conducted manually. The developed themes related to specific issues observed during the delivery process are derived from the participants' experiences and opinions. These themes will be presented and analysed in the following Analysis Chapter (Chapter Four).

The following section discusses the second phase of the research design which includes the analysis of the quantitative data. The reason for using a survey questionnaire is explained and in addition to this the questionnaire design, the sample characteristics and the quantitative data analysis are described.

3.4.3 Survey approach

A survey instrument is used by researchers when they attempt to collect data from a range of respondents who are representative of a specific population; data are collected through asking questions to record respondents' attitudes, behaviours and opinions on the study subject (Baker & Foy, 2008; Ghauri & Gronhaug, 2010). Considering that surveys could take diverse forms such as structured interviews, structured observations and questionnaires (Maylor & Blackmon, 2005), it is vital that researchers choose the appropriate survey form to fit with the purpose of the proposed research project (Bernard, 2012). In this study, a questionnaire survey is used in order to collect the required quantitative data.

The collection of quantitative data was considered necessary in order to identify the factors that influence the level of innovation applied within the PSC in the UK and Greece and test the relationships between and among the study variables; to achieve that, a questionnaire survey is the most appropriate survey form (Blair *et al.*, 2013). There are different questionnaire survey types, including drop-off surveys, fax surveys, mail surveys and web surveys (Zikmund *et al.*, 2012). A mail type and a web type questionnaire survey were used during the data collection phase of this research in order to raise the response rate and reduce the collection time (Greenlaw & Brown-Welty, 2009; Groves *et al.*, 2011). Prize incentives were reported to produce consistent improvements in response rates (Nikitas *et al.*, 2011). In addition to this, the researcher attended a

conference related to pharmacy management where she distributed the questionnaire to suitable respondents. This enabled her to collect more data, as she faced difficulties in gathering them due to the small population of the potential sample and the issues with accessing them described in the previous section referring to the qualitative part of the data collection.

Besides the selection of an appropriate survey form, researchers have to identify and elaborate in detail two key factors - the instrument design and the sample approach - in order for the survey to be successful, meeting the research aims and objectives (Maylon & Blackmon, 2005). The following sub-sections will address these two key factors.

Questionnaire design

A questionnaire survey includes a list of questions, which are often accompanied by a range of answers, created under a standardised format in order to gather the required data (Matthews & Ross, 2010). One challenge that researchers have to deal with when they create a questionnaire is the selection of the appropriate types of question. According to Couper *et al.* (2001) there are two main types of question that can be used: i) open-ended questions where the participants need to provide an answer, and ii) closed-ended questions where the participants need to choose an answer. In this research, closed-ended questions were used in order to collect the required data. The reason for choosing closed-ended questions was to ensure the reliability and validity of the measurements of the core variables and also increase the response rate and accuracy of the responses as this type of questions is quick and easy to answer (Saunders *et al.*, 2015).

Subsequently, the researcher had to best structure these closed-ended questions in order to guide the respondents to provide the required information. Researchers tend to use scales in order to measure the subject under investigation (Zikmund *et al.*, 2012). Scales include multiple items, each referring to a statement, and there are no 'right' or 'wrong' answers related to it (Spector, 1992). According to Trochim and Donnelly (2008), Likert point scaling has been widely used where these items are summed to provide the final scale score.

Although multiple item scales have been used in order to enable the researcher to estimate the measurement properties in a more valid, accurate and reliable manner, single item measures have been used as well. Bergkvist and Rossiter (2009, p. 618) claim that "*carefully crafted single-item measures are at least as valid as multi-item measures of the same constructs, and that the use of multiple items to measure them is unnecessary*". Single item measures could demonstrate equally

high predictive validity as multiple item scales "*if the object of the construct can be conceptualised as concrete and singular*" (Diamantopoulos *et al.,* 2012, p.435). The reasons researchers abandon multiple item scales in favour of single items are: i) sometimes multiple item scales and single items perform differently, for example Kwon and Trail (2005) found that single item measures were a better predictor; ii) a single item is often the only one that can measure a construct and as a result using multiple item scales might affects the measure's validity (de Jong *et al.,* 2010).

The following table, Table 3.3, presents the measurements that have been used in this research. As the table indicates, the core constructs and variables under investigation have been measured based on multiple-item and single-item Likert-type scales. In particular, in this thesis all the study variables are based on scales and items that are measured in 5-point Likert scales. According to Dawes (2008), these are the most commonly used scales as they are as precise as 7-point Likert scales, but less complicated and cognitively challenging.

Variable	**Survey items**	**Measurement**	**Cronbach's α**
Factor 1 supporting innovation	To what extent was the following factor important in your decision to innovate in products/services? - Reduced time to respond to customer or supplier needs	1–5 (1 = Not Important at All to 5 = Very Important)	
Factor 2 supporting innovation	To what extent was the following factor important in your decision to innovate in products/services? - Improved staff communication	1–5 (1 = Not Important at All to 5 = Very Important)	
Factor 3 supporting innovation	To what extent was the following factor important in your decision to innovate in products/services? - Enhanced staff or patient satisfaction	1–5 (1 = Not Important at All to 5 = Very Important)	
Factor 1 preventing innovation	To what extent was the following factor important in constraining innovation activities? - Excessive perceived economic risks	1–5 (1 = Not Important at All to 5 = Very Important)	
Factor 2 preventing innovation	To what extent was the following factor important in constraining innovation activities? - Direct innovation costs too high	1–5 (1 = Not Important at All to 5 = Very Important)	
Factor 3 preventing innovation	To what extent was the following factor important in constraining innovation activities? - Lack of finance	1–5 (1 = Not Important at All to 5 = Very Important)	

Access to information	To what extent was information from each of the following sources important to your organisation's innovation activities? - Your organisation - Suppliers of equipment, materials, services or software - Patients or end users - Government or public research institutes	1–5 (1 = Not Important at All to 5 = Very Important)	α=.620
External/internal Collaboration	To what extent do your organisations co-operate on any innovation activities with any of the following? - Other healthcare organisations - Suppliers of equipment, materials, services or software - Patients or end users	1–5 (1 = Strongly Disagree to 5 = Strongly Agree)	α=.727
Innovation level regarding the use of technology	To what extent has the pharmacy invested in any of the following, for the purposes of current or future innovation? - Acquisition of advanced machinery, equipment and software for innovation: Computer hardware - Acquisition of advanced machinery, equipment and software for innovation: Computer software	1–5 (1 = Strongly Disagree to 5 = Strongly Agree)	α=.742
Innovation level regarding the introduction of new/improved products/services	To what extent has the pharmacy introduced? - New or significantly improved products - New or significantly improved services for delivering products	1–5 (1 = Strongly Disagree to 5 = Strongly Agree)	α=.666

Note. Please see Appendix 1 for the full version of the questionnaire

Table 3.3: Measurement items for study constructs

As has been summarised in Table 3.3, key informants were asked questions related to factors supporting innovation (reduced time to respond to customer or supplier needs; improved staff communication; enhanced staff or patient satisfaction), factors preventing innovation (excessive perceived economic risks; direct innovation costs too high; lack of finance), access to information (four-item scale, α=.620), external/internal collaboration (three-item scale, α=.727), innovation level regarding the use of technology (two-item scale, α=.742) and innovation level regarding the introduction of new/improved products/services (two-item scale, α=.666). For those variables that were measured based on more than one item, the Cronbach's alpha determines whether the scale is

reliable (Field, 2009). According to Nunnaly and Bernstein (1994), values of Cronbach's alpha between .60 and .69 indicate an acceptable reliability level, values of Cronbach's alpha between 0.70 and 0.79 demonstrate a good reliability level and values of .90 and above indicate an excellent reliability level. Please see Appendix 2 for the SPSS output regarding the reliability tests.

The translation process

This survey was distributed to key professionals working within the Pharmaceutical Supply Chain in the UK and Greece. The questionnaire was created based on questions written in English. Subsequently, the English version (source questionnaire) of the survey was translated into a Greek version (target questionnaire). This action was considered necessary in order for the Greek participants to be able to accurately understand the questionnaire and precisely provide the answers that best suited their personal perspectives (Cha *et al.*, 2007). In order for the translation process to be conducted successfully, the researcher had to adopt the most suitable translating techniques (Usunier, 1998).

These techniques include: forward-only translation; forward translation with testing; back translation; back translation and monolingual test; back translation and bilingual test; and back translation and monolingual and bilingual tests (Maneesriwongul & Dixon, 2004). Each of these techniques is characterised by a number of strengths and weaknesses. The back translation technique was adopted by this thesis, which involves two translation processes: i) initially the questionnaire was translated from the source language (English) into the target language (Greek) by a translator; then ii) the Greek version (target language version) was translated back into the English version (source language version) by another translator; and finally the two different versions were compared (Maneesriwongul & Dixon, 2004). The aim of this translation technique is to ensure the questionnaires' accuracy in a different language (Douglas & Craig, 2007).

The pilot testing process

In order to ensure the validity of the questionnaire used, a pilot testing process was conducted. A pilot test can be considered a small-scale study aiming to test the validity and reliability of questionnaires used for research purposes in order to minimise the likelihood of respondents facing problems in answering the questions (Saunders *et al.*, 2015). According to Bell (2005), during this process specific aspects are assessed, including the length of the questionnaire, the clarity of

instructions, the existence of ambiguous questions, the existence of a clear and attractive layout and the existence of major topic omissions.

The questionnaire used in this research was developed and then pilot tested by ten experts; the main suggested change was related to the time that the respondents would spend filling in the questionnaire. As a result, a shorter version of the questionnaire was developed, which increased the response rate. No changes were required to the questionnaire's construction and layout.

Sample technique

Sampling techniques are used by researchers in order to collect the required data focusing only on a specific group of cases (Saunders *et al.,* 2009). Researchers select the sample that matches a number of criteria and best answers the research questions meeting the research aims and objectives (Matthews & Ross, 2010). In non-probability sampling, the selection of samples is based on personal judgment or convenience, which means that the probability of particular members of the population being selected is unknown; on the other hand, in probability sampling, samples are chosen based on statistical theory and are highly representative of the population (Zikmund *et al.,* 2012). In the first category, a purposive or judgmental sampling technique, such as a snowball sampling technique, is adopted in order for the samples to be selected based on the researcher's judgment regarding individuals that could be potential participants to answer the research questions (Saunders *et al.*, 2015). Conversely, in the probability sampling approach, random sample techniques are used, providing an equal probability of each member of the target population being selected (Hair Jr. *et al.,* 2011).

Considering that this study focuses on elements related to the PSC, the population that meet the participation criteria contains very few members, who are hard to find; therefore a snowball sampling technique was used (Bernard, 2012). Particularly, the sample was derived from two main national contexts: the UK and Greece. These two geographical areas were chosen mainly because it was easier for the researcher to approach the target group and also because these two countries are in different stages of development, which might have an impact on the drug delivery processes.

Sample characteristics

Taking into account that a snowball sampling technique was used and the fact that the questionnaire was distributed through mail accounts and web accounts, the actual response rate is difficult to indicate. This is one of the disadvantages of this distribution strategy (Dillman, 2000) but the researcher decided to adopt it in order to receive sufficient responses. The final sample (N=130) consisted of 81 specialists working within the PSC in Greece while the remaining 38% of the total sample (49 specialists) were located in the UK. The majority of the participants in the total sample (68%) had fewer than 15 years of working experience in the pharmaceutical supply chain while 42 participants had worked in the specific sector for more than 15 years. In the Greek sample, 62% had fewer than 15 years of working experience in the PSC while the remaining 22 participants had more than fifteen years. In the UK sample, 78% of the participants had fewer than 15 years of working experience in the PSC while 22% had more than 15 years. The majority of the participants (69%) in the total sample held a bachelor's degree, 18% of them did not attend university and the rest of the total sample (13%) had successfully completed a postgraduate/PhD programme. In the Greek sample, 94% of the participants possessed an undergraduate degree, while 6% never attended university. In the UK sample, 37% of the participants did not hold a higher education degree, 36% possessed an undergraduate degree and the rest (27%) had successfully completed a postgraduate/PhD programme. Table 3.4 summarises the sample size and its characteristics.

	National Context	**Sample Size**	**Sample Characteristics**				
			Working Experience		**Educational Level**		
			> 15 Years	**< 15 Years**	**Professional Qualification**	**Bachelor's Degree**	**Postgraduate Degree**
Total Sample	Greece + UK	130	68%	32%	18%	69%	13%
Greek Sample	Greece	81	62%	38%	6%	94%	-
UK Sample	UK	49	78%	22%	37%	36%	27%

Note. Please see Appendix 3 for the SPSS output – frequencies for sample characteristics

Table 3.4: The sample size and characteristics

Control variables

Residence was measured by asking the participants to indicate whether they live in 1 = Greece or in 2 = the UK. This dummy variable was used as a control variable in the total sample analysis and served as an indicator of dividing the sample groups in the multi-group analyses. This approach has been adopted by a number of researchers in order to be able to split the sample and address the research questions (e.g. Velayutham *et al.,* 2012; Esfahbodi *et al.*, 2016; Manning *et al.,* 2016).

Data analysis

This thesis has implemented two types of statistical technique: descriptive and inferential techniques. According to King and Minium (2003), descriptive statistics are conducted in order to organise and summarise observations, and on the other hand, inferential statistics aim to reach conclusions about conditions that exist in the population on which a study focuses. In particular, in this study, descriptive statistics have been used to calculate means, standard deviations and correlations among the study variables. In addition, bivariate statistics have been used to examine the relationship between and among the study variables (Field, 2009). Both descriptive and bivariate statistics are presented in the following analysis chapter (Chapter 4). In order to implement these statistical techniques, the statistical software SPSS IBM 20 version has been used, which supports an upgraded statistical analysis.

Specifically, a Linear Regression Analysis (LRA) was conducted to assess the relationships between all pairs of variables in the study (Gravetter & Wallnau, 2011). According to Fahrmeir *et al.,* (2009) LRA is able to conduct three actions: i) description: the means of regression analysis statistically describe the relationships between and among the study variables; ii) estimation: the values of the independent variables estimate the values of the dependent variables; and iii) prognostication: prognoses can be determined through the identification of the factors that influence the outcome. Particularly, the significance of the relationship between and among the variables is indicated by the *p*-values; a non-significant relationship is indicated when a *p*-value is greater than .05 while a significant relationship is designated when a *p*-value is lower than .05, .01 and .001 levels (Burns, 2008). The direction of a relationship is suggested by the coefficient values; a positive association coefficient value states that the variables tested move in the same direction, while a negative association shows that the variables move oppositely (Argyrous, 2011). According to Gravetter and Wallnau, (2011) the value of the coefficient can range between -1 and 1; the values

-1 and 1 suggest a very strong relationship, values between 0.7 and 0.9 and -0.7 and -0.9 state a strong relationship, those between 0.4 and 0.6 and -0.4 and -0.6 represent a moderate relationship, and those between 0.1 and 0.3 and -0.1 and -0.3 show a weak relationship, and the value 0 suggests that a relationship does not exist (King & Minium, 2003). The criteria presented have been adopted to accept or reject the hypotheses of this research.

When conducting statistical analyses, researchers have to ensure the measurement validity, which refers to the accuracy of the research being conducted (Maylor & Blackmon, 2005). One way of ensuring the measurement validity is by checking for Common Method Bias (CMB) related to Common Method Variance (CMV) (Podsakoff *et al.*, 2003). According to Richardson *et al.* (2009, p.763), the existence of CMV is "*a systematic error variance shared among variables measured with and introduced as a function of the same method and/or source*". Confirmatory Factor Analysis (CFA) is one of the techniques used in order to examine CMB and test whether the measured variables represent the number of constructs (Lance *et al.*, 2010).

3.5 Conclusion

This chapter started by discussing the research design of the study, analysing its three components: the research philosophy, the research methodology and the research methods (Kirkwood & Campbell-Hunt, 2007). In particular, the ontological, epistemological and methodological assumptions of the research were presented, explaining how they influence the research strategy and the selection of a suitable scientific paradigm.

The adoption of, initially, an exploratory sequential research design, and subsequently an exploratory parallel/simultaneous research design, including a mixed-methodology approach under a pragmatic paradigm was justified. This enabled the researcher to best meet the research aims and objectives of the current study. Subsequently, the two parallel and diverse phases of the research process (qualitative and quantitative approach) were described in detail, stating the reasons for conducting them. Finally, the research tools and techniques used (interviews and survey questionnaire) were presented, analysing the way that they applied in order to collect the required qualitative and quantitative data. The author believes that the collection and analysis of these data will provide a better understanding of the study phenomenon and enable a contribution to the existing literature related to the downstream domain of the Pharmaceutical Supply Chain (PSC)

context to be made. The following figure (Figure 3.6) summarises the research approach adopted, presenting the diverse components of the research design and the link between them.

The following chapter will describe the analysis of the qualitative and quantitative data collected and present the findings of this research. It will also highlight how the two data sets can be integrated to lead to the interpretation.

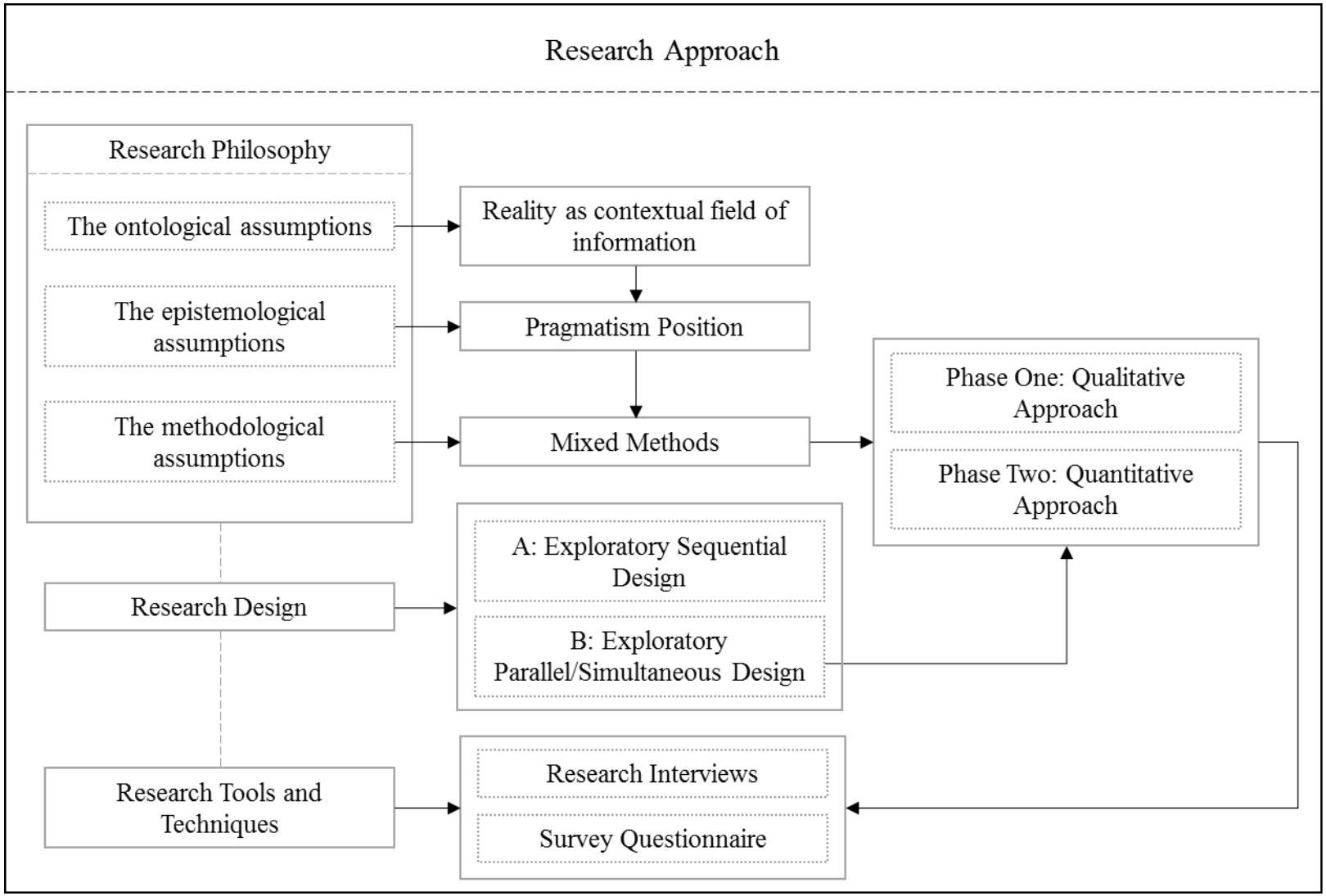


Figure 3.6: The research approach of the study

4 Chapter Four: Research Findings – Data Analysis

4.1 Introduction

This chapter presents the findings of the research separating them into two phases. The first set of findings is based on the analysis of the qualitative data, which were collected through the means of unstructured and semi-structured interviews with key pharmacy professionals operating in two countries, the UK and Greece, as detailed in Chapter Three. The reason for gathering this data was to understand how the downstream domain of the Pharmaceutical Supply Chain (PSC) operates within the context of the two countries and the role of the different groups of stakeholders therein. In addition, an investigation of the factors increasing pharmaceutical expenditure and preventing high quality healthcare services was undertaken. The second data collection phase refers to quantitative data; key pharmacy professionals were asked to complete an on-line survey in order to allow the researcher to explore whether innovative programmes could be implemented and improve the delivery of medicines. Therefore, by conducting a two-phase data analysis, this chapter firstly aims to explore the problems related to the delivery of medicines and how these issues impact upon the healthcare organisations' performance; and secondly, to test whether the effectiveness and efficiency of the system can be improved by applying innovation. For the purpose of this research, innovation has been defined as new or significantly improved services or processes used to produce or supply any products or services that the organisation delivers. The innovation must be new to the organisation, but it does not need to be new to the healthcare sector.

This chapter sets the foundations for the development of discussions and suggestions, which will be presented within the Discussion Chapter. To contextualise the research, this chapter initially provides information related to the background and the current situation of the downstream domain of the PSC, emphasising the activities involved within the downstream domain, using some primary qualitative data. Secondly, it reports on the qualitative findings derived from the analysis of 30 interviews, which analyse and categorise the key issues preventing an effective and efficient delivery process, achieved through thematic analysis. Finally, the chapter presents the analysis of the quantitative data conducted by using Linear Regression Analysis (LRA); 130

questionnaires were collected and analysed as a means to examine to what extent particular factors impact the system's innovativeness.

4.2 The current situation of the PSC

The pharmaceutical sector operates globally, manufacturing and distributing products to millions of people every day; therefore it generates a massive amount of income and affects almost everyone in the developed world (Mustaffa & Potter, 2009). In particular, the global pharmaceuticals market was worth approximately $740 billion in 2014 (EvaluatePharma, 2015), which represented approximately 10% of annual healthcare spending (Uthayakumar & Priyan, 2013). However, it is characterised as a complex enterprise because it has to deal with conflicting objectives and numerous intractable constraints (Rosseti *et al.*, 2011). In particular, it aims to meet customer demand effectively; which means patients should be able to find the required pharmaceutical products with ease. The Department of Health (2010) reported that there is a serious issue in terms of pharmaceutical over-prescription and process inefficiency. Globally, more than half a billion pounds worth of unused drugs is flushed down the toilet annually (Hester & Harrison, 2015). On the other hand, one of the main problems facing this sector is process inefficiency related to pharmaceutical distribution (Department of Health, 2012).

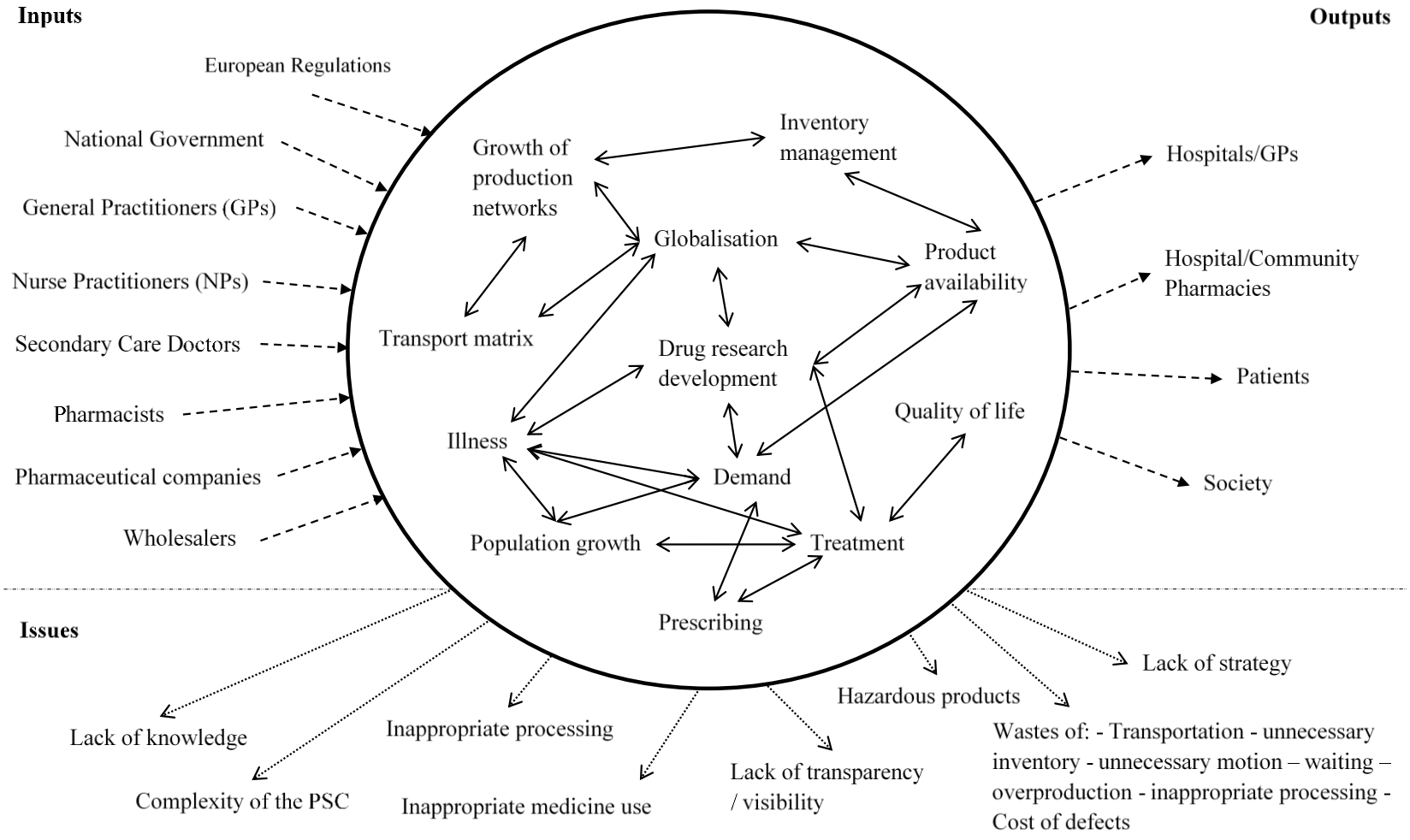
The current process inefficiency is caused by the use of basic but robust logistics and planning systems for pharmaceutical stock control; research suggests that existing systems use only simplistic push logistics (Jamali *et al.*, 2010). It is believed that standard logistics strategy models that have been useful in guiding managerial policy in other distribution industries are not easily applied to the PSC (Rosseti *et al*, 2011) due to the number of consumption points, the role and number of intermediaries, and the long lead times and highly unpredictable nature of bio-pharma manufacturing, which have created a web of contingencies, interdependencies and uncertainties (Buchanan *et al*., 2007; Bhakoo *et al*., 2012).

One of the increasing concerns in the PSC is related to particular characteristics of medicines. In other words, drugs can be converted into dangerous or useless products for consumers due to their short expiration dates (Cherrett *et al.*, 2012). Moreover, the disposal of expired/unwanted medication can be very costly and harmful to the environment (Department of Health, 2012). In

particular, there is emerging concern about the potential impact of pharmaceuticals that reach lakes and rivers via sewage plants and other sources (New Hampshire Department of Environmental Services, 2009).

The respective Departments of Health in many countries, including the UK and Greece, have produced a series of guidance on best practice waste management in order to help healthcare organisations deal with the perceived perishability issues (WHO, 2004; National Organisation for Medicines, 2016). For example, in December 2012 an action plan to reduce waste medicines was launched, aiming to determine how best practice could be shared to improve the use of medicines and address medicine wastage within the NHS (Department of Health, 2012). However, there has been no evidence of the adoption of these ideas. Therefore, an efficient PCS is considered essential due to the consistent demand for better delivery processes to improve quality of life and develop a sustainable competitive advantage (Khanna, 2012). The following figure (Figure 4.1) illustrates a model of the perceived complexities of the PSC within wider society, which was informed by the existing relevant literature and the analysis of primary qualitative data.

Figure 4.1 presents the complexity of the PSC by adapting the fundamental operations system. As is explained in the Literature Review Chapter, operations management enables organisations to transform a number of inputs into outputs in order to satisfy their customers (Brown *et al.*, 2013). As can been seen from Figure 4.1, there are different groups of stakeholders involved within the PSC, such as pharmaceutical companies, wholesalers, suppliers, the Government and communities; each has a different role and influences the delivery of medicines. Therefore, healthcare organisations have to balance those different roles and translate them into high quality healthcare services. However, there are numerous challenges that healthcare organisations need to deal with. They have to consider population growth, the quality of treatment, the increasing level of demand, the prescribing process and product availability in order to provide high quality services to their customers: hospitals, GPs, community pharmacies, patients and society. They might have to face a significant number of issues during the delivery of medicines, all of which need to be solved. These are related to the high cost of services, lack of finance, high level of wastage, lack of transparency and visibility, lack of communication, lack of information and knowledge and even lack of strategy (Liddell *et al.*, 2008; Mustaffa & Potter, 2009; Bhakoo *et al.*, 2012; Xie & Breen, 2012; Papalexi *et al.*, 2015).

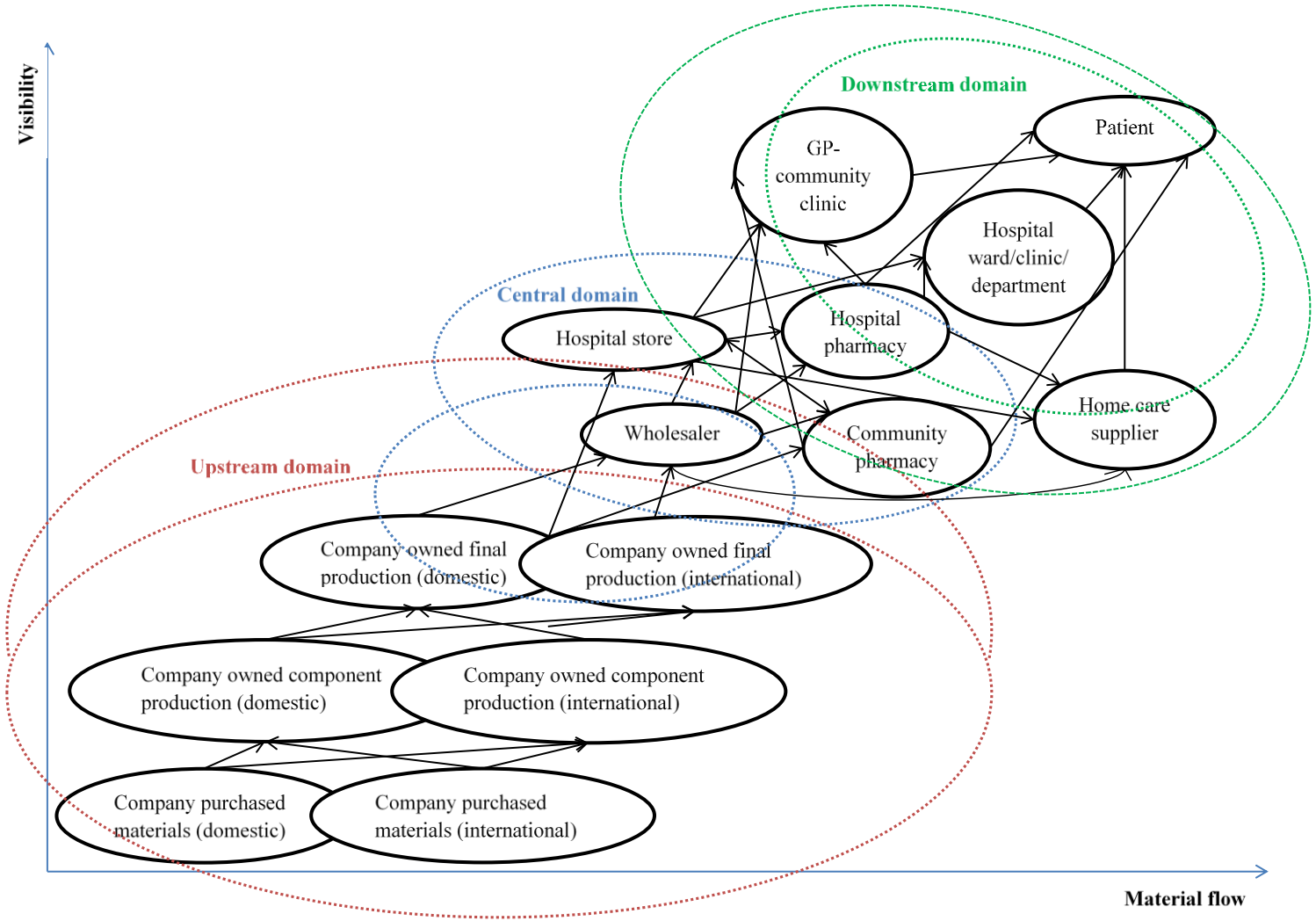


Note:- → represents the inputs and outputs/ ⇔ represents the interrelationships between the different elements involving within the transformation process/ ⇢ represents the perceived issues of the PSC

Figure 4.1: A fundamental model of the Pharmaceutical Supply Chain and Society

It is suggested that these issues can be solved by focusing on and improving the PSC. Many researchers interested in this particular area have concluded that implementing effective SCM raises the opportunity of reducing the existing level of wastage, hence improving services' effectiveness (Jamali *et al.,* 2010; de Vries, 2011; Xie & Breen, 2012; Papalexi *et al.,* 2015). The following figure (Figure 4.2) presents the 'total' PSC including the different groups of stakeholders. Figure 4.2 illustrates the PSC upstream, central and downstream domains where different groups of stakeholders are involved.

The literature indicates a low and fragmented focus on issues related to the entire PSC, which is presented in Figure 4.2 (Narayana *et al.,* 2014). The main research focus has been on the upstream business processes, revealing an emerging interest in exploring the interactions between pharmaceutical manufacturing and the R&D-specific biotechnology industry (Lane & Probert, 2007; Gupta *et al.,* 2009). The upstream domain of the PSC is responsible for ensuring the quality and effective distribution of the raw materials being used to manufacture the final pharmaceutical products (Sen *et al.,* 2013). On the other hand, most of the research related to the downstream network of the PSC concentrates on aspects of operations management, including healthcare procurement, logistics and decision making (Yu *et al.,* 2010; Pazirandeh, 2011; Narayana *et al.,* 2014). The central domain involves activities related to the distribution processes, marketing and sales, and it can stand as a separate part of the supply chain or it can be included in the upstream or downstream network, depending on the type of end user and the finished product (Levis & Papageorgiou, 2004).

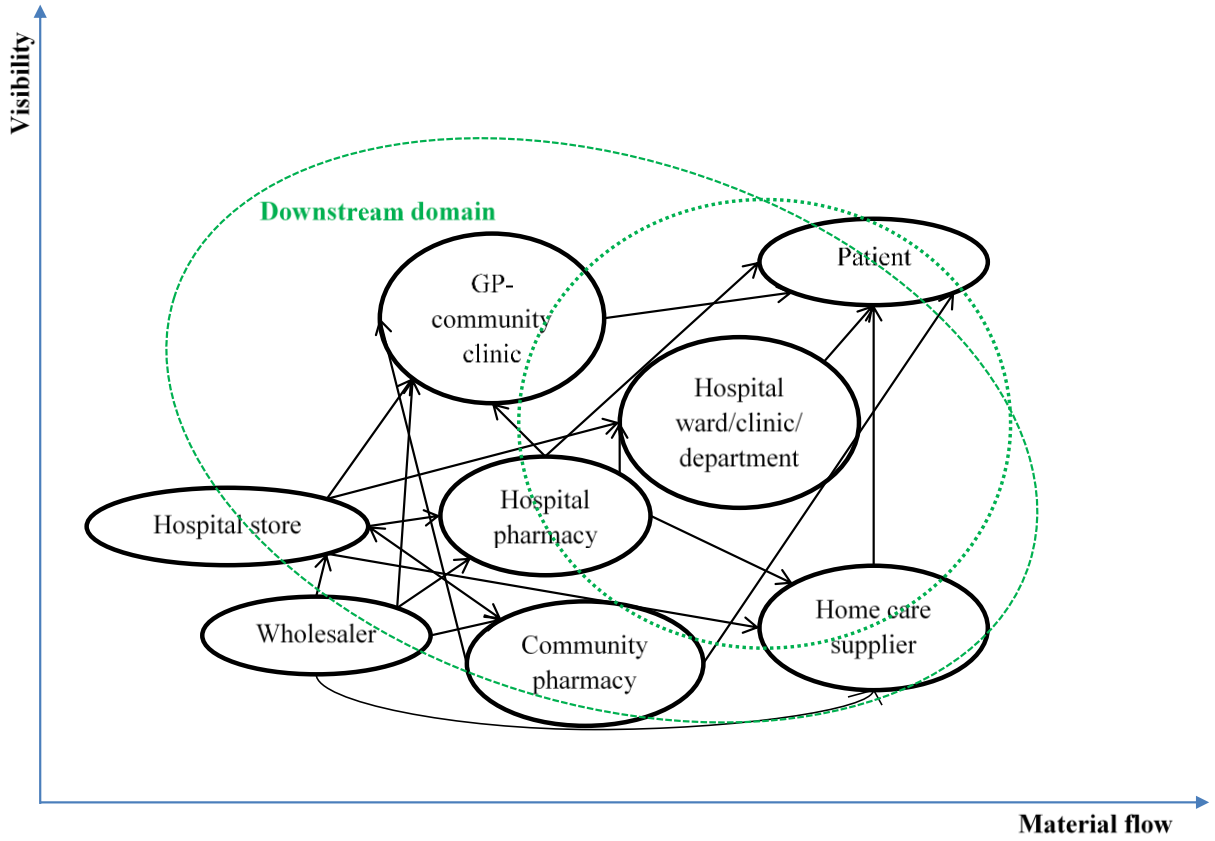


Note: cycles present the different distribution lines of each domain

Figure 4.2: A conceptual model of the PSC upstream, central and downstream domains

From Figure 4.2, it is clear that the PSC is not linear and there are many different distribution lines. For example, stakeholders involved within the upstream domain of the PSC could be either only pharmaceutical companies that produce the products or this domain could also include the distributor/wholesaler. Although the figure shows the entire PSC, this research focuses on the PSC downstream domain, as the researcher believes that this is the most critical because it is directly related to the distribution of the finished products to customers (patients). This research focus will also contribute to the low emphasis on the PSC downstream network in the existing literature, as reported by Narayana *et al.,* (2014).

Figure 4.3 presents the downstream domain of the PSC. Similarly to Figure 4.2, Figure 4.3 shows the different distribution lines that exist in the PSC downstream domain. As can be seen from Figure 4.3, the downstream network of the PSC involves myriad stakeholders, such as: suppliers, pharmacists, GPs, physicians, clinical staff and the end user/patients; this increases the complexity of the PSC and is considered one of the main reasons for delivery process inefficiency (de Vries, 2011). In particular, the perceived weak knowledge and information flow within the PSC (Bhakoo *et al.,* 2012); the tendency of the PSC stakeholders to operate independently (Jimmerson *et al.,* 2005); the several storage areas (Mustaffa & Potter, 2009); and the difficulties in predicting the market demand for medicines (McKone-Sweet *et al.,* 2005), cause considerable uncertainties and barriers to implementing innovation (Grol & Wensing, 2004).



Note: cycles present the different distribution lines of the downstream domain

Figure 4.3: A conceptual model of the PSC downstream domains

This section introduced the PSC concept focusing on its complexity and the need for a more effective and robust supply chain. The following section will analyse the current situation within the PSC in both countries, the UK and Greece. It will provide more detail about the practices involved during the delivery of medicines and the issues associated with this process.

4.3 Understanding the background and the delivery process in the UK and Greece

For a better understanding of the environment in which the selected healthcare organisations operate, reference to some general data related to both countries: the UK and Greece, is necessary. The UK's population was 64.96 million and the gross domestic product (GDP) or the value of all final goods and services produced within the nation was $2.989 trillion, according to measurements carried out in 2015 (World Bank, 2016a). Based on the same measurements,

Greece's population totalled 10.84 million people and the GDP was $235.6 billion in 2015 (World Bank, 2016b). Greece is a considerably smaller country, just 16.7% of the population of the UK.

Focusing on the healthcare sector, as Figure 4.4 shows, in the UK the total expenditure on healthcare as a percentage of GDP was 8.5% ($3,235 per person) in 2013 (OECD Health Statistics, 2015a) and on the other hand, the share of GDP allocated to health spending in Greece was 9.2% ($2,366 per person) in 2013 (OECD Health Statistics, 2015b). From Figure 4.4, it can also be seen that public sources in the UK accounted for 83% of overall health spending and 17% covered private expenditure in 2013 (OECD Health Statistics, 2015a). Regarding Greece, public expenditure accounted for 66% of overall health spending and 34% was related to private expenditure in 2013 (OECD Health Statistics, 2015b).

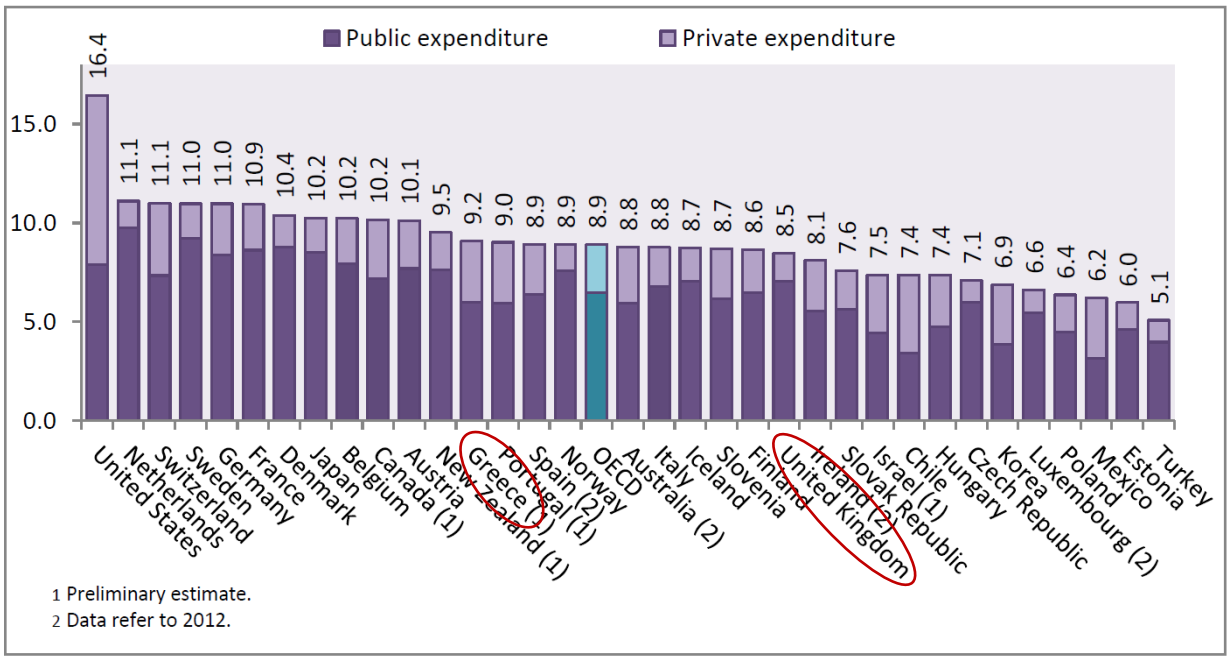


Figure 4.4: Health spending as a share of GDP, OECD countries, 2013 (Source: OECD Health Statistics 2015c)

Household payments, referred to as out-of-pocket expenditure, mainly fund the healthcare private sector (Eurostat, 2015a). As government spending on healthcare in Greece reduced by approximately €5 billion from 2009 to 2013, out-of-pocket spending in Greece increased by 3% during the same period of time; it covered 28% of overall healthcare expenditure in 2009 and 31% in 2013 (OECD Health Statistics, 2015b). Besides, out-of-pocket expenditure in the UK is

relatively low, less than 10% in 2013, which is similar to other western European countries such as Germany (14%), but well below southern European countries such as Italy (22%) (OECD Health Statistics, 2015a). Based on the statistics presented, it could be inferred that the public sources in the UK appear to be more developed than those in Greece, where patients tend to use the private healthcare sector more. This element will be analysed extensively throughout the Discussion Chapter.

Other indicators for measuring the healthcare services in both countries are the total number of physicians and nurses (Eurostat, 2015a). In 2012, a high number of practising physicians per 1000 inhabitants was recorded in Greece (6.2) (OECD Health Statistics, 2014b), while the same statistics indicate a significantly lower number of doctors per 1000 population in the UK (2.8) (OECD Health Statistics, 2014a). On the other hand, the number of nurses per 1000 population in Greece (3.3) (OECD Health Statistics, 2014b) was well below compared that recorded in the UK (8.2) (OECD Health Statistics, 2014a). Based on these statistics, it could be summarised that the Greek healthcare system places more emphasis on curative services, using a relatively higher number of physicians, while the UK healthcare system appears to focus more on primary healthcare provision, using a higher number of nurses to facilitate disease prevention (Lionis *et al.*, 2009).

Overall, UK healthcare expenditure grew by 0.6% in 2013, but a number of initiatives aiming to reduce the public financial resources have been reported (OECD Health Statistics, 2015a). Oppositely, in Greece, a 2.5% reduction in healthcare spending occurred in 2013, which can be explained based on the deep and ongoing economic crisis (OECD Health Statistics, 2015b). Regarding pharmaceutical spending, in 2015 the worldwide expenditure was estimated to be around $1,069 billion (Statista, 2016a); in particular, the European Union (EU) market reported a growth of 2% compared to the previous year (Statista, 2016b). However, a 2% cut in pharmaceutical spending has been reported across OECD countries including the UK between 2009 and 2013 (OECD Health Statistics, 2015c). In 2012, 12.3% ($367 per person) of the total UK healthcare expenditure was on pharmaceuticals (OECD Health Statistics, 2014a). Apparently, the current economic crisis has left all sectors of the Greek healthcare system affected; in particular, the government's annual bill for pharmaceutical products was reduced by €1.8 billion (6%) between 2009 and 2013 (OECD Health Statistics, 2015b). Pharmaceutical

spending covered 25.2% ($599 per person) of Greek healthcare expenditure in 2012 (OECD Health Statistics, 2014b), which is significantly higher than the total amount spent in the UK. Table 4.1 summarises the information related to the countries' population, GDP, healthcare expenditure and healthcare resources that have been presented in this sub-section. The OECD average healthcare spending and available resources are also provided in Table 4.1 to compare them against the UK and Greece figures.

	United Kingdom	**Greece**	**OECD average**
Population	64.96 million (2015)	10.84 million (2015)	-
Gross Domestic Product (GDP)	$2.989 trillion (2015)	$235.6 billion (2015)	-
Healthcare expenditure			
Health expenditure as a % GDP	8.5% (2013)	9.2% (2013)	8.9% (2013)
Health expenditure per capita	$3,235 (2013)	$2,366 (2013)	$3,453 (2013)
Public expenditure on health (% health expenditure)	83% (2013)	66% (2013)	73% (2013)
Out-of-pocket payments for health care (% health expenditure)	10% (2013)	31% (2013)	25% (2013)
Pharmaceutical expenditure (% health expenditure)	12.3% (2012)	25.2% (2012)	15.9% (2012)
Pharmaceutical expenditure per capita	$367 (2012)	$599 (2012)	$498 (2012)
Healthcare resources			
Number of physicians (per 1000 population)	2.8 (2012)	6.2 (2012)	3.2 (2012)
Number of nurses (per 1000 population)	8.2 (2012)	3.3 (2012)	8.8 (2012)

Source: OECD Health Statistics (2014; 2015); World Bank (2015)

Table 4.1: Key facts for the UK and Greece (Adapted from OECD Health Statistics, 2014a)

This section provided some useful background information related to the healthcare sector in the two selected European contexts. Based on the statistics presented, one could conclude that there

are differences between these two countries in terms of their healthcare spending and healthcare structure. For example, it is reasonable to suggest that the Greek healthcare system has been constantly affected by the economic crisis, which has caused remarkable reductions in Greek healthcare expenditure. This was not the case for the UK healthcare system, but there are still pressures put on it to minimise healthcare spending while improving healthcare quality, as is highlighted throughout this thesis. Although the statistics presented provide general information related to the healthcare sector in the two selected European countries, the availability of more financial and structural data related to the specific regions where this research was conducted, based on official sources, could provide a more parsimonious analysis. However, the collection of more context-specific data was achieved through conducting interviews with key professionals working within the PSC in both countries and presenting it in the following sections of this chapter.

Having presented some general information related to the healthcare sector in both European countries, the following section evaluates the set-up and physical distribution of the PSC, which has been developed based on the collected qualitative data.

4.3.1 An introduction to the qualitative data analysis

As mentioned previously, the aim of this sub-section is to present the current medicine delivery practices undertaken in both European contexts. To structure the following sub-section and help the reader to capture the current downstream delivery processes employed from the UK and Greek PSCs, the use of the data collected via the initial unstructured interviews with key professionals, working within the focus industry, was considered necessary. This will add value to the following analysis as the experience and opinion of the interviewees can confirm the described delivery practices. The following sub-section can be considered as an introduction to the thematic analysis that follows, which is based on the data collected via the semi-structured interviews and focuses on the issues associated with the inefficiency of the pharmaceutical delivery process.

In this thesis, a total of 8 unstructured pilot-interviews took place as a means of developing a clearer understanding of the current medicine delivery process. The following table (Table 4.2)

presents certain characteristics of the interviewees participating to the unstructured interviews, aiming to provide information related to their background, which might explain their view regarding the study subject (McCracken, 1988). This information is related to the participants' gender, position, working experience and the innovativeness of the delivery system in whuch they are involved, based on their perspective. This initial qualitative analysis represents a founding basis on which the thematic analysis that follows will stand, as explained in Chapter Three. The coding process was introduced in Chapter Three and presented in Table 3.1.

#	Reference	Gender	Position	Working Experience	System's Innovativeness
1	1/UK	F	Lead Pharmacist	12 Yrs	Neutral
2	2/UK	M	Chief Pharmacist	8 Yrs	Neutral
3	3/UK	M	LPC Secretary	6 Yrs	Agree
4	4/UK	M	Procurement and Homecare Manager	7 Yrs	Agree
5	5/UK	F	Chief Pharmacy Technician	2 Yrs	Agree
6	15/Gr	M	Hospital Pharmacist	13 Yrs	Disagree
7	17/Gr	F	Community Pharmacist	22 Yrs	Neutral
8	18/Gr	F	Hospital Pharmacist	15 Yrs	Disagree

Table 4.2: Participants' Characteristics - Unstructured Interviews

4.3.2 Describing the downstream delivery process

The PSC within hospital pharmacies

The different supply routes

Hospital pharmacies, in both countries, have to prepare and deliver three different types of supply routes. The first involves the medicines that are for general use, and are not patient specific, such as paracetamol. These are stored in the wards' cupboards. The second supply route includes the medication issued for a particular patient; this medication is stored in the box next to the patient's bed and is used during the 'In Stay' and when patients return home. Finally the third

supply route is related to the discharged medication; only the drugs that patients will use when they are back home are involved in this supply route.

Once the hospital pharmacy receives the prescriptions, it has to ensure the availability of the required medicines, their quality and their delivery on time. As 1/UK stated, *"We receive a prescription, we have three types of prescriptions: one prescription for people that are going home and one prescription where the patient is staying in the hospital and one which is not exactly a prescription but a 'top up' profile that includes the medicines are needed in the wards"*. She continued explaining that "*doctors on wards prescribe medication electronically, they input all the medication into the computer system, which is really useful as it makes our job easier! Subsequently, the prescription can be either checked by a pharmacist on the ward or in the dispensary and then we print it off and complete the prescription*". A pharmacist in Greece, 18/Gr, commended on this, saying that "*we still deliver medication using a paper-based process. Electronic prescription has been introduced and even used in some hospitals but the problem that we face is that doctors do not have time to spend on electronic prescription*".

Delivery Process

The different supply routes existing within hospital pharmacies have been described. However it is essential to understand the pharmaceutical logistics process, which includes the ordering process and the storage of medicines by pharmacies. Hospital pharmacies in the UK and Greece tend to order the required products five days per week, twice a day. They order them from large wholesalers, which are multinational companies; this fact enables pharmacies to receive the majority of medicines from them. According to 15/Gr, "*approximately 90 % of the required products are delivered through wholesalers*". However, there are pharmaceutical companies that prefer to supply the required items directly to pharmacies; they tend not to use a wholesaler.

Hospital pharmacies set up an agreement with their suppliers which enables them to receive the products on time and at a better price. 4/UK said that "*hospitals sign up contracts with their suppliers which enable them to receive the medicines at better prices and also build a relationship with them which, at some point, ensures the quality and on time delivery*".

Hospital pharmacies order the items using an online system, which includes a list of all products that they manage; in this way, they can easily provide useful information related to each item, such as: the supplier's name, the quantity needed, the price and the order frequency. This information system informs them about the items that are running short and which need to be reordered. Subsequently, they create the order using the same system and send it to their suppliers. 4/UK stated that "*the information system that we use enables us to check our stock level, create the next order, calculate the cost and send the order to our suppliers*". A hospital pharmacist, 15/Gr, explained that in Greece they use a similar information system, which enables them "*not only to check and order stock but also inform them about any type of changes, such as cost or stock changes*".

1/UK explained that "*wholesalers deliver items twice a day, every day and we sometimes receive an order on Saturday morning […], so we usually have ten or eleven deliveries from each wholesaler per week*". However, order frequency depends upon the type of product and how often it is needed, as a hospital pharmacist, 15/Gr, stated: *"the delivery process would depend on how frequently we need the products and the agreement that we have set up with our suppliers. For example, the large bags of fluids are delivered twice a week because we constantly use them and because they are so bulky […], some items might be next day delivery while others are only delivered on a specific day*".

Inventory Management

To ensure the availability of medicines and minimise the risk of them being out of stock, hospital pharmacies, in both countries, are tasked with having an average of two weeks' stock. As 5/UK explained, "*we have to keep two weeks' safety stock […], however, there are some medicines that may only have one or two days' stock and others that are used once a year but we have to keep them just in case they are needed […], we have to comply with the national guidance*". Similar processes are followed in Greece; 18/Gr suggested that *"according to our national guidance, we have to store some medicines, such as some antidotes for poisoning, in case a patient needs them […], but generally we keep two weeks' safety stock"*. Hospital pharmacies in both countries have structured the described strategy based on actual usage figures.

Hospital pharmacies manage quite sensitive products characterised by their short expiration dates, which means that they have to frequently stock check them to ensure their quality. 15/Gr explained that "*we do stock check the whole stored supply during the year to minimise the risk of the medicines being out of date […]. In particular, the expiry date check has officially to happen every month*". 1/UK commented on that, saying that "*the information system that we use controls our stock levels but we need to double check them to make sure that this information is accurate, so we still have to conduct stock checking manually, which is a time-consuming process*". She continued saying that "*once the stock check has been done, if we discover that there are some short dated items we can swap them with other medicines from the Co-operative pharmacy where they might be used more frequently and vice versa; we have set up an agreement with the Co-operative pharmacy which helps us to reduce the waste of 'unused' medicines"*. This type of agreement does not exist in the Greek system.

The perceived level of system wastage

As is described above, hospital pharmacies receive three types of prescription: i) the medicines general use, stored in the wards' cupboards; ii) the medication issued for a particular patient; iii) the discharged medication. According to the respondents, within a hospital the level of wastage is really high and it mainly occurs at ward level. 18/Gr explained that "*the ward staff has the responsibility to manage their own stock of medicines […] considering that their main focus is to treat patients properly, they have limited time to focus on stock related issues, something that in general increases the level of wastage"*. 4/UK agreed with this statement, saying that "*stock checking is not an essential part of the nursing role and they have not been trained to effectively manage stock rotation, hence stockpiling and obsolescence occurs*".

Another issue reported during the research is related to discharge medication. It has been noticed that sometimes discharge medication is issued to the wards, but the patient has left before the medication is ready. In a similar vein, sometimes medication does not follow the patient; patients, after their assessment, are sent to the appropriate department without the medication issued to them. 5/UK stated that *"we do not waste these medicines; they are returned back to the pharmacy and are reused"*. In this case, the waste is not related to the product, but is related to the effort and time spent to put them back to the system. Pharmacy staff has to collect them,

check their quality, remove the label and re-label them again, which is process duplication. 1/UK explained that "*we supply approximately £30 million of medication per annum of which £36,000 per annum is returned and reused*".

On the other hand, on various occasions, medicines cannot be re-used. 18/Gr reported that "*a lot of times patients bring their medication with them, if, according to their condition, this medication has to be changed, we are not allowed to use the previous one based on the national guidelines"*. This is a common practice in both countries, as 1/UK explained *"there is the guidance from the General Pharmaceutical Council which does not allow us to use any medication issued by a community pharmacy or another hospital […], this is reasonable because we cannot attest the source and control of it"*.

Hospital pharmacies, in order to collect the 'spare' medication from the wards, have installed green bins in each ward. These bins are lockable and the leftover or unused medicines can be put into them. 5/UK stated that "*we receive these bins every day including numerous medicines; however the problem that we have to deal with is that we do not receive only medication but rubbish as well. This means that not only do we have to separate the medicines that can be reused from those that have to be destroyed, but we also need to throw away the rubbish"*. According to a hospital pharmacist in Greece, 15/Gr, there are similar bins in each ward which enable them to collect the 'spare' medication, hence reducing the number of products that they destroy.

The process map of the PSC with in hospital pharmacies

Figure 4.5 illustrates the perceived process map of the medicine delivery process in hospital pharmacies in both countries. The arrows show the forward logistics process and the dashed arrows the way that items can be reused or destroyed. Figure 4.5 presents the suppliers: wholesalers and pharmaceutical companies, the hospital pharmacy and the three different sorts of supply route. It describes not only the forward but also the reverse components of the defined pharmaceutical logistics process. Data related to the particular time spent on delivering the products and returning them into the system was not available. Participants suggested that such data is difficult to estimate because the PSC includes different supply routes, and a number of

stakeholders have diverse roles and have to deal with the diversity in demand. The unavailability of those data, therefore, is due to the highly complex delivery system and the lack of standardised processes.

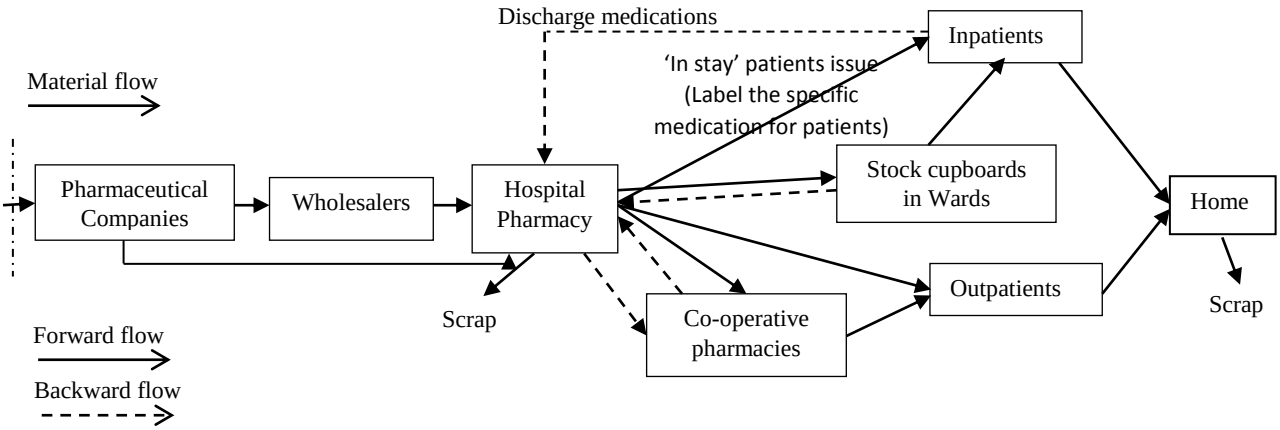


Figure 4.5: The process map of drug delivery in hospital pharmacies (Adapted from Papalexi et al., 2014)

The PSC within Community pharmacies

The supply route

The delivery process within the community pharmacies is similar but simpler than those of the hospital pharmacies. They have to deal with just one type of supply route: patients visit them providing their prescription and requesting their medicines. A community pharmacist, 3/UK, stated that "*our main concern is about the availability and quality of drugs […], we can manage both of them quite well*". A community pharmacist, 17/Gr, explained that "*it is a routine process […] our only challenge is to understand what is written on the prescription […]. The electronic prescription has solved this problem but we still have to decode some of them which are handwritten*".

Delivery Process

In both countries, community pharmacies receive the majority of required products from one main wholesaler and a minority of them from pharmaceutical companies. As a community pharmacist, 3/UK explained that "*community pharmacies in the UK tend to be big companies having many stores all over the country, such as Boots and Lloyds; they run their own warehouse, so they have better control of the products that they manage*". According to the participants, community pharmacies in the UK normally receive medicines two times per day and they can easily deal with an emergency because the warehouse is located close to them.

The situation in Greece is different, as community pharmacists can have their own store but they tend to cooperate. In particular, in Greece there are 27 organisations founded by a group of cooperative pharmacists which are responsible for the smooth and regular supply of pharmaceuticals and paramedical products to the pharmacies operating in the same geographical area; there are approximately 6,000 associate member pharmacies (www.sofla.gr). A community pharmacist, 17/Gr, stated that "*we are quite satisfied with the foundation of such an organisation; it works like a wholesaler for us and we order more that 90% of the required medicines from it. We order the rest of the items directly from the pharmaceutical companies because they prefer not to use a wholesaler […], this makes our job more complicated*". She continued saying that "*we are able to receive items five or six times per day; we can have them within an hour of the order*".

Therefore, the difference between the UK and Greece in terms of the delivery process is that in the UK there are big companies owning a warehouse and on the other hand in Greece there are many small stores cooperating and creating a cooperative warehouse. In the UK, community pharmacists receive the products two times per day, while in Greece they have five or six deliveries per day because the warehouse is more localised.

Community pharmacies in both countries order the required products using an online system that is similar to that used by the hospital pharmacies, albeit more developed. Community pharmacists have access to the wholesalers' system, which enables them to check the availability of medicines and then to order them. As a community pharmacist, 17/Gr, explained *"we share the same software with the wholesaler which means that we can see the products that are available, their price and the time that we will receive them"*.

The perceived level of system wastage

17/Gr stated that *"the level of wastage is low within the pharmacy because we do not really store products. We just keep enough quantities of the medicines that we sell more frequently"*. A community pharmacist, 2/UK, reiterated this, stating that *"we are quite good in managing our products […]; the information system that we use informs us about the level of stock that we have; there is a minimum and maximum level of stock and when it gets down to a certain level that is the critical point where we have to re-order. Our system automatically replenishes but in some other pharmacies they still have to re-order suppliers manually"*. He continued by explaining that *"there is not much waste within the pharmacy, however there is always the risk of a product expiring but we would take that risk in order to ensure that our customers are satisfied"*.

According to the respondents, the biggest amount of waste comes from patients. 3/UK stated that *"patients have not been educated to bring their spare medication back to the pharmacy; they tend to keep it just in case they need it in the future"*. He continued saying that *"we are able to collect the unusable medication; there is a dupe bin in each store where any patient returns or any out of date stock can go into. Subsequently, those medicines are collected and destroyed by the local authority"*. A community pharmacist in Greece, 17/Gr, explained that *"according to national guidance, each pharmacy has to display a bin for collecting the unused medication. On the one hand it is hard to persuade patients to bring back their spare medicines and on the other hand the local authority does not collect them often"*.

The process map of the PSC within Community Pharmacies

The following figure, Figure 4.6, presents the perceived process map of the medicines delivery process in community pharmacies in both countries. Community pharmacies order approximately 90% of the required products through wholesalers and the rest of them directly from pharmaceutical companies. Subsequently, they sell those products to their customers. In addition, they are able to collect the spare medication; they cannot reuse them, but they can collect and destroy them. Therefore, similarly to Figure 4.5, the arrows show the forward

logistics process and the dashed arrows describe the way that medicines can be destroyed. There were also difficulties in estimating the particular time required to deliver and return medication back to the system due to the perceived complexity of the delivery system, as explained in the previous sub-section.

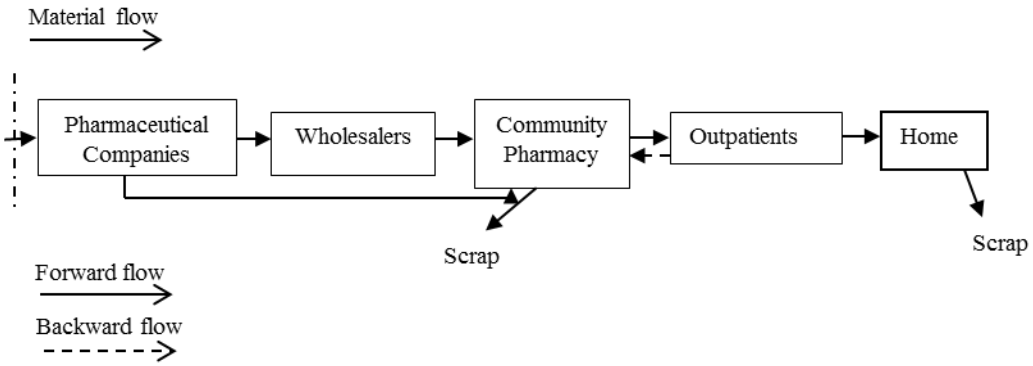


Figure 4.6: The process map of drug delivery in community pharmacies (Adapted from Papalexi et al., 2014)

This section presented the current pharmaceutical delivery process with hospital and community pharmacies in both countries: the UK and Greece. This analysis was based on the qualitative data collected through unstructured interviews with key professionals within the PSC. The following section analyses the qualitative data, collected via semi-structured interviews, by conducting a thematic analysis. The aim of this approach is to identify the main issues preventing a smooth and accurate delivery process. Therefore the following section highlights the reasons behind the weak process performances in the PSC.

4.4 Understanding the current situation: a Thematic Analysis

Collecting data through interviews has become a commonly used qualitative methodology (Allen *et al.,* 2009; Devine-Wright & Devine-Wright, 2009; Solberg *et al.,* 2010; Harper & Thompson, 2012; Braun & Clarke, 2013). Researchers try to capture the specific characteristics of a particular research area via extensive discussions with key professionals. This process helps them to gather the information needed to understand the current situation. A successful way of

conducting a systematic analysis of the data collected is under the control of a thematic analysis. This approach highlights the themes that are significant in the description of the phenomenon under study (Harper & Thompson, 2012; Guest *et al.,* 2012).

In this research, a total of 22 semi-structured interviews took place as a means of developing a better understanding of the issues that the PSC has to deal with. Braun and Clarke's (2006; 2013) linear model was used to conduct the thematic analysis; this was introduced in Chapter Three. Each interview transcript was closely examined and coded manually using MS Excel; the researcher acknowledges that the same process could have been delivered by using a software package, such as NVivo. However, a systematic process of identifying the core themes that meet the research aims and objectives was reasonably conducted manually, as explained throughout the Methodology Chapter.

Four main themes were selected as being the most suitable for this particular analysis. The researcher acknowledges that the thematic analysis was driven by her theoretical or analytic interest in this particular research area. In other words, there is an element of subjectivity, implying that different researchers might have chosen a set of different themes (Petty *et al.,* 2012). Apparently, other interesting data categories were quite evident during the process of identifying the core themes, but they were not in the immediate focus of this research and thus were not selected. Different data patterns could inspire future research.

The following sub-section provides the output of the thematic analysis. Throughout the following sub-section, the data are analysed and presented embedding extracts to achieve not only a data description but also an argument related to the particular research questions. As the data are based on the participants' experiences and opinions, providing some information about the participants' characteristics has been considered necessary. Table 4.3 presents the characteristics of the interviewees that participated in the semi-structured interviews. Similarly to Table 4.2, presented in the previous section of this chapter, Table 4.3 discloses information related to the participants' gender, position and working experience measured in years and also their perception about the innovativeness of the delivery system tin which they are involved. The information provided in Table 4.3 complements that presented in Table 3.2 in Chapter Three.

#	Reference	Gender	Position	Working Experience	Educational Level	System's Innovativeness
1	6/UK	M	Acting Chief Pharmacist	5 Yrs	Bachelor's Degree	Disagree
2	7/UK	F	Chief Pharmacy Technician	9 Yrs	Bachelor's Degree	Neutral
3	8/UK	M	Lead Pharmacist	11 Yrs	Bachelor's Degree	Neutral
4	9/UK	F	Community Pharmacist	7 Yrs	Bachelor's Degree	Disagree
5	10/UK	F	Chief Pharmacist	9 Yrs	Bachelor's Degree	Agree
6	4/UK	M	Procurement and Homecare Manager	7 Yrs	Postgraduate Degree	Agree
7	5/UK	F	Chief Pharmacy Technician	4 Yrs	Bachelor's Degree	Agree
8	11/UK	M	Lead Pharmacist	8 Yrs	Bachelor's Degree	Neutral
9	12/UK	F	Reader Advancing Clinical Practice	14 Yrs	Postgraduate Degree	Neutral
10	13/UK	F	Senior Lecturer, Nursing & Health Studies	12 Yrs	Postgraduate Degree	Neutral
11	14/Gr	M	Hospital Pharmacist	15 Yrs	Bachelor's Degree	Disagree
12	15/Gr	M	Hospital Pharmacist	13 Yrs	Bachelor's Degree	Disagree
13	16/Gr	F	Community Pharmacist	5 Yrs	Bachelor's Degree	Neutral
14	18/Gr	F	Hospital Pharmacist	15 Yrs	Postgraduate Degree	Disagree
15	17/Gr	F	Community Pharmacist	22 Yrs	Bachelor's Degree	Neutral
16	19/Gr	M	Community Pharmacist	6 Yrs	Bachelor's Degree	Agree
17	20/UK	M	Community Pharmacist	7 Yrs	Bachelor's Degree	Neutral

18	21/UK	F	Community Pharmacist	4 Yrs	Bachelor's Degree	Neutral
19	22/UK	M	Community Pharmacist	5 Yrs	Bachelor's Degree	Disagree
20	1/UK	F	Lead Pharmacist	8 Yrs	Postgraduate Degree	Agree
21	2/UK	M	Chief Pharmacist	11 Yrs	Bachelor's Degree	Neutral
22	23/UK	M	Community Pharmacist	4 Yrs	Bachelor's Degree	Neutral

Table 4.3: Participants' Characteristics – Semi-structured Interviews

As can been seen from Table 4.3, there is a mix of male and female participants, who are quite experienced and qualified. The majority of them (64%) have been working within the pharmaceutical sector for between 4 to 10 years, while 36% of them had more than 10 years of working experience. 77% of the participants held a bachelor's degree and the rest of them (23%) had successfully completed a postgraduate/PhD programme. Attempting to assess the innovativeness of the delivery system, half of the interviewees had an opinion and characterised the delivery practices that they apply as innovative (23%) or conventional (27%), while the other half could not measure the system's innovativeness. These characteristics describe the participants' background, referring to their role, experience and qualifications. This information adds value to the following analysis, as knowing the background of the interviewees could, to some extent, provide an insight into the participants' reasoning or standpoint regarding some of their views on the phenomenon under investigation.

4.4.1 Presenting the Output of theThematic Analysis

The quality of services and the cost of care are the main focus for healthcare organisations. The interviews gave the opportunity to understand further the complexity of these elements and analyse them based on the collected data. Healthcare organisations appear to acknowledge their weaknesses but they have difficulties in finding a solution, and they consider these difficulties to be part of the overall complexity of the system. As 7/UK said, *"we cannot compare the*

healthcare supply chain with the manufacturing one as in this case we have to deal with people's health and, on the contrary, they produce a product; this fact by itself can explain the complexity of our services". 15/Gr agreed with this highlighting that *"a mistake during the delivery of healthcare services has more possibilities to produce an unadjusted condition, for example a loss of a life"*.

Theory-driven thematic analysis has, therefore, been undertaken to analyse the rich data collected via the semi-structured interviews. This data analysis allowed the researcher to improve the understanding of the pharmaceutical delivery practices and identify the factors preventing an effective and efficient delivery process. Subsequently, a framework inspired by Bhakoo *et al.*'s (2012) categorisation of the root-causes was established; the researcher categorised the identified factors under four themes: i) Financial issues; ii) Communication issues; iii) Waste issues; and iv) Complexity issues.

These four main themes were selected as they fit with the specific research questions of the thesis. The first theme is related to the financial issues that pharmacies have to deal with. The literature is rich in evidence revealing a pressure on healthcare organisations to minimise their expenditure (Chassin, 2013; Al-Balushi *et al.,* 2014; Page, 2014). This is the case in both European countries, which are facing a constant reduction in pharmaceutical spending, as was reported by OECD Health Statistics (2015c), between 2009 and 2013. Communication issues emerged as another very important factor that could influence the accurate delivery of medicines; the existence of fragmentation and duplication in services has been reported (Radnor & Boaden, 2008; Bamford, 2011; Williams, 2011). The third theme is about any type of waste observed with the PSC. Uthayakumar and Priyan (2013, p. 52) highlighted that "*Pharmaceutical products can be expensive to purchase and distribute, but shortages of essential medicines, improper use of medicines, and spending on unnecessary or low-quality medicines also have a high cost in terms of wasted resources and preventable illness and death*". The final theme emerging from the analysis is the perceived complexity issues of the delivery system. A group of scholars suggested that the PSC are more complex compared to supply chains in other sectors (Liddell *et al.,* 2008; Greenhalgh *et al.,* 2012). It has been characterised as a highly sensitive supply chain because of its direct impact on health and safety (Uthayakumar & Priyan, 2013).

Each of the identified themes affects the medicine delivery process in a different manner and causes a number of problems and delays. The following sub-section analyses them extensively, focusing on the delivery of medicines from hospital and community pharmacies to customers/patients within the two selected European contexts.

4.4.1.1 Financial Issues

Expensive healthcare services

Based on the analysis of the collected qualitative data, one of the critical issues identified was the high cost of the produced services. Drug treatment is the most common form of healthcare intervention and represents the highest non-staff revenue cost in healthcare organisations (Davis, 2010). Medication is produced and prescribed in large volumes every year; for example over 100 tonnes of the top three compound medications (paracetamol, melformin hydrocholoride and ibuprofen) are prescribed in the UK each year (Xie & Breen, 2012). Specifically, worldwide expenditure, regarding pharmaceuticals, was estimated at around $1,069 billion in 2015 (Statista, 2016a). Focusing on the two selected European countries, 12.3% ($367 per person) of the total UK healthcare expenditure (OECD Health Statistics, 2014a) and 25.2% ($599 per person) of Greek healthcare expenditure was spent on pharmaceutical products in 2012 (OECD Health Statistics, 2014b).

This high cost is the reason why there has been pressure on healthcare organisations to keep a tight rein on their medicine spending. Healthcare organisations have to deal with the challenge of producing more with less. As a pharmacist, 8/UK stated, *"clinical commissioning groups have extensively focused on the drug expenditure; they want to know where all their money is going to, so they are very much now looking at medications, they have looked at it for a long time to say 'why are we spending so much money on antibiotics and analgesia?'"*

Limited financial resources

Trying to control their pharmaceutical spending, each healthcare organisation has been allocated a specific amount of money; 7/UK explained that *"[…] it may be different in other*

organisations, but in our organisation the budget for the medicines is held by the individual board consultant; a consultant has a team of prescribers, so any drugs that are spent, any drugs that are purchased are spent against that budget.[…]in particular, we manage and supply approximately £40 million of medication per annum". She continued, highlighting that *"each consultant area will have its own budget; we cannot overcome this budget and this is a way used for controlling the service cost".* Similarly, 18/Gr explained that *"in a hospital we cannot spend more than the budget that has been allocated for us, which is approximately €30 million per annum. For this reason, we double-check any single prescription received from the different departments. However, there is a difference in community pharmacies; patients can buy the quantity of medicines that they wish, especially if you think about those medicines that do not require a prescription".*

Community pharmacies are not facing the issues of limited financial resources as they operate independently, running their own business. However, they have to carefully manage the complex pharmaceutical delivery system to be able to predict the demand, satisfy their customers and control their expenses. The budget spent on pharmaceutical depends on the business size and the market demand. For example, according to 16/Gr, "*a medium size community pharmacy in Greece spend approximately 500,000€ per annum*".

Difficulties in controlling pharmaceutical spending

Healthcare organisations, especially in the UK, try to keep the patients in the primary health care level and this has been considered a way of reducing the cost of services. This can be confirmed based on the statistics provided by OECD Health Statistics (2014a) which refer to the practising physicians and nurses involved within the UK healthcare system; it includes a low number of physicians (2.8 per 1000 population) and a high number of nurses (8.2 per 1000 population) compared to other of European countries and in particular Greece. This can also be confirmed by a nurse practitioner 12/UK who stated that *"there is a big push to keep people in the community; patients only go into hospital: i) if they are going to die or ii) if they need an urgent operation or an emergency. Once they have been stabilised in a hospital, they are then back to the community".* According to the interviewee *"we should be looking after people in their own home for two reasons: i) people feel happier in their own home, they have a better chance of getting*

better in their own home and less of a chance to get an infection because they live in their own dirt and everybody is different so they are immune to it all […]; ii) the second reason is that hospital beds are very expensive to keep people in for 'no good reason'".

Healthcare organisations in Greece agree with this practice but they have a slightly different view; as 14/Gr explained *"it is too expensive to keep patients in hospitals, especially when they are feeling better, but we want to make sure that they have recovered and there is no risk associated with their health".* He continued, highlighting that *"we know that other countries can deal with that risk by introducing the 'home care practice'; they have trained their staff, the nurses for example, to follow up with the patients visiting them at their own place. Unfortunately, we have not established a system like this and currently we do not have the capacity for introducing it*".

High cost of innovation

The interviewees have also been asked about the cost of innovation and how this element has influenced their decision to be innovative. As 15/Gr stated, *"it is hard to be innovative when you try to minimise the cost of the service that we offer. The application of innovative programmes requires the investment of a particular amount of money which is not always available; how can you be innovative with limited resources available?"* 2/UK raised a similar issue, suggesting that *"healthcare organisations try to reduce the cost of the existent system; there is no space for new investments, especially when nobody can guarantee their success".* He continued by stating that *"our role is to find the best way of treating our patients and make them feel better; if we change the way we operate, if we invest an amount of the existing funding into innovative programmes then we might lose the control of the existing system and we will be unable to offer the required services; imagine a situation of not having a required medicine especially under an emergency".*

A community pharmacist, 20/UK, highlighted that *"applying an innovative programme is a difficult decision to make because on one hand it requires money and on the other hand we might lose a customer in case we are unable to sell the required medicine".* 20/Gr had the same opinion, saying that *"new ideas and especially good ideas are always very welcome but in my understanding money has to be spent in order for them to be implemented; as we are*

experiencing a difficult economic situation we have left those ideas aside". He also stated that *"in a hospital pharmacy this decision could have been made more easily considering the relationship that they have created with their suppliers; they are able to set up a contract with them and as a result they can buy products much more cheaply, which is not the case for a community pharmacy".*

An overview of the perceived financial issues

Based on the analysis above, it becomes apparent that both the hospital and community pharmacists in the UK and Greece have linked innovation with cost. They believe that they have to invest an amount of money in order to introduce and implement an innovative programme. They have also stated some challenges that they might have to deal with if they decide to be innovative. Those challenges are similar in the two examined geographical areas and different in the two working environments (hospital and community pharmacies). In the UK and Greece, pharmacists believe that it is difficult to apply innovative programmes due to the lack of available funding. In both countries, hospital pharmacies have to deal with the challenge of reducing pharmaceutical spending. On the contrary, the community pharmacies in both countries are more open in introducing innovative programmes but they are not willing to invest their money in those programmes and perhaps face the risk of losing their customers due to an unsuccessful intervention; especially in Greece considering the current economic crisis.

Although data related to the cost of innovation within the PSC are not available and the interviewees were not in a position to estimate it, it was apparent that financial issues were not the only factor preventing pharmacies from being innovative. As mentioned previously and presented in Figure 4.1, PSC is characterised as a significantly complex system because, apart from its impact on human health and society, myriad stakeholders are involved in this system and have diverse and independent roles. Managing and orchestrating their role appropriately supports the adoption of innovative approaches.

4.4.1.2 Communication Issues

According to the present analysis, the lack of adequate communication appears to be an issue that creates some difficulties in delivering high quality healthcare services. This section demonstrates that the level of communication, synchronisation and information sharing between the different groups of stakeholders has a significant impact on the delivery process and can cause a number of problems such as increased cost and waste, which is what healthcare organisations try to avoid.

Lack of communication and synchronisation

As mentioned previously, there are a number of different stakeholders involved within the PSC and the communication between them is weak. 11/UK stated that *"there is often lack of communication between secondary care and primary care, so sometimes people get double prescriptions or medications changed yet primary care do not know and as a result they are still prescribing the other medication"*. A pharmacist in Greece 17/Gr commented on this expressing a different point of view; he explained that *"sometimes there is not enough information provided in a prescription which makes us unable to deliver it, and so we have to contact the doctors asking for additional information […]. Two years ago, we received the prescription on paper, handwritten by doctors, and we had even more difficulties in understanding what was written; now this process has been improved by the introduction of the electronic prescription service […]. However, we still have to go back to doctors and ask them for additional information to ensure that we are providing the correct medicine".*

Limited (or limited access to) information shared between the different groups of stakeholders

Besides the miscommunication between the prescribers or between them and the pharmacists, there are similar incidents between pharmacies and their suppliers. A community pharmacist 23/UK in the UK explained that "*the thing with working for a big company like Boots is that you do not necessarily get involved with the delivery process. We just order and receive the medicines; this is all we see really […]. If you own your own pharmacy you absolutely know the*

detail of how they get to you and where you buy your stock from". He continued, saying that *"we always order the required products through the online system and we are very satisfied with it, but it is really hard to contact our supplier if we need any additional information; we might spend half a day waiting for their response […]. I think this is because they try to keep only the online system as a communication tool […], but this causes a number of delays to us and perhaps raises the risk of losing customers or making them unsatisfied".* There is a similar situation in Greece; 16/Gr stated that *"we can get five or six deliveries per day which is very convenient, but we face some communication problems […]. We order medicines through the online system, we can check what medicines are available in the warehouse and order them, but sometimes we need to contact our suppliers either because we need some additional information or because we need to order a product which is not in the system […]. It happened to us that we had to wait half an hour in the line for their response which put us in a very difficult position because we were unable to meet the demand".*

The communication issues that the community pharmacies have to deal with have been described thus far, however in hospital pharmacies the situation is slightly different. Hospital pharmacies look after the in-patients – the patients that are still in hospital. As a hospital pharmacist, 4/UK stated that *"one of our main problems is that the medication does not follow the patient. What I mean is that patients are admitted into the hospital and after their assessment they move to the appropriate department […]. This process is associated with two types of miscommunication: i) if the drugs do not get to the accident and emergency assessment units in time and patients have been sent to another ward, they will end up having those drugs re-ordered; and ii) even if the medication has been delivered to those units on time, patients may need to move to another ward without taking their medicines with them, which again causes double ordering".*

Another hospital pharmacist, 7/UK, highlighted that *"we are aware of the communication issues between secondary and primary care […]; for this reason we prescribe medication for up to 28 days and try to make sure that when patients leave the hospital, they are taking their medication with them. Therefore, they do not need to arrange an appointment with their GP asking for more medicines, which reduces the level of wastage. […] what I have described is the ideal process, a lot of the times, patients leave the hospital without taking their medicines with them".*

Besides the patient self-medication, which is the drugs that have been prescribed for a particular patient, the wards stock some medicines, such as paracetamol, in the ward cupboards for general use. As a hospital pharmacist, 14/Gr, stated that*"nurses from a different department often come to the pharmacy asking for products without having checked their availability in the ward cupboards or without being informed that one of their colleagues have already order the same items".* Therefore, miscommunication between the staff not only increases the level of wastage, but also increases the time spent in order to distribute the correct medicines or ascertain their availability.

Lack of cross-functional understanding of the process

The weak communication and synchronisation between the PSC stakeholders, stemming from the qualitative data analysis, can be explained considering the role of the different actors involved within the pharmaceuticals delivery process. As detailed in the previous sub-section, healthcare providers in both selected countries tend to operate independently, without perceiving that they are part of a wider service process. They focus on delivering the service that they provide without considering that their actions affect the whole delivery system as the outputs of their job are transformed into inputs for the next stage of the process. Particularly, 18/Gr explained that "*there are incidents where the medication has been processed, but the doctor had changed the prescription without us being informed*". Those actions might generate delays and waste during the service production, which increases the PSC inefficiency and the associated cost. In addition, 4/UK stated that *"we try to get the medication out to the departments as quickly as we possibly can, this is how an in-patient pharmaceutical department functions, but instead of just working as ourselves just as a pharmacy, we also look at the wards and the role of employees there. For example, the nurses themselves play a very integral part in the delivery of medicines. We have asked them to provide us with more information regarding patients' status and to make sure that they pass the medication from one ward to another when patients move […]. Working as a team can improve the communication between us hence enhancing the efficiency and effectiveness of the system".*

An overview of the perceived communication issues

From the analysis of the collected data, it was clear that the level of communication, synchronisation and information shared between the different groups of stakeholders could influence the efficiency and effectiveness of a process. Good communication between the stakeholders in both countries, the UK and Greece, can increase the quality of healthcare services, hence satisfying the patients. Apart from a number of problems occurring due to miscommunication within the PSC, the one that has been considered most critical is the increased level of wastage. The following sub-section will present the collected data related to this theme.

4.4.1.3 Waste Issues

System's Inefficiency

The third theme preventing the effective and efficient delivery of medicines relates to the level of wastage that exists within the PSC. Community pharmacists believe that the reason for the high level of wastage derives from the existing system itself; it is related to the way clinicians prescribe and patients' attitude. A community pharmacist in Greece 19/Gr stated that *"in Greece we do not have a well-established primary care, there are only a few GPs who can assess and advise the patients; as a result, people try to assess themselves and decide who is the best doctor-specialist to visit. Patients, here, tend to visit the private doctors so they have to decide whether they need a throat specialist or an orthopaedic doctor".* He continued saying that *"patients visit the doctor who assesses them and prescribes the medication for them; what happens sometimes is that they do not want to follow this prescription either because they think that it does not suit their needs or because they have decided to see another doctor who will prescribe a different medication. As a result, they are not going to use the previous medication, which is apparently a waste".*

Based on the pharmacists' opinion, patients in Greece tend to ask for more medication until they find what they think works for them and on the other hand, different doctors tend to prescribe different medication; the one that they believe it will best treat their patients. A community pharmacist in the UK, 22/UK, reiterated this by saying that *"the problem is epidemic, it derives*

from the system; people might take medication for two days and say 'I feel better' and stop taking them but keeping them because they think 'I will keep them in case I have another infection'. However, if that happens, they tend to visit the GP again who will prescribe another medication for them. So they end up with more medicines than they need and they just keep them". 10/UK stated that *"patients are not willing to return the spare medication back to the pharmacy because on one hand having some medicines makes them feel more secure and on the other hand they want to keep them because they paid for them".*

A community pharmacist, 1/UK, believes that they do not waste medicines within the pharmacy, but a lot of waste exists within people's homes. She highlighted that "*I believe that waste does not come from the pharmacy; most waste comes from patients. If they order something on a prescription and then they do not use it, which is where the bulk of the waste comes from*". On the same note, 17/Gr explained that *"as we are able to receive our order five or six times per day we do not really store many products, so we do control and manage them effectively. It is rare for a product to expire. However, in houses' cupboards, you might find many expired drugs that people simply did not return back to us".* She continued saying that *"'dupe bins' were introduced two years ago. These are bins where any patient can return medication or any out of date stock; then these drugs are collected by the local authority and destroyed. The problem with those bins is that they are not visible, which might influence people to return medication, and also they are not collected by the local authority very often".*

Limited knowledge regarding return policy approaches – patients' perspective

13/UK explains that *"I think we have not educated patients so that they will always return their unused medications. Sometimes patients would come to see me in the practice and bring me their medication, and I have to say 'you need to take it to the pharmacist' and sometimes they just cannot be bothered or they forget or they just do not do that".* She continued by saying that *"I think we need to take more responsibility as clinicians and pharmacists and encourage our patients to return their spare medication. We should have a public health campaign 'Return Your Medication!'. I think there need to be more innovative ways of managing medicines in practice".*

Healthcare organisations tend to focus on return polices to deal with the system's waste; however it is generally accepted that these actions require the support of all the actors involved within the PSC. Patients as the end users of pharmaceutical products need to take forward these initiatives and return the spare or useless medication back to the system. Apparently, they are not willing to do this due to various reasons; primary because they tend to keep medication just in case they need it in the future. A better communication of the benefits of the return policies might influence patients' practices and reduce the level of waste in the system.

Lack of orchestration of healthcare resources

As described above, community pharmacies in both countries believe that they do not generate waste. The majority of out of date drugs are within people's homes, according to the interviewees. However they agree that there is a lot of waste within the PSC, which arises from the complexity of the healthcare system and the multiple stakeholders involved in it. The situation in hospital pharmacies is different; hospital pharmacists believe that the main waste derives from the poor communication and the lack of synchronisation between the pharmacy and the wards. As 6/UK explained *"the main waste comes from the wards; medication is returned to the pharmacy on a daily basis […] either because the treatment has changed or because patients left the hospital, without having taken their medication with them, which has been stored in the ward box beside the patient's bed […]. The problem is that we have to destroy this medication because it has been used or ordered for a particular patient and thus, we cannot reuse it.* He continued saying that *"nurses tend to order more medicines than they need because, by doing so, they feel that they have more capacity and they can better meet the demand. This fact increases the risk of drugs expiring, which is another type of waste"*

A hospital pharmacist, 15/Gr, reiterated this by explaining that *"a couple of years ago, nurses had the responsibility to stock check the wards' cupboards; this does not happen anymore because when this checking is done by a pharmacy's staff the quantity of the expired drugs is reduced"*. 10/UK stated that *"it is pharmacy staff's responsibility to stock check the wards' cupboards because nurses focus on their patients' health and often do not have enough time to do the checking […] or they cannot really understand the value of these products".* A hospital pharmacist, 4/UK, reported that "*the staff in wards do not really know the actual cost of*

medicines, they use or ask for them without thinking that they might waste them. I know that in a hospital, here in the same area, they have labelled every single package of drugs, writing their price, just to make the staff rethink before they use them".

Complying with the national and international guidelines

Another type of waste arises from some lines/types of medicines that have to be stored in the pharmacy according to the guidance from the General Pharmaceutical Council. 2/UK explained that *"we have to keep in some type of medicines, such as antidotes for poisoning, just in case they are needed. However, we rarely use them and as a result they often go out of date"*. Similarly, the medicines included in the emergency drugs boxes can easily go out of date as they are not used frequently but they have to be kept according to the national guidance. 4/UK stated that *"trying to minimise the waste, one of our plans is instead of waiting until the drug runs out of date, we open up an emergency drugs box which will go out of date in three months, we send those drug to the emergency department where they need them and we order a new emergency drugs box which is going to last eighteen months"*. A lot of waste comes from the medicines that patients bring with them as a hospital pharmacist in Greece 18/Gr explained; *"patients often bring their medication with them; if, based on their assessment, this medication has to be changed, we cannot re-use those medicines because they cannot be attested regards source and control; we have to comply with the national guidance".*

Limited knowledge regarding returns policy approaches – staff perspective

Hospital pharmacies acknowledge the high level of wastage that exists within hospitals and for this reason they have introduced green bins; these are lockable boxes in which leftover or unusable medicines are put. They use these bins in order to be able to identify the products that can be reused and those that have to be destroyed. In addition, putting the unused medicines in the bins ensures that they provide the correct product to patients. A hospital pharmacist, 2/UK, explained that *"there is a green bin in each ward and our stock replenishment team collects them on a daily basis. These are lockable bins where nurses can put the medicines that are not needed any more. This system works very well but the trouble is that we do not just receive the leftover*

or unusable drugs but we also get all the rubbish as well. It has not been clear that these bins can include only medicines, I guess". According to the interviewee 5/UK, separating the medicines that can be reused from those that have to be destroyed is a time consuming process; *"[…] we have to make sure that these medicines can be reused, some of them might be unlabelled and according to the guidance from the General Pharmaceutical Council, we cannot re-use them until we have correctly identified them"*.

Another pharmacist, 4/UK, stated that *"originally the return process belonged to the dispensary; all the drugs would come back and they would be put in the dispensary. However, the dispensary is too busy, so there was not enough time spent on returns. Therefore, they set up some very strange rules, for example if something was worth less than a pound they would throw it away because it was not worth the time processing it. But think about it, they might process twenty items that cost a pound in an hour if they throw them away, they definitely increase the existing level of wastage"*.

An overview of the perceived waste issues

Although the different groups of stakeholders involved within the PSC focus on reducing the level of wastage derived from the delivery of medicines, this level is still high. Community pharmacists believe that there is limited waste within the pharmacy; they manage their products quite well. However, based on the interviewees' opinion, the main waste exists within people's houses; patients tend to keep unused drugs and constantly ask for more medication. Hospital pharmacists have a slightly different view; they believe that waste occurs due to the poor communication, synchronisation and limited information shared between the stakeholders. In addition, they think that the delivery process is not only their responsibility; they need to work collectively with their colleagues based in wards in order for an effective and efficient process to be achieved.

4.4.1.4 Complexity Issues

Before the analysis of the complexity issues associated with the PSC are presented, the definition of a complexity system is considered necessary. For the purpose of this research, the notion of complexity has been defined as "*the interrelatedness of components of a system*" (Kannampallil *et al.,* 2011). Specifically, the complexity of a system is related to the relationships between the system's components. Understanding the interactions between those components provides an indication of the level of the system's complexity. This implies that the more components involved within a system, the higher the complexity they generate. The analysis of complex systems is important in order for the root-cause of a potential problem to be identified.

The complexity involved within the process of the delivery of medicines was the final, but highly important, major element that emerged from the thematic analysis. It has been positioned as the final theme on purpose, as it provides an overall layer that sums up all the issues that cannot be framed by the more straightforward financial, communication and waste issues. This will become clear throughout the following part of this sub-section, which analyses the factors that increase the complexity of the PSC applied within the two selected geographical areas.

Pharmaceuticals' characteristics

The complexity of the delivery process of medicines was the final, but equally important theme that emerged from the thematic analysis. As has been mentioned in the Literature Review Chapter, the role of healthcare organisations is to provide high quality services in order for patients to be adequately taken care of and more lives to be saved. In particular, the role of the PSC is to supply the required medicines to the correct place on time. The type of services offered is enough to represent the level of complexity within this system. As 8/UK stated, *"we have to deal with not only sensitive products but also very expensive ones. That makes our job very critical because we have to make sure that the products that we manage are appropriate for use."* He continued explaining that *"medicines have a short shelf-life, for this reason we have to check their condition regularly to ensure their properness".* It is generally accepted that medicines can be converted into dangerous or useless products for consumers; based on this assumption, 9/UK highlighted that *"we are responsible for people's lives so we have to be able*

to supply the correct medicine in the best condition […]. Besides patients' life, an expired product, most of the times, means that we have to destroy it […] which is a loss, it is a profit loss". According to the Transparency Market Research (2014), the medical waste management market cost $14.5 million in 2012.

In addition, 1/UK explained that *"different medicines have different characteristics which means that we have to treat them differently; we have to store them based on their needs […], for example in our storage we have products that need to be stored in a fridge so we cannot keep them on the shelves".* Therefore, within the PSC there are different distribution lines; they cannot treat all the products that they manage in the same way. He continued highlighting that *"besides the regular medicines that we manage, we have to keep in store some lines/types of medicines that might only be used once a year; we must keep them just in case a patient needs them. A representative example is that of antidotes for poisoning, we keep them and more often than not they go out of date because luckily nobody has poisoned themselves; but we have to hold them, we have to comply with national guidance"*. Based on this fact and considering that hospitals have a particular amount of money to spend on pharmaceuticals, it can be concluded that healthcare organisations are generally relatively centralised organisations.

In addition, as 15/Gr reported, *"we store our products differently based on their frequency of use; we want to have easy access to those that are immediately consumed and of course this influences how frequently we order them".* A hospital pharmacist, 8/UK, reiterated this, saying that *"we receive the required products usually twice a day; we will have ten or eleven deliveries from each wholesaler per week, but this is not a norm applying to every medicine […], it would depend on how frequently we need the different products".* He continued, explaining that *"the system requires an excellent relationship with our suppliers including a high level of trust […]; we try to store as few products as we can in order to be able to manage them properly and also possibly to prevent having expired items on our shelves; as a result, the role of suppliers is crucial in the supply chain".*

The role of suppliers

Hospital pharmacies in both countries tend to receive their madicine supplies twice per day; they have set up a contract with a couple of big wholesalers that are multinational companies, which gives them the opportunity to carry a range of medications and deliver them to hospitals. These contracts enable them to negotiate the prices and get a better offer. As 18/Gr stated, *"the reason of setting up contracts with our suppliers is to be able to receive the required products on time and also reduce the associated cost; we can minimise the cost by 50% for the medicines which are under a contract".* However, community pharmacies operate differently; a community pharmacist, 16/Gr, highlighted that *"hospital pharmacies are different; they used to have contracts with their suppliers and get the best deals".*

Although community and hospital pharmacies have to deal with similar issues, they have to store the medicines based on their characteristics and their frequency of use, community pharmacies are not in a privileged position where they can set up contracts with their suppliers and receive the products they need at a reduced price. For this reason, they tend to create collaborations between them or alternatively have their own wholesaler company and supply their stores. In particular, in Greece there are 27 organisations founded by groups of cooperative pharmacists, operating within a particular region. These organisations operate as warehouses; they locate close to their members which creates flexibility, enabling them to deliver the products on time. As an associate pharmacist member 17/Gr explained *"the aim of this organisation is to deliver the products to us, we are 105 associate members in this geographic area, and so the organisation has to order enough products to satisfy our customers. The more quantities of medicines we order, the better deals we can get. They negotiate the prices and as a result we can buy the same product at a better price through them".* She continued saying that *"we do not store many products anymore because we can receive the required medicines within an hour of the order".*

In the UK they do not have those groups of cooperative pharmacists but community pharmacies tend to be big companies with many stores all over the country, such as Boots and Lloyds. They run their own warehouse, which is also able to get some good deals from the pharmaceutical companies. 9/UK explained that *"we have just one supplier who is able to deliver the products to all our stores; we get a delivery twice a day including some really good offers as well".*

Hospital and community pharmacies in both countries order some products directly from the pharmaceutical companies, which makes the delivery process more complex and sometimes increases the cost and time for the medicines to be received. A pharmacist in Greece 16/Gr characterised this process as *"more complex because we have to contact them individually and make sure that we have ordered sufficient quantity of the required items as we do not have more than one delivery of them per week".* Similarly, a pharmacist, 21/UK, stated that *"there are some products that we have to order directly from the pharmaceutical companies, this is because those companies are not willing to supply their products through wholesalers; they think that they are losing control. This is a problem to us; it takes more time to contact them separately and of course we are not getting much discount".*

The role of stakeholders

Having analysed the complexity of the system created from the suppliers, the following section will focus on the role of the remainder of the stakeholders during the distribution of medicines and how they influence this process. Especially, in the PSC there are numerous stakeholders who are responsible for the delivery of medicines such as General Practitioners (GPs), Nurse Practitioners (NPs), secondary care doctors and pharmacists. In the UK all of them can prescribe medication or advise the patients. In particular a nurse practitioner, 13/UK, explained that *"I am an independent prescriber; nurse practitioners in the UK have trained working alongside the general practitioner. They can assess patients, manage and prescribe medication".* On the other hand, in Greece nurses have not been trained to prescribe medication which is something that only doctors are qualified to do.

A pharmacist in Greece 19/Gr stated *"I am aware that in other countries nurses or sometimes pharmacists can prescribe medication but here in Greece only doctors have the knowledge and the authority to prescribe medicines; this makes the process of providing healthcare services more secure. It is hard to control the medicines that do not have to be prescribed, patients have unlimited access to them; how can we control medication if there are multiple prescribers?"* Based on this, a nurse practitioner, 12/UK, highlighted that *"in the UK we can prescribe medication which is really helpful for the patients because they can be served quicker. However, that creates some issues: GPs and hospital doctors will not be informed; they will only know*

when the costs come in because they will see how much is being used". A patient has access to all those prescribers; she continued by saying that *"it is possible for a GP to assess patients and prescribe a medicine for them and then the hospital doctor or nurse practitioner to decide that this medication is wrong and prescribe a different one […] and then there are the pharmacists as well, who might suggest something different. As a result, the patients end up having multiple different medicines not knowing what to do with them".*

Although in the Greek healthcare system there is only one prescriber, the physicians, patients are still collecting medication from different sources. As 14/Gr explained "*within the Greek healthcare system the role of the GP is missing, which has particular consequences […]; patients have access to all healthcare providers, which means that they are able to visit more than one specialist until the right treatment, based on their opinion, to be suggested"*. He continued by saying that "*each specialist prescribes different medication, which it is not necessarily followed by the patients […]; however, they buy and store the medicines*".

In addition, prescribers and patients' culture influence this system. Doctors feel that they are responsible for people's health and they try to treat them properly; they try to offer high quality of services including the prescription of the correct medicines. 13/UK explained that *"each of the prescribers want to make the best decision for their patients as they cannot decide by themselves, so they change the medication to improve patients' health"*. On the other hand, patients tend to keep and ask for more medication. As 11/UK stated *"patients buy their medication, use it for a couple of days and then they might decide that they do not like it; they visit the NHS again or a nurse visits them at home, they get a different prescription without letting the prescriber know about the previous one […], as a result, they store medicines without needing them".*

Therefore, ordering medicines by multiple prescribers can cause a number of problems such as an increase in the cost spent and the level of wastage. Although healthcare organisations are willing to keep them as they can deliver the healthcare services more quickly, they have to increase the level of information sharing between them and enhance their communication to avoid the generation of these problems.

An overview of the complex delivery system

To sum up, there are multiple factors that generate the perceived complexity during the delivery of medicines in both selected countries. Initially, the complexity of the system based on the characteristics of the products is managed throughout the PSC; they are produced in different forms, which means that they cannot be treated and stored in the same way; they are not only expensive, but also sensitive and can be converted into highly dangerous products for society and the environment. This is directly related to the waste issues, which is the third emerging theme; therefore, the greater the complexity regarding managing the pharmaceutical products, the higher the wastage level in the delivery system.

In addition, complexity is generated due to the role of stakeholders involved in the PSC. The role of suppliers is critical as it is associated with the availability of medicines. Hospital and community pharmacies try to collaborate with one or two suppliers in order to facilitate the delivery process, receiving the required products on time and at better prices. However, this is challenging when they have to order some items directly from pharmaceutical companies because negotiation and the delivery process are not standardised and takes more time. As a result, pharmacies tend to keep more safety stock of those products to ensure their availability until the next delivery. On average, pharmacies tend to keep two weeks' stock. However, this is dependent on the frequency at which products are likely to be used; some types of medicine could be kept for a year and others may only have a one or two-day stock.

Regarding the role of the rest of the PSC stakeholders, in both European contexts, patients buy more medication than they need. This issue stems from the existence of multiple prescribers within the UK healthcare system and, on the other hand, the uncontrolled access to healthcare services observed within the Greek healthcare system. Healthcare providers, in both contexts, seem to operate independently with their own perception. They prescribe medication that best fits with the patients' condition, but without communicating their actions with the other providers. Lack of communication is one of the main factors responsible for PSC inefficiency, as explained in one of the previous sub-sections of this chapter.

4.4.1.5 Summary of the qualitative data analysis

In this section the set of qualitative data has been analysed according to the principles of an analyst-driven thematic analysis, as described in the Methodology Chapter. Based on this analysis, four factors preventing an effective and efficient delivery of medicines are identified and categorised as follows:

i. Financial Issues: Besides the considerable pressure put on healthcare organisations globally to reduce their pharmaceutical spending, the qualitative analysis revealed the limited financial resources available for providing the required healthcare services. In addition, the complexity of the pharmaceutical delivery system generates difficulties in managing and controlling pharmaceutical spending. Healthcare organisations also face difficulties in implementing innovation, which might be the solution to the challenges that they have to deal with, because innovation is associated with significant investment.

ii. Communication Issues: The analysis of the qualitative data indicates that the lack of adequate communication between the PSC stakeholders is one of the main issues associated with the system's inefficiency. Specifically, the limited information shared between the different groups of stakeholders and the lack of cross-functional understanding of the process increase not only the complexity of the delivery system, but also the cost and waste, which are the elements that have to be avoided.

iii. Waste Issues: The perceived level of wastage that exists within the PSC is an equally important issue that influences the effective and efficient delivery of medicines. Based on the qualitative data analysis, the system's inefficiency, the patients and healthcare providers' culture, the lack of orchestration of the healthcare resources and lack of education related to the returns policies are the factors that generate waste within the PSC.

iv. Complexity Issues: As Figure 4.1 describes, the PSC is characterised as a relatively complex system. The qualitative analysis shows that the particular characteristics of medicines, the role of the different groups of stakeholders and low level of transparency

during the delivery process are the main factors that generate the complexity of the system.

The issues related to these themes have been discussed and analysed based on the interviewees' answers. The following Table 4.4 presents the qualitative findings, highlighting the main issues.

Financial Issues	**Communication Issues**	**Waste Issues**	**Complexity Issues**
Expensive healthcare services	Lack of communication and synchronisation	System's inefficiency	Characteristics of medicines
Limited financial resources	Limited information shared between the different groups of stakeholders	Patients and healthcare providers' culture	The role of suppliers
Difficulties in controlling pharmaceuticals spending	Lack of cross functional understanding of the process	Lack of orchestration of the healthcare resources	The role of the different groups of stakeholders
High cost of innovation		Lack of education	Low level of transparency during the delivery process

Table 4.4: The four factors preventing effective and efficient delivery of medicines

Based on the qualitative data analysis, it is apparent that some of the identified issues associated with PSC inefficiency are listed under more than one of the themes that emerged from the thematic analysis. This is because the identified issues are related to the components that constitute the pharmaceutical delivery process. The interrelatedness of these components generates the system's complexity (Plsek & Greenhalgh, 2001; Kannampallil *et al.*, 2011). For example, the high cost of the healthcare service, the particular characteristics of medicines and weak communication between the PSC stakeholders influence the complexity of the delivery system. Similarly, the perceived communication issues increase the level of wastage, which, on the other hand impacts upon financial issues. Figure 4.7, below, presents a representation of the

interrelatedness of the issues identified from the Thematic Analysis. This figure will be revisited in the Discussion Chapter that follows, providing more details.

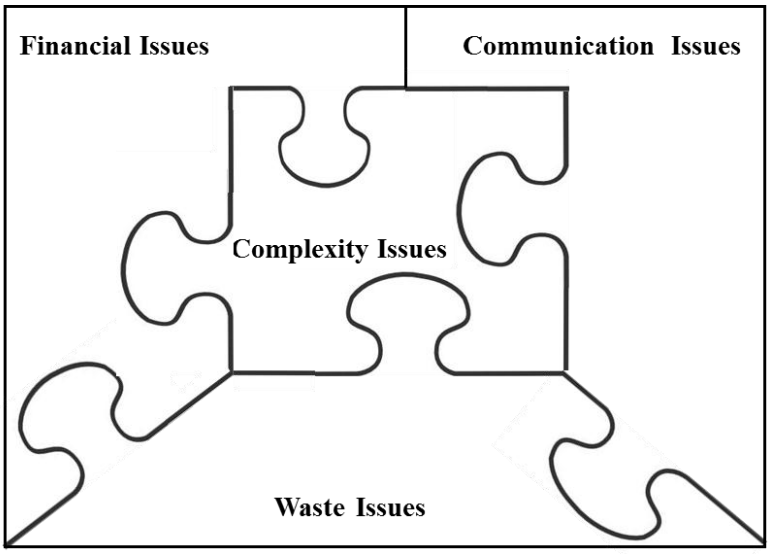


Figure 4.7: The interrelatedness of the emerged themes

4.5 Survey Analysis-Level of Innovation within the downstream domain of the PSC

After developing an understanding of the key issues relating to the delivery of medicines, based on the qualitative analysis, it has been considered essential to measure the existing level of innovation and identify the factors that support or prevent innovative programmes that can be applied within the downstream domain of the PSC. The collection and analysis of quantitative data have been considered necessary in order for a better understanding of the phenomenon under investigation to be gained. However, the quantitative data analysis that follows has a supportive role, as it addresses only one of the main research objectives presented in the Introduction Chapter. The outputs of the quantitative analysis can therefore be considered as an indication related to the innovativeness of the downstream domain of the PSC. However, this indication can facilitate the development of the recommendations regarding the improvements that are necessary.

A survey was, therefore, designed based on the existing literature and some initial findings of the interview phase, and distributed to key professionals working within the downstream domain of

the PSC in both countries: the UK and Greece. The purpose of this survey was to i) capture the level of innovation applied during the delivery of medicines; and ii) identify the factors that influence positively or negatively the decision of hospital and community pharmacies to innovate. For these two aims to be achieved, the collected quantitative data were analysed using the Linear Regression Analysis (LRA) statistical technique. The results of this analysis are presented in the following sub-section, testing the hypotheses:

Hypothesis 1(H1): Reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patients satisfaction (c) are positively related to the innovation level regarding the use of technology.

Hypothesis 2 (H2): Economic risk (a), cost of innovation (b) and lack of finance (c) are negatively related to the innovation level regarding the use of technology.

Hypothesis 3 (H3): Access to information (a) and external/internal collaboration (b) are positively related to the innovation level regarding the use of technology.

Hypothesis 4 (H4): Reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patients satisfaction (c) are positively related to the innovation level regarding the introduction of new/improved products/services.

Hypothesis 5 (H5): Economic risk (a), cost of innovation (b) and lack of finance (c) are negatively related to the innovation level regarding the introduction of new/improved products/services.

Hypothesis 6 (H6): Access to information (a) and external/internal collaboration (b) are positively related to the innovation level regarding the introduction of new/improved products/services.

The study variables

The quantitative analysis contains 10 variables; each of which was operationalised on a 5-point Likert scale. Table 3.3, presented in the Methodology Chapter, provides more details regarding the measurements that have been used in this research. The study variables are listed and presented in Table 4.6. Variables 2-9 are the independent variables for this study. As mentioned

previously, they were derived from previous studies related to the current research subject and the analysis of the qualitative data collected through the initial unstructured interviews.

Regarding the first independent variable, reduced time to respond to customers/suppliers, this is directly related to the service quality. Responding on time to the market demand is of paramount importance as pharmaceuticals are related to human health. The second independent variable refers to communication. Weak communication between the PSC stakeholders was highlighted by the participants. The development of the communication level might be a reason for applying innovation; for example, Information Systems (IS) could facilitate and improve the communication between the stakeholders of the system. The third independent variable is related to staff/patient satisfaction, which, based on the qualitative data analysis, is one of the main focuses of healthcare organisations. The adoption of innovative programmes, services and products could further enhance the efficiency and effectiveness of a system, and consequently, the satisfaction rate.

Regarding the fourth independent variable, economic risk, participants believe that the implementation of innovation requires particular investments and its success rate cannot be ensured. They believe that innovative activities need to be supported by the available financial resources. This statement refers to the fifth independent variable related to the cost of innovation. Considering the increased pressure that has been put on healthcare organisations to minimise their pharmaceutical spending, it is obvious that the availability of financial funds is limited. The lack of finance might prevent innovation, which refers to the sixth independent variable.

The last two independent variables are related to the availability of information and the development of external/internal collaboration. Data, knowledge and information sharing are considered key resources for the introduction of innovative approaches and especially for developing new products and improving services. In addition, the successful implementation of such initiatives requires individuals to be actively engaged and work together as a team.

In this study, there are two dependent variables: the innovation level regarding the use of technology and the innovation level regarding the introduction of new/improved products/services. One could suggest that these are two diverse forms of innovation; however, as was apparent from the qualitative data analysis, there is no clear distinction between them, as input of technology could affect the service outputs.

This sub-section provided the reasons for the study variables being selected. These details enable a smooth and clear description of the quantitative data analysis that follows. The relationships between the study variables will be assessed throughout the following sub-sections. Initially, the data analysis will focus on the total sample and subsequently the hypotheses will be tested based on the multi-group analysis, using residence as the grouping factor.

Sample size

This section presents the analysis of the total sample (N=130) and then the analysis of the Greek (N=81) and the UK (N=49) sample separately. The following table, Table 4.4, illustrates relevant information regarding the participants of the survey. The total number of responses was 130, of which 81 were pharmacists operating in Greece and 49 were those operating in the UK. Out of 81 Greek responses, 39 (48%) were hospital pharmacists and the remaining 42 (52%) were community pharmacists. On the other hand, out of 49 UK responses, 27 (55%) were hospital staff and the remaining 22 (45%) were community pharmacists. The information provided in Table 4.5 complements that presented in Table 3.4 in Chapter Three.

	Frequency		
Residence	**Hospital Pharmacist**	**Community Pharmacist**	**Total**
Greece	39	42	81
The UK	27	22	49
Total	66	64	130

Table 4.5: Respondents' frequency table

4.5.1 Total Sample

The following table, Table 4.6, presents the descriptive statistics in the form of means, standard deviations and correlations among the study variables in the total sample. The first part of the Table 4.6 shows the items' average scores, which were between 3.51 and 4.02. The second column relates to the standard deviation (SD), which provides information regarding the spread or variation of the data around the mean. The values of SD ranged between 0.75 and 1.10.

Considering that a 5-point Likert scale was selected where the value '3' is the middle point, it can be concluded that the respondents agreed to some degree with the statement. In addition, Table 4.6 presents correlations between the study variables. The correlation matrix provides a rough idea of the relationships between the independent and dependent variables. In particular, this matrix suggests that of all of the predictors the external/internal collaboration correlates best with outcome 1: the innovation level regarding the use of technology ($r = .297$, $p < .01$), and on the other hand, access to information correlates best with outcome 2: the innovation level regarding the introduction of new/improved products/services ($r = .299$, $p < .01$). Therefore, it is likely that those independent variables will best predict each of the dependent variables.

The fact that some of the study variables can be correlated relatively highly to each other raises concerns regarding Common Method Bias (CMB) (Podsakoff *et al.*, 2003). In order to assess the existence of Common Method Bias, a Confirmatory Factor Analysis (CFA) would be necessary (Lance *et al.*, 2010) as long as this is appropriate for the specific data set (Kaiser-Meyer-Olkin statistics fall into the range .80 to .90 and Barlett's test of Sphericity is highly significant). Besides, high correlations ($r>.90$) may relate to multi-collinearity issues (Field, 2009). In Regression Analysis, multi-collinearity evaluates whether or not there is a strong correlation between the predictors. It is critical that the existence of multi-collinearity is checked as it can influence the significance level of the variables (Tabachnick & Fidell, 2007). According to the correlations table in this thesis (please see Table 4.6) provided below, no concerns are raised regarding common method variance or multi-collinearity issues regarding the specific variables in the data set. The assumptions of normality and linearity also need to be respected to ensure the validity and reliability of the results derived from the Regression Analysis. Normality exists when the data are normally distributed; the sampling distribution tends to be normal in samples of 30 or more (Field, 2009).

		Mean	SD	1	2	3	4	5	6	7	8	9	10	11
1	Residence	1.62	.49	-										
2	Reduced time to respond to customers/suppliers	4.02	1.05	.270**	-									
3	Improved staff/patients communication	3.51	1.10	-.014	.383**	-								
4	Enhanced staff/patients satisfaction	3.88	1.01	.236**	.550**	.618**	-							
5	Economic risk	3.87	1.03	-.223*	.095	.029	.037	-						
6	Cost of innovation	4.03	.93	-.251**	.040	-.012	-.071	.759**	-					
7	Lack of finance	3.96	.99	-.292**	.023	.044	.018	.610**	.716**	-				
8	Access to information	3.59	.75	.076	.383**	.445**	.523**	-.059	-.167	-.087	-			
9	External/internal collaboration	3.58	.82	-.142	.182*	.290**	.275**	.112	.069	-.050	.284**	-		
10	Innovation Level- Technology	4.01	.85	.086	.269**	.107	.159	.015	-.050	-.083	.234**	.297**	-	
11	Innovation Level-New/improved products/services	3.51	.83	-.062	.147	.268**	.192*	-.198*	-.151	-.110	.299**	.283**	.437**	-

Note. ** $p < .01$, * $p < .05$

Note. Please see Appendix 4 for the SPSS output – means, standard deviations and correlations in the total sample

Table 4.6: Means, standard deviations and correlations between the study variables (N = 130)

Linear multiple Regression Analysis

In this section, a Linear Regression Analysis (LRA) will be conducted in order to test the relationships between the dependent and independent variables. This statistical technique has been considered as a way of predicting an outcome variable from one or several predictor variables (Field, 2009). In particular, in this study, there are two dependent variables: the innovation level regarding the use of technology and the innovation level regarding the introduction of new/improved products/services; therefore the Linear Regression Analysis will assess the relationships between each dependent variable with several independent variables: time to respond to customers/suppliers, staff communication, staff/patient satisfaction, economic risk, cost of innovation, lack of finance, access to information and external/internal collaboration, which were derived from reviewing the existing relative literature and the initial qualitative data analysis. The results of the LRA represent the best prediction of how the innovation level applied within the Pharmaceutical Supply Chain (PSC) can be influenced by the eight independent variables.

Initially, a model that presents the relationships between the dependent and independent variables in the total sample is employed. Schneider *et al.* (2010) highlighted the important use of regression analysis as a statistical method for the analysis of data related to the healthcare sector, because it assesses the influences of various factors on the variety of healthcare outputs. A representative example is this of Westrick and Mount's (2009) study, where they used an LRA to examine factors influencing the diffusion of an innovation, in this case in-house immunisation services, among community pharmacies. Klein *et al.*, (2013) conducted an LRA to predict recurrence score, which could facilitate the chemotherapy decision-making process; their research outputs could guide oncologists regarding the therapy needs to be followed. In Boulet *et al.*'s (2016) study, an LRA was conducted to test the relationships between each spinal curve and centre of pressure position, which are associated with back pain. Twenty-one male subjects were involved in this study; the number of participants was characterised as one of the main limitations of the study. Schneider *et al.* (2010) stated that one of the main issues observed in medical studies is that they often involve many independent variables and a number of observations that are fewer than the model requires.

Subsequently, a multi-group regression analysis will be presented, aiming to assess and compare the relationship among the study variables in the two different European contexts. This approach has been adopted by a number of researchers when they attempt to compare diverse groups. Manning *et al.*, (2016) used multi-group regression analysis to examine the effects of breast density information and imaging technology information on breast-health decision-making. Data were collected from 138 African-American and European-American women; the hypotheses were tested based on the multi-group analysis, using race as the grouping factor. Similarly, Esfahbodi *et al.* (2016) conducted a multi-group regression analysis to examine and compare the impact of sustainable supply chain management (SSCM) on environmental and cost performance within two diverse geographical areas: China and Iran. The study identified the similarities and differences of these two emerging markets by analysing the data collected from 128 manufacturing firms; 72 in China and 56 in Iran. Although they acknowledged the sample size as one of their research limitations, they highlighted the difficulties that they had to face during the recruitment of knowledgeable and experienced respondents.

The research examples provided above justify the quantitative data analysis adopted by the current research. They also underline the research limitation related to the sample size. As Esfahbodi *et al.* (2016) stated, approaching knowledgeable and experienced individuals and persuading them to be involved in a research is quite challenging.

Results in the Total sample: Innovation Level - Technology

According to Hypothesis1, reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patient satisfaction (c) were expected to relate positively to the innovation level regarding the use of technology. Table 4.7 indicates that improved staff communication *(β = -.096, p = .399)* and enhanced staff/patient satisfaction *(β = -.076, p = .558)* were not significantly related to the innovation level regarding the use of technology. Therefore, H1b and H1c have been rejected in the total sample. Contrary, reduced time to respond to customers/suppliers *(β = .240, p < .05)* was significantly and positively related to the innovation level regarding the use of technology (Table 4.7). Based on this result, H1a has been accepted in the total sample.

Hypothesis 2 suggested that economic risk (a), cost of innovation (b) and lack of finance (c) are negatively related to the innovation level regarding the use of technology. The results (Table 4.7) indicated that none of the aforementioned variables was significantly related to the innovation level regarding the use of technology (economic risk β = .069, p = .600; cost of innovation β = -.139, p = .371; lack of finance β = .045, p = .735). Therefore, H2 has been rejected in the total sample.

Based on Hypothesis 3, access to information (a) and external/internal collaboration (b) would be positively related to the innovation level regarding the use of technology. Table 4.7 shows that access to information has a non-significant *(β = .140, p = .185)* while external/internal collaboration has a significant and positive relationship *(β = .284, p < .01)* with the innovation level regarding the use of technology. These results indicate the rejection of H3a and the acceptance of H3b in the total sample.

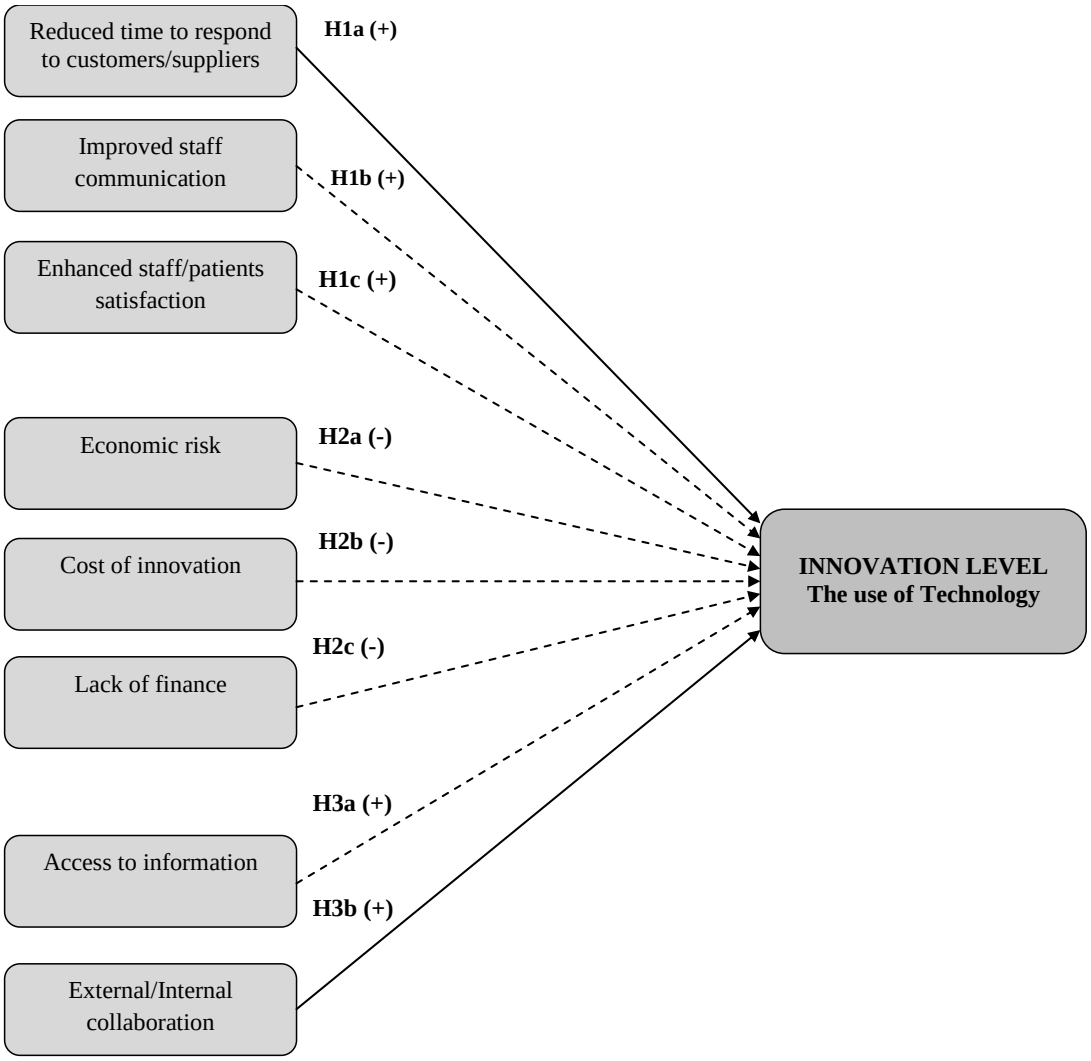
Variables	**Innovation Level-Technology**	
	β	***p***
Residence	.082	.410
Reduced time to respond to customers/suppliers	***.240***	***.026***
Improved staff communication	-.096	.399
Enhanced staff/patient satisfaction	-.076	.558
Economic risk	.069	.600
Cost of innovation	-.139	.371
Lack of finance	.045	.735
Access to information	.140	.185
External/internal collaboration	***.284***	***.003***

Note. Please see Appendix 5 for the SPSS output-regression for the innovation level (technology) in the total sample

Table 4.7: Results of linear regression analysis: Innovation Level - Technology (N = 130)

Figure 4.8 below provides the visual representation of the significant and non-significant relationships in the total sample group. In particular, Figure 4.8 illustrates that two factors, reduced time to respond to customers/suppliers and external/internal collaboration, play a

significant role in positively influencing pharmacies, operating in both countries, to adopt innovative programmes, specifically through using technology. Hospital and community pharmacies, operating in the two selected European contexts, suggest that a possible time reduction to respond to customers/suppliers and the collaboration between the PSC stakeholders, which can be inspirational and motivational, are the catalysts for adopting technology within a pharmacy. Based on the quantitative analysis, the remainder of the independent variables were not significantly related to the dependent variable that refers to the innovation level regarding the use of technology. These results will be extensively discussed throughout the Discussion Chapter that follows.



Note. Dashed arrows represent non-significant relationships

Figure 4.8: Results in the Total sample: Innovation Level - Technology

Results in the Total sample: Innovation Level - New/improved products/services

According to Hypothesis 4 reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patients satisfaction (c) were expected to relate positively to the innovation level regarding the introduction of new/improved products/services. The results (Table 4.8) suggested that none of the aforementioned variables was significantly related to the innovation level regarding the introduction of new/improved products/services (reduced time to respond to customers/suppliers β = .048, p = .647; improved staff communication β = .113, p = .312; enhanced staff/patient satisfaction β = -.031, p = .809). Therefore, H4 has been rejected for the total sample.

Hypothesis 5 assumed that economic risk (a), cost of innovation (b) and lack of finance (c) are negatively related to the innovation level regarding the introduction of new/improved products/services. Table 4.8 indicates that cost of innovation (β = .040, p = .792) and lack of finance (β = .027, p = .837) were not significantly related to the innovation level regarding the introduction of new/improved products/services. Therefore, H5b and H5c have been rejected in the total sample. In contrast, economic risk (β = -.258, p < .05) was significantly and negatively related to the innovation level regarding the introduction of new/improved products/services. Based on these results, H5a has been accepted for the total sample.

Based on Hypothesis 6, access to information (a) and external/internal collaboration (b) would be positively related to the innovation level regarding the introduction of new/improved products/services. The results (Table 4.8) indicated that both variables were significantly and positively related to the innovation level regarding the introduction of new/improved products/services (access to information β = .215, p < .05; external/internal collaboration β = .221, p < .05). Therefore, H6 has been accepted for the total sample.

Variables	Innovation Level - New/improved products/services	
	β	***p***
Residence	-.070	.470
Reduced time to respond to customers/suppliers	.048	.647
Improved staff communication	.113	.312
Enhanced staff/patient satisfaction	-.031	.809
Economic risk	**-.258**	**.048**
Cost of innovation	.040	.792
Lack of finance	.027	.837
Access to information	**.215**	**.038**
External/internal collaboration	**.221**	**.019**

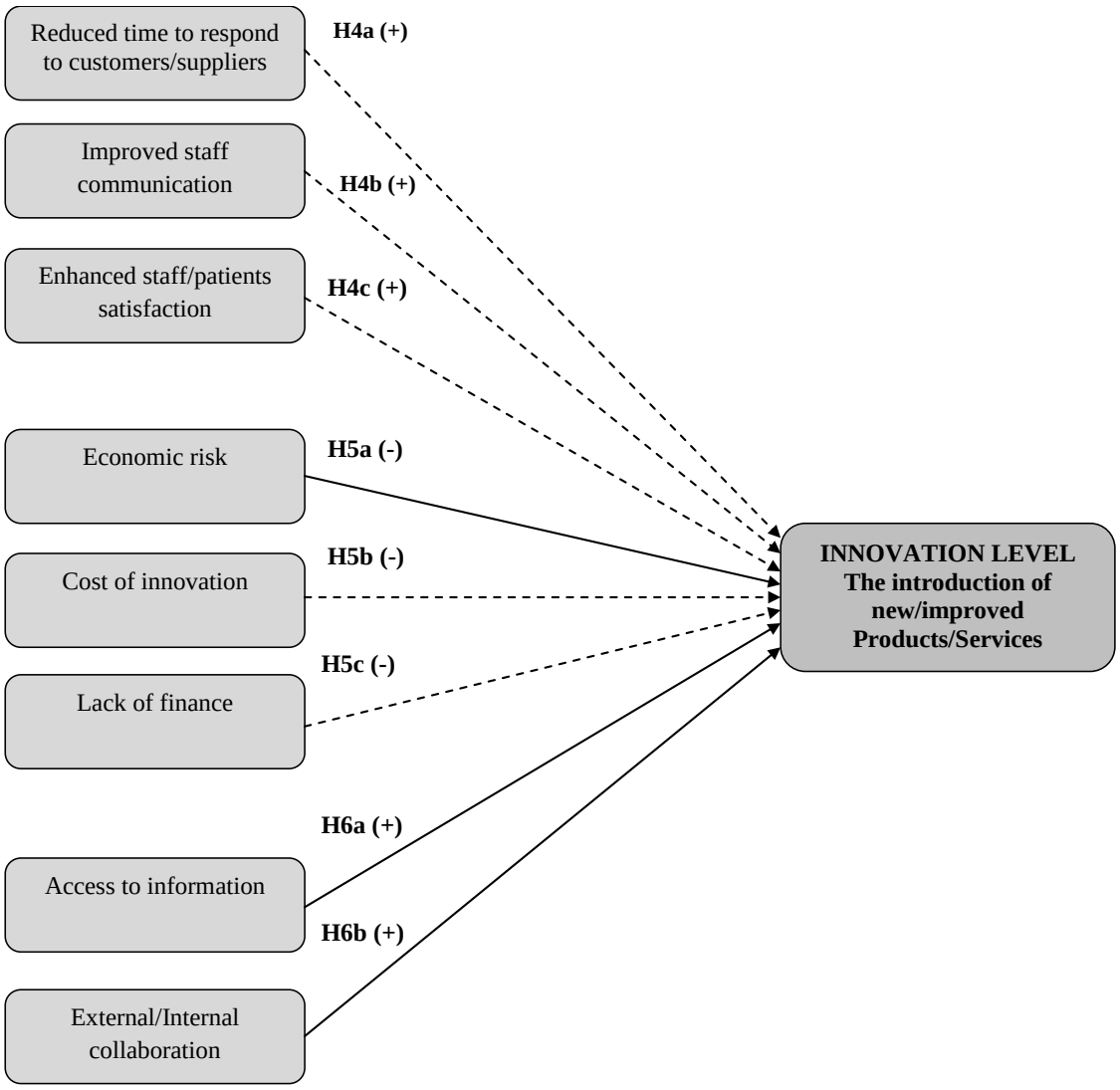
Note. Please see Appendix 6 for the SPSS output-regression for the innovation level (new/improved products/services) in the total sample

Table 4.8: Results of linear regression analysis: Innovation Level - New/improved products/services (N = 130)

When it comes to the single control variable used in both regression analyses, the results show that residence was neither significantly related to the innovation level regarding the use of technology (Table 4.4, β = .082, p = .410) nor significantly related to the introduction of new/improved products/services (Table 4.5, β = -.070, p = .470).

Similarly to Figure 4.8, the following figure, Figure 4.9, summarises the outputs of the LRA related to the total sample's innovativeness regarding the use of new or significantly improved products and services. Specifically, from the analysis of the total sample, it can be concluded that there are three factors that influence pharmacies' decision to introduce new or improved products and services: economic risk, access to information and external/internal collaboration. As can been seen in Figure 4.9, economic risk is considered a barrier to introduce new or improved products and services; there are a number of reports and previous research that agree with this statement (Bhakoo *et al.*, 2012; D'Este *et al.*, 2012). Regarding the two other factors, access to information and external/internal collaboration, they can have a positive effect on innovation adopted within the PSC in both countries. Pharmacists believe that information sharing and

collaboration with other healthcare organisations, suppliers and customers increase the likelihood of innovative products and services being successfully introduced.



Note. Dashed arrows represent non-significant relationships

Figure 4.9: Results in the Total sample: Innovation Level - New/improved products/services

4.5.2 Multi-group Analysis

Table 4.9 below, presents the descriptive statistics in the form of means, standard deviations and correlations among the study variables in the multi-group analyses. Similar to Table 4.6 in the previous section, the first part of Table 4.9 presents the variables' average scores and the standard deviation (SD) related to the data collected from Greece. The items' means were between 3.47 and 4.23 and the values of SD ranged between 0.78 and 1.10, which means that the respondents agreed with the statement, taking into account that a 5-point Likert scale was used, where the value '3' is the middle point. The second column provides the same information as the first one, focusing on the UK sample. The items' average scores were between 3.51 and 4.33 and the values of SD were between 0.58 and 1.10; therefore, similarly to the Greek sample, it can be concluded that the respondents agreed with the statement provided.

In addition, in Table 4.9, the correlation matrix was developed. The correlation matrix indicates the correlations between the study variables related to both the Greek and the UK sample. It creates the first impression regarding the existing relationships between the predictors and the outcome variables. Specifically, based on this matrix, it can be presumed that in the Greek sample, of all of the predictors, external/internal collaboration best correlates with outcome 1: the innovation level regarding the use of technology ($r = .380$, $p < .01$) and improved staff communication best correlates with outcome 2: the innovation level regarding the introduction of new/improved products/services ($r = .316$, $p < .01$).

Regarding the UK sample, it can be assumed that of all of the predictors, economic risk and cost of innovation seem to be the independent variables that best correlate with outcome 1: the innovation level regarding the use of technology ($r = .356$, $p < .05$) and access to information may correlate best with outcome 2: the innovation level regarding the introduction of new/improved products/services ($r = .419$, $p < .01$). Although it is likely that those independent variables will best predict each of the dependent variables in each of the two different samples, further parsimonious analysis is required.

		GR		UK											
		Mean	**SD**	**Mean**	**SD**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1	Reduced time to respond to customers/suppliers	4.23	.96	3.65	1.09	-	.538**	.525**	.192	.310*	.361*	.484**	.011	.101	.046
2	Improved staff communication	3.50	1.10	3.53	1.10	.309**	-	.808**	-.049	.037	.076	.537**	.012	-.094	.159
3	Enhanced staff/patients satisfaction	4.06	.93	3.57	1.08	.515**	.521**	-	-.211	-.128	.041	.553**	.208	-.080	.173
4	Economic risk	3.69	1.08	4.16	.87	.154	.064	.269*	-	.812**	.528**	-.039	.019	.356*	-.191
5	Cost of innovation	3.85	.97	4.33	.77	.008	-.040	.051	.717**	-	.669**	-.029	-.027	.356*	-.246
6	Lack of finance	3.73	.99	4.33	.87	-.039	.024	.125	.607**	.704**	-	.129	-.246	.315*	-.156
7	Access to information	3.63	.78	3.51	.69	.318**	.401**	.508**	-.046	-.211	-.166	-	.193	.036	.419**
8	External/internal collaboration	3.49	.90	3.73	.64	.347**	.417**	.389**	.106	.055	-.041	.340**	-	.141	.153
9	Innovation Level- Technology	4.07	.89	3.92	.78	.352**	.217	.283*	-.101	-.191	-.235*	.319**	.380**	-	.199
10	Innovation Level-New/improved products/services	3.47	.95	3.58	.58	.232*	.316**	.244*	-.227*	-.146	-.122	.273*	.310**	.531**	-

Note. ** p < .01, * p < .05; Correlations below/above the diagonal refer to the GR/UK group

Note. Please see Appendix 7 for the SPSS output - means, standard deviations and correlations in the multi-group analysis

Table 4.9: Means, standard deviations and correlations between the study variables in the multi-group analyses (GR, N = 81; UK, N = 49)

Results in the Greek and UK sample: Innovation Level - Technology

Results as shown in Table 4.10 state that, both in the Greek and UK samples, reduced time to respond to customers/suppliers (GR, β = .239, p = .058; UK, β = .017, p = .932), improved staff communication (GR, β = -.084, p = .516; UK, β = -.138, p = .622), enhanced staff/patient satisfaction (GR, β = .100, p = .508; UK, β = .009, p = .977), economic risk (GR, β = -.066, p = .675; UK, β = .156, p = .536), cost of innovation (GR, β = -.150, p = .400; UK, β = .089, p = .764), lack of finance (GR, β = -.023, p = .886; UK, β = .217, p = .333) and access to information (GR, β = .112, p = .385; UK, β = .051, p = .784) appeared to have no significant relationship with the innovation level regarding the use of technology. According to Table 4.10, the relationship between external/internal collaboration and the innovation level regarding the use of technology (GR, β = .276, p < .05) might influence the Greek pharmacists' decision to innovate, while this was not the case regarding the UK sample (UK, β = .188, p = .283).

Variables	**Innovation Level - Technology**			
	GR		**UK**	
	β	***p***	***β***	***p***
Reduced time to respond to customers/suppliers	.239	.058	.017	.932
Improved staff communication	-.084	.516	-.138	.622
Enhanced staff/patient satisfaction	.100	.508	-.009	.977
Economic risk	-.066	.675	.156	.536
Cost of innovation	-.150	.400	.089	.764
Lack of finance	-.023	.886	.217	.333
Access to information	.112	.385	.051	.784
External/internal collaboration	**.276**	**.025**	.188	.283

Note. Please see Appendix 8 for the SPSS output – multi-group analysis for the innovation level (technology)

Table 4.10: Results of multi-group analysis: Innovation Level - Technology

(GR, N = 81; UK, N = 49)

Best practices and successful applications of innovative activities appear to influence Greek pharmacies' decision to use technology in order to improve their services and satisfy their customers. However, none of the factors included in the analysis model has an effect on the UK based pharmacies' decisions to adopt technology. There might be different factors that encourage them to use the technology innovatively. The explanation of this result may also be based on the

limitation of this analysis which refers to the sample size; the UK sample is N=49 which is not sufficient to analyse a model including eight predictors (Field, 2009).

Results in the Greek and UK sample: Innovation Level - New/improved products/services

Table 4.11 shows that, both in the Greek and UK samples, reduced time to respond to customers/suppliers (GR, β = .102, p = .426; UK, β = -.068, p = .723), improved staff communication (GR, β = .128, p = .334; UK, β = .079, p = .771) and enhanced staff/patient satisfaction (GR, β = .099, p = .526; UK, β = -.166, p = .567) tend to have no significant relationship with the innovation level regarding the introduction of new/improved products/services. In addition, the results suggested that the cost of innovation - innovation level regarding the introduction of new/improved products/services link (GR, β = .123, p = .503; UK, β = -.204, p = .481) and the lack of finance - innovation level regarding the introduction of new/improved products/services link (GR, β = .049, p = .768; UK, β = -.032, p = .883) were insignificant.

There is an indication suggesting that aspects of economic risk might act as a barrier to the introduction of new/improved products/services in the Greek delivery system (β = -.381, p < .05), while this was absent in the UK group (β = -.010, p = .967). Moreover, accessing information was considered an important element that might encourage UK pharmacists to introduce new/improved products/services (UK, β = .483, p < .05), but this was not the case in the Greek sample (GR, β = .125, p = .347). Finally, external/internal collaboration appeared to have no impact on decisions related to the introduction of new/improved products/services in both European contexts (GR, β = .194, p = .122; UK, β = .082, p = .627).

Overall, it was suggested that economic risk seems to play an important role in the Greek pharmacists' decision to introduce innovative products and services. Apparently, the current economic crisis seems to have affected the pharmacists' decision to innovate. This unpleasant situation may have made them more sceptical and cautious about undertaking such initiatives. Besides, the accessibility to relevant information might influence the UK pharmacies' decision to introduce new or improved products and services. Hospital and community pharmacists in the

UK tend to believe that access to required data, knowledge and information can guide them to successfully introduce new or significantly improved services and products.

Variables	Innovation Level - New/improved products/services			
	GR		UK	
	β	***p***	***β***	***p***
Reduced time to respond to customers/suppliers	.102	.426	-.068	.723
Improved staff communication	.128	.334	.079	.771
Enhanced staff/patient satisfaction	.099	.526	-.166	.567
Economic risk	**-.381**	**.022**	-.010	.967
Cost of innovation	.123	.503	-.204	.481
Lack of finance	.049	.768	-.032	.883
Access to information	.125	.347	**.483**	**.011**
External/internal collaboration	.194	.122	.082	.627

Note. Please see Appendix 9 for the SPSS output – multi-group analysis for the innovation level (new/improved products/services)

Table 4.11: Results of multi-group analysis: Innovation Level - New/improved products/services (GR, N = 81; UK, N = 49)

4.6 Conclusion

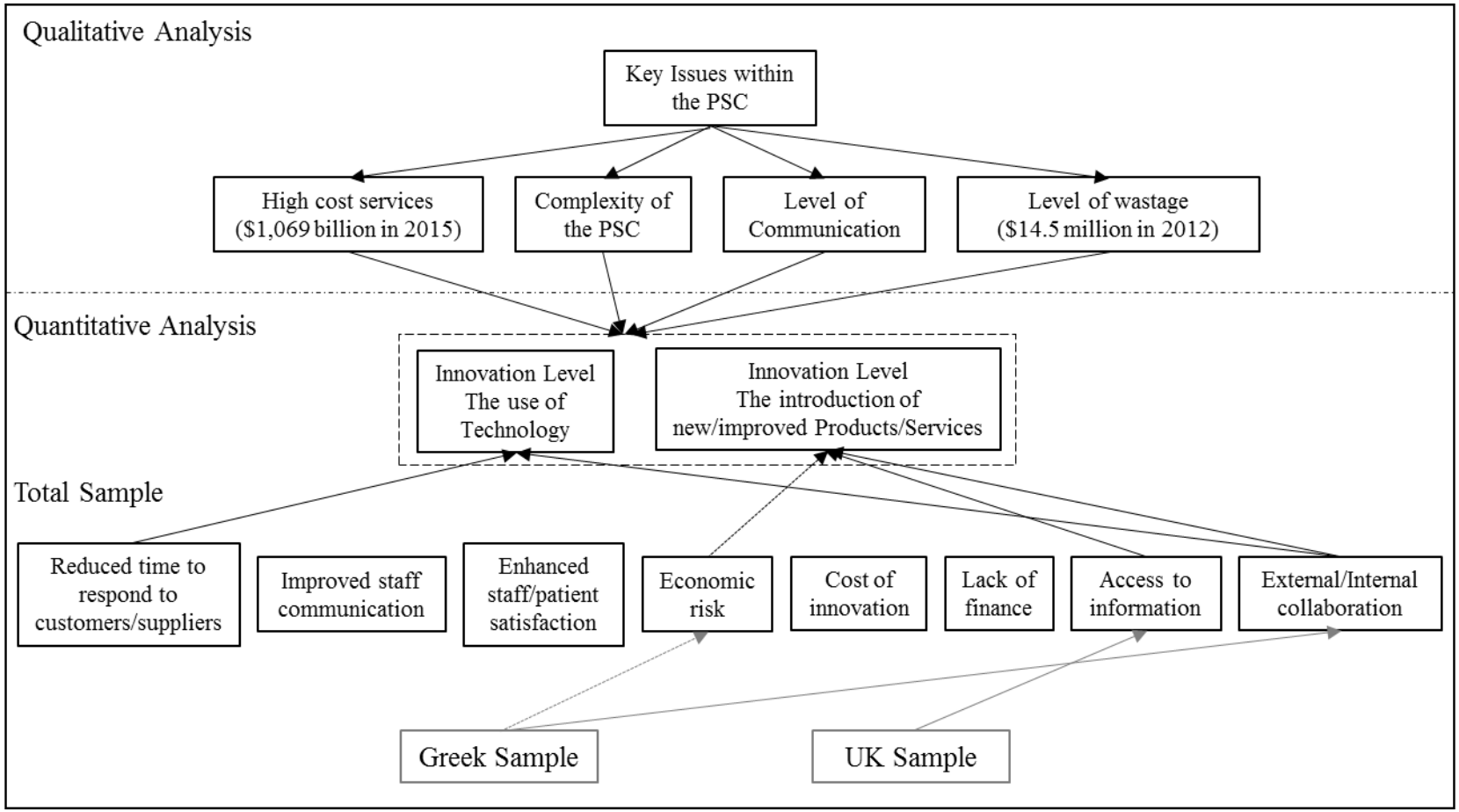
This chapter has analysed the current situation of the medicine delivery process within hospital and community pharmacies in both countries: the UK and Greece, highlighting the issues that professionals within the PSC have to face. By conducting a thematic analysis, four themes have emerged: 1) Financial Issues; 2) Complexity Issues; 3) Communication Issues and 4) Waste Issues, based on the interviewees' opinions. These factors differentiate the PSC from the other supply chains in different sectors and explain the reasons associated with the PSC inefficiency.

Subsequently, a survey was created, informed by the existing literature on the study subject and the initial analysis of the collected qualitative data, and distributed to key professionals working within the PSC in both European contexts. The aim of the survey was to measure the innovation level applied within the PSC and identify the factors that supported or prevented pharmacies

being innovative. The Linear Regression Analysis of the total sample suggests that two factors – 1) reduced time to respond to customers/suppliers and 2) external/internal collaborations – encourage pharmacies to use the technology. They believe that using integrated information systems can improve the quality of services because these systems help the delivery process to be faster and more accurate. In addition, pharmacies are willing to introduce new or improved services during the delivery of medicines when they have access to relevant information and when they have created external/internal collaboration to support them. On the contrary, they are very sceptical of implementing new or improved services when they have to invest a particular amount of money; their concern is related to the potential economic risk associated with this action.

Figure 4.10 illustrates the conceptual model of this chapter that summarises the research findings. In particular, it provides the visual representation of both the qualitative and quantitative data analysis. It also suggests that the identified key issues associated with the perceived inefficiency of the pharmaceutical delivery process affect the system's innovativeness. From the data analysis, it was apparent that the limited financial resources, the system's complexity, the weak communication between the PSC stakeholders and also the waste observed throughout the delivery process, minimise the likelihood that innovative approaches will be successfully introduced and implemented.

In addition, Figure 4.10 presents the factors that have the potential to support or prevent innovation within the PSC in the two selected European contexts. The significant and non-significant relationships, among the study variables in the Total, Greek and UK samples, are also summarised and presented.



Note. Dashed arrows represent negative relationships

Figure 4.10: The research findings conceptual model

Having developed an understanding of the medicines delivery system, in the two selected countries, through identifying the main issues preventing an effective and efficient delivery process and the factors that influence pharmacists' decision to innovate, the next challenge that needs to be addressed is the development of recommendations of how best the emerged issues can be overcome. The following chapter will present suggestions and any improvements that can take place within the PSC. It will also connect the findings with previous research studies and will ultimately provide answers to the research questions. Innovative programmes that can be implemented in order to improve the delivery of medicines will be highlighted, explaining their impact on this process.

5 Chapter Five: Discussion

5.1 Introduction

This chapter synthesises the reviewed literature referring to the phenomenon under investigation with the primary research findings in order to answer the research questions. Particularly, it systematically discusses the research findings based on the qualitative and quantitative data analysis to identify and assess aspects of innovation across the Pharmaceutical Supply Chain (PSC) in two diverse geographical contexts: the UK and Greece. The discussion builds on the issues associated with the delivery of medicines and the factors influencing the implementation of innovative programmes within the PSC in both countries, which were identified, analysed and presented throughout Chapter Four. The analysis of qualitative and quantitative data was considered necessary in order, on one hand, to capture the participants' (professionals working in the downstream domain of the PSC in both countries) views, opinions and attitudes on the study subject and, on the other hand, to reach and create a more objective picture regarding the decisive factors that could lead healthcare organisations to be innovative. The analysis of the collected data enabled the researcher to have a better understanding of the study phenomenon and reach a more focused conclusion. Furthermore, as the research focused on two diverse geographical areas, this gave the researcher the opportunity to compare and contrast them thus identifying the differences and similarities which might increase the likelihood for a framework to be generalised and used as guidelines for applying innovation within the downstream domain of the PSC.

To facilitate the discussion throughout this chapter, a brief review of the literature that has informed the developed conceptual model will be summarised in the following section. Subsequently, the literature-based conceptual model will be linked with the research findings conceptual model in order for the overall research concept to be visualised, providing a holistic perspective on the research and its findings to best structure the research discussion. Finally, the last section of this chapter provides the discussion of this study regarding the PSC downstream domains and the impact of innovation across it. Based on the discussion, suggestions on the best way to apply innovation and guideline for healthcare organisations will be generated.

5.2 The Research Overview

Before focusing on the discussion of this study, it would be relevant to re-visit the conceptual models developed in the Literature Review and Findings Chapter in order to present and summarise the study so far. The following section will begin the process of synthesising and fitting the diverse research elements together.

5.2.1 The Literature Conceptual Model

As presented and explained in the Literature Review Chapter, there are three core bodies of knowledge on which this thesis relies: i) Supply Chain Management (SCM); ii) Innovation; and iii) Healthcare sector. Each of these were reviewed and analysed in detail in Chapter Two, aiming to frame the research gap that has formulated this thesis. The inter-connections of these three disciplines have been studied based on multiple perspectives and backgrounds; however, this research suggests the synthesis of these three fundamental bodies of knowledge under the lens of Operations Management (OM). The OM lens has been used to detect the links between the bodies of literature and the Resource-Based View (RBV) has been adopted as the strategic management theory employed to establish the theoretical boundaries of this research, addressing the research's scope.

RBV sets the foundations upon which the Operations Strategy (OS) can be structured to develop and sustain a competitive advantage by utilising and mobilising the organisation's resources (Barney, 1991; 2012; Boyer *et al.,* 2005; Ferlie *et al*., 2016). This particular research attempted to investigate how establishing strategies based on the healthcare organisations' resources could increase the likelihood for these organisations to adopt innovation and through it to gain a competitive advantage. This attempt is in line with a well-established perspective that has characterised innovation as the fuel for gaining and sustaining organisations' advantages (Kostopoulos *et al*., 2002; Brown *et al.,* 2013; Wu & Chiu, 2015). The following figure (Figure 5.1) illustrates the synthesis of the three bodies of knowledge created under the lens of OM and RBV theory. It presents the areas of intersections derived from this synthesis that set up a theoretical foundation upon which the development of any improvement could be achieved, leading to a sustainable competitive advantage.

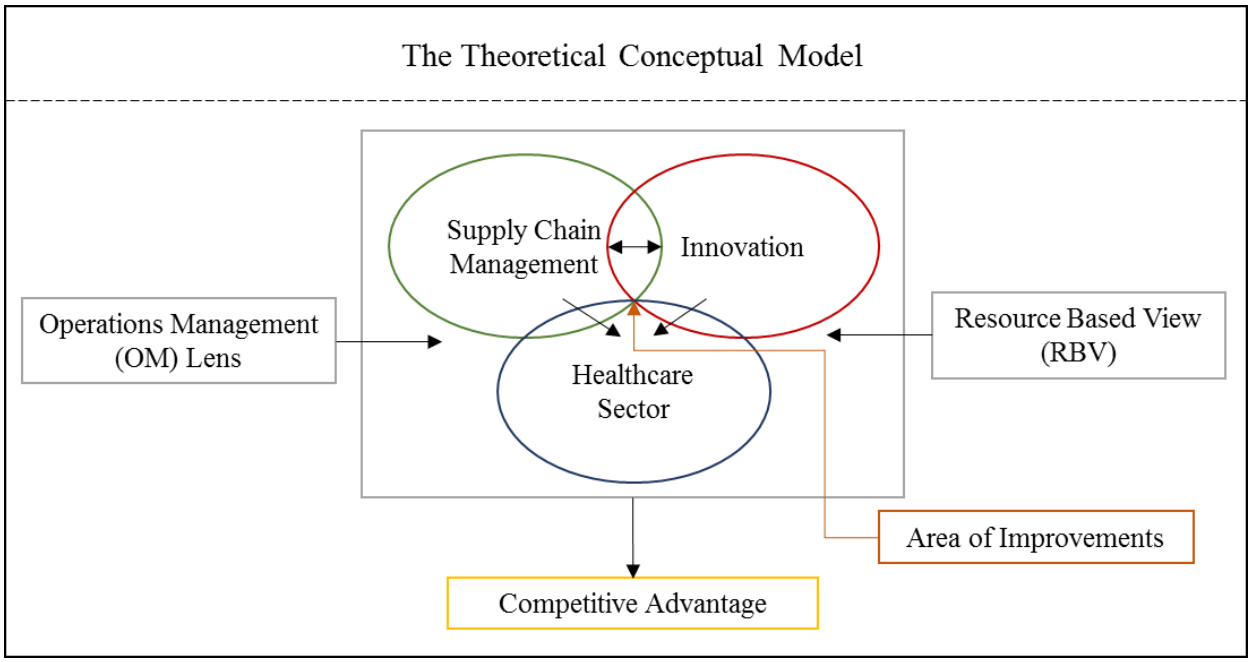


Figure 5.1: The theoretical conceptual model of the core bodies of knowledge

The competitive advantage used to be measured based on the average rate of economic profit that firms earn when compared with other firms competing within the same market, as Besanko *et al.* (2000) explained. This statement is partially applicable in this research. Apart from community pharmacies, which could use their profit as an indicator for assessing their competitive edge, hospital pharmacies tend to be mission-driven organisations. Public hospitals are dedicated to furthering their particular social cause, which is to provide a high quality healthcare service to protect and ensure public health; thus they utilise their surplus revenues in order to achieve this mission (Cheng & Chang, 2012). They may have a different rationale for their competitive edge than for-profit organisations. Yoo *et al.* (2006) and Hill and Hill (2012), among others, supported that competitive advantage can be achieved through producing different and special services or products that customers value or offer similar services or products at a lower cost than the competitors. This is the argument that the current research has been built upon. Although healthcare organisations do not produce their services in order to increase their profit, they are willing to improve them satisfying their customers' needs and surviving within a highly competitive environment. A report published by the Department of Health (2014)

highlighted that healthcare organisations are facing the challenge of being competitive as patients are demanding customers and able to select the healthcare provider that meets their criteria.

According to the RBV paradigm (Barney, 1991), a competitive advadage can be achieved through establishing strategies based on organisations' resources: assets, competences, and capabilities (Perunovic´ *et al.,* 2012). Healthcare organisations need to utilise their resources effectively, as one element that this study takes into consideration is the pressure put on healthcare organisations to minimise their expenses while improving the quality of services (Smits *et al.,* 2009; Lainez *et al.,* 2012). As a result, one could conclude that there are no additional funds available to be invested in the healthcare sector. Therefore, using the existed bundle of resources and capabilities under certain conditions could potentially enhance the organisations' performance, enabling them to deal with the described challenge. Resources per se do not generate value to patients, but the transactions made with the use of those resources can create an advantage (Marler & Fisher, 2013).

In addition to this, the RBV theory asserts that organisational resources and capabilities should be: i) valueble, ii) rare, iii) imperfectly imitable and iv) without strategically equivalent substitutes, in order to be sources of competitive advantage (Barney, 1991). Focusing on the resources and capabilities of the downstream domain of the PSC, they contribute value to healthcare organisations through producing one of the most important parts of healthcare services (e.g. availability and delivery of medicines). They are quite rare as the services provided are often customised according to patients needs – there are difficulties in predicting the exact demand for medicines (Bhakoo *et al.,* 2012). There are hard to imitate because they are based primarily on tacit knowledge and information resources. Finaly, there are no strategically equivalent substitutes for these resources and capabilities. Therefore, this research investigates how the resources involved within the downstream domain of the PSC can be utilised effectively though implementing innovation in order to enhance the medicine delivery process in term of quality, speed, flexibility and cost (e.g. Martín-Peña & Díaz-Garrido, 2008).

Considering that, on one hand, the aim of RBV is to guide organisations on how to strategically implement this potential to improve their services, satisfying their customers' needs and differentiating themselves from their competitors (Yoo *et al.,* 2006), and on the other hand, the aim of healthcare organisations is to become the first choice on patients' list, the research

rationale behind looking at managing the PSC resources based on the RBV perspective can be justified.

Kostopoulos *et al.* (2002), and Ferlie *et al*. (2016) believe that managing the supply chain resources in a way that enables organisations to be innovative supports organisations' attempts at improving their service quality, minimising waste in the system, controlling cost, enhancing their overall productivity and as a result satisfying their customers' requirements; those are the required ingredients for developing a competitive advantage. Apparently, as Barney (2001) stated, these attempts can be successful through implementing a well-established strategy. Supply Chain Strategies (SCS) and innovative solutions attract organisations attention no matter the industry in which they operate (Fawcett *et al.*, 2014; Wisner *et al.*, 2015). However, selecting the appropriate SCS and applying suitable innovative programmes is highly dependent on the specific organisations' characteristics, such as: business conditions, issues in the production and delivery process, culture, knowledge and employees' skills, and the environment in which they operate (Williams & Dickinson, 2008; Kim *et al.*, 2012; Fayezi & Zomorrodi, 2015). The success rate of innovation in a supply chain context also relies on its characteristics, which include: relative advantage, compatibility, complexity and trialability (Rye & Kimberly, 2007; Kimberly & Cook, 2008).

This research focuses on the specific context, which is the healthcare sector, looking at identifying solutions for healthcare organisations to best deal with the well-documented challenge of minimising cost while improving the service quality (Institute of Medicine, 2007; Chassin, 2013; Page, 2014). Therefore, it suggests the implementation of innovation within the Pharmaceutical Supply Chain (PSC). In particular, it investigates the aspects of innovation in the downstream domain, which has been presented by Figure 4.3 in the Findings Chapter. This focus was initially derived from reviewing the existing literature on the study subject. On one hand, Cherrett *et al.*, (2012) suggested that pharmaceuticals are considered as expensive products and can be harmful to human health and the environment; in 2015, $1,069 billion was spent on medicine expenditure worldwide (Statista, 2015). On the other hand, Jamali *et al.* (2010), Xie and Breen (2012), and Papalexi *et al.* (2015), among others highlighted that there is an opportunity to not only control and reduce this high cost but also provide a more robust medicine

delivery process through implementing innovative Supply Chain Management (SCM) approaches.

Interestingly, Maher *et al.* (2008) and Doyle *et al.* (2013) suggested that applying innovation effectively within the supply chain context could overcome systems' inefficiency and provide a continuous improvement solution to healthcare organisations. For the purpose of this research, innovation is considered as the intentional introduction of new or significantly improved services, processes or products within the organisation in order to benefit it and wider society (Omachonu & Einspruch, 2010). In particular, in this thesis, it is argued and demonstrated that adopting innovative programmes, which have been successfully implemented in other sectors such as manufacturing, can support healthcare organisation to meet the challenge of being more productive by using the same or fewer resources (Cheng *et al.*, 2015). The adoption of theoretical innovation such as Lean thinking and reverse logistics (Lewis *et al.*, 2010) in combination with technical innovation such as integrated IT systems (Lai *et al.*, 2008) is suggested by this research in order for a more effective and efficient PSC to be applied. This potential solution will be analysed and discussed in light of the research findings in one of the following section of this chapter.

The literature review chapter presented and analysed the main state of knowledge used as the foundations for identifying the research gaps and developing this thesis. It has also facilitated the design and justification of the theoretically-driven development of the research questions and sub-research questions. In this chapter of the thesis, the research questions and sub-research questions will be explicitly answered based on the research findings supported by the existing literature.

Having summarised the main bodies of knowledge, concepts and ideas upon which this research has been built, the following section provides a brief overview of the research findings. It summarises the key points of the Findings chapter, which can be considered as an introduction to the following discussion.

5.2.2 The Conceptual Model designed based on the Findings

To address the main and sub-research questions, the research design of this study includes two diverse phases: the qualitative and quantitative approach. Initially, an exploratory sequential design and subsequently, an exploratory parallel/simultaneous design were adopted in order to best explore the phenomenon under investigation based on multiple perspectives (Teddlie & Tashakkori, 2009; Creswell & Plano Clark, 2011; Creswell, 2013). This mixed-methodology approach was conducted under a pragmatic paradigm, enabling the researcher to meet the study's research aims and objectives (Tashakkori & Creswell, 2007a, 2007b), as explained throughout the Methodology Chapter. The research tools and techniques used in order to collect the required data were face-to-face research interviews (N=30) and survey questionnaires (N=130) distributed to hospital and community pharmacy professionals operating in two diverse geographical areas: the UK and Greece; the total survey sample consisted of 81 Greek and 49 UK responses.

The collection and analysis of the qualitative data enabled the researcher to gain a better understanding of the current delivery practices and identify the issues based on the participants' experience, views and beliefs (Gill *et al.*, 2008; Rowley, 2012). Conversely, the supportive quantitative data analysis allowed the researcher to draw a picture of the level of innovation applied within both countries, identifying a number of factors that could influence healthcare providers' decision to innovate. This was achieved by testing the relationships between and among the study variables (Blair *et al.*, 2013).

In particular, the qualitative data analysis, conducting by adopted a Thematic Analysis approach (Guest *et al.*, 2012; Braun & Clarke, 2013), confirmed the weak performances throughout the medicine delivery process resulting in an ineffective and inefficient Pharmaceutical Supply Chain (PSC). The key themes identified within the PSC in both countries, the UK and Greece were classified into four categories: i) Financial issues; ii) Communication issues; iii) Waste issues; and iv) Complexity issues.

On the other hand, the quantitative data analysis, conducted by using Linear Regression Analysis (LRA) (Field, 2009), tested the relationships between the two dependent variables: the innovation level regarding the use of technology and the innovation level regarding the introduction of new or significantly improved products or services, and the eight independent

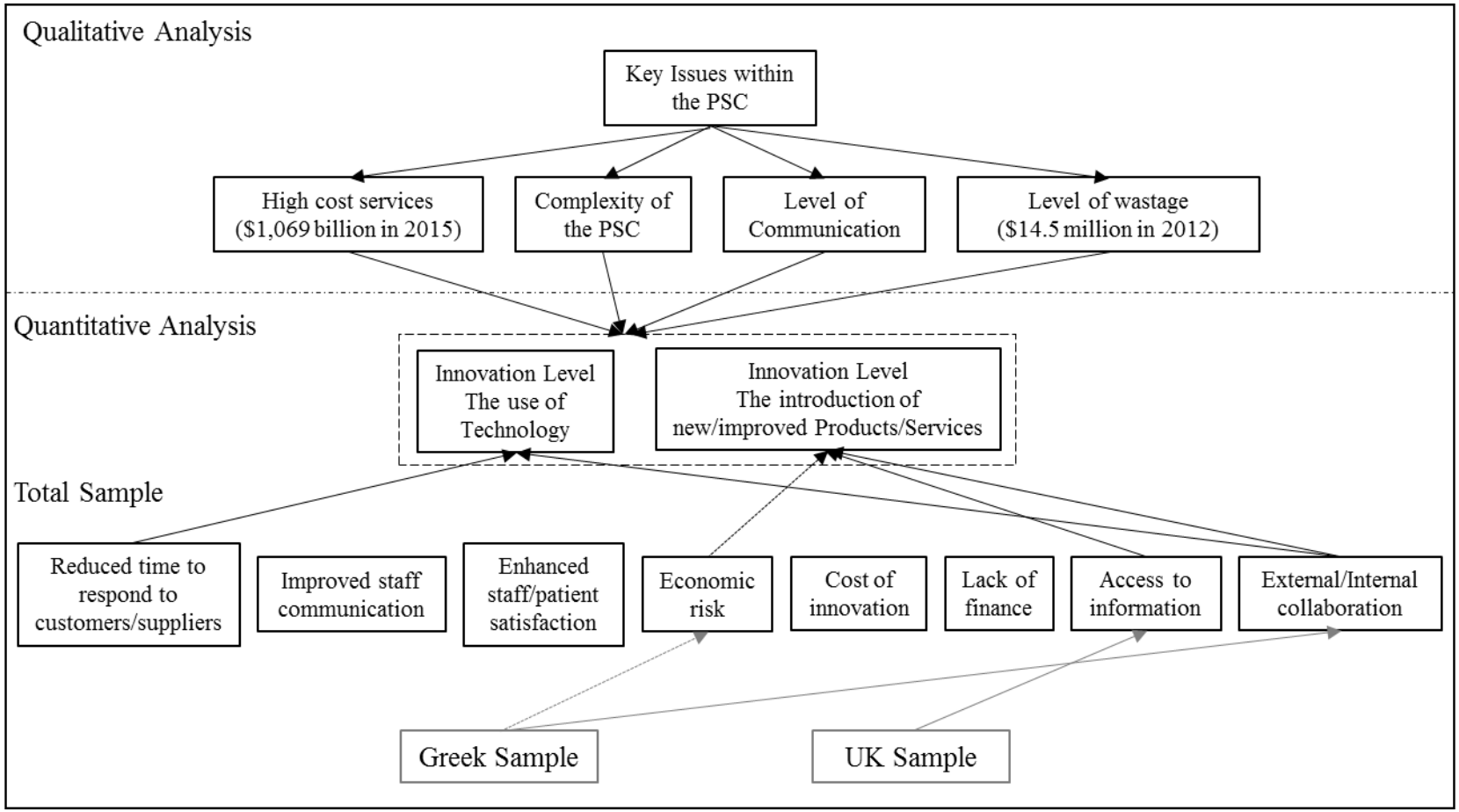
variables: time to respond to customers/suppliers, staff communication, staff/patients satisfaction, economic risk, cost of innovation, lack of finance, access to information and external/internal collaboration. The LRA of the total sample showed that out of eight factors, only two were identified that significantly and positively influence pharmacies to adopt innovative programmes through using technology: reduced time to respond to customers/suppliers and external/internal collaboration. Regarding being innovative by introducing new or improved products or services, it has been concluded that only three factors have an impact on pharmacies' decision: economic risk, access to information and external/internal collaboration. In other words, the quantitative data analysis established and confirmed that there are a number of factors supporting or preventing the implementation of innovation within the PSC. Particularly, pharmacies in both countries are willing to apply innovation in order to improve their services and specifically to reduce the time between the order and delivery, and enhance their external and internal collaboration. However, they seem to have a more sceptical view about innovation when they need to invest a particular amount of money on new or improved products or services, when they have limited access to relevant information and when they have not created external or internal collaborations.

When the Greek and UK samples are analysed separately, there is an indication suggesting that Greek pharmacists focus on creating external and internal collaborations in order to apply an integrated Information Technology (IT) system and as a result improve the service quality, but they are not willing to introduce new or significantly improved products and services, especially when these actions are associated with new and costly investments. Based on the analysis of the UK sample, the UK pharmacies tend to concentrate on the information required in order to be innovative; high accessibility to relevant information increases the likelihood for them to introduce new or significantly improved products and services, which can lead to the implementation of a more robust and accurate PSC.

All the elements presented above will be discussed and analysed within this chapter, indicating the innovative programmes that can overcome the identified issues observed within the PSC in both geographical areas and suggesting the most suitable innovative practices that fit with the study's context and organisations' plan. Figure 5.2 presents the conceptual model, which

summarises the research findings, linking them with the research questions and the sub-research questions.

Having summarised the literature upon which this research has been built and the research findings, the following sections of this chapter will discuss them in order for the research questions and the sub-research questions to be answered.



Note. Dashed arrows represent negative relationships

Figure 5.2: The research findings conceptual model

5.3 Research Questions

The Discussion Chapter is structured according to the research question and sub-research questions in order to help the reader to follow the chapter's flow. As introduced in Chapter One, the two overarching research questions are:

RQ 1: What are the issues associated with the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece?

RQ 2: How can the implementation of innovative programmes within the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece be promoted?

Each of the main research questions is accompanied by sub-research questions in order for a more detailed analysis to be achieved:

S-RQ1: What are the common factors observed within the downstream domain of the Pharmaceutical Supply Chais?

S-RQ 2: What are the region-dependent factors observed within the downstream domain of the Pharmaceutical Supply Chains?

S-RQ 3: What are the factors that influence the level of innovation within the downstream domain of the Pharmaceutical Supply Chain?

S-RQ 4: What innovative programmes should be implemented to improve the downstream delivery of medicines?

The rest of this chapter focuses on answering these research questions, aiming to create a contribution to the existing relevant literature.

5.3.1 RQ 1: What are the issues associated with the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece?

As indicated from the literature and confirmed from the data analysis of this study, healthcare organisations have to deal with a number of supply chain issues when they attempt to produce their services, such as financial, complexity, cultural and communication issues (Bhakoo *et al.*, 2012; Xie & Breen, 2012; Davies & Edwards, 2013, Papalexi *et al.*, 2015). These issues influence the healthcare service quality (Chassin, 2013; Al-Balushi *et al.*, 2014) and in particular prevent an efficient and effective delivery process (Mustaffa & Potter 2009; Williams, 2011). Considering that healthcare services have an impact upon individuals' health and wellbeing, facing these issues has become a priority for healthcare organisations (Smits *et al.*, 2009; Lainez *et al.*, 2012).

According to the data analysis, it was established that the complexity of pharmaceutical supply chain processes combined with the increasing pressure on healthcare organisations to minimise their expenditure while increasing their service quality is the major problem that healthcare providers have to deal with. This fact is in line with a number of reported cases that also highlight the importance of these factors (e.g. Mustaffa & Potter, 2009; Department of Health, 2014, Rosseti *et al*, 2011; Bhakoo *et al.*, 2012; Hester & Harrison, 2015).

In this section, the issues associated with the PSC in the two European contexts: Greece and the UK, which were presented throughout the Findings Chapter, are discussed, comparing the two delivery systems in order for any similarities and differences to be identified. This comparison provides the answer to the first overarching research question and the associated sub-research questions.

5.3.1.1 S-RQ1: What are the common factors observed within the downstream domain of the Pharmaceutical Supply Chains?

Financial Issues

Water (2009) indicated that organisations in every sector have to effectively manage their supply chain to be able to survive in a highly competitive environment. He particularly, explained that internal and external pressures force them to change the way that they operate, adapting the new situation. Lainez *et al.* (2012) and Al-Balushi *et al.* (2014), referring to the healthcare sector, stated that constant external pressures impel healthcare organisations to undertake operational changes in order to minimise their pharmaceutical spending. Based on the qualitative data analysis, these pressures generated a number of concerns within the healthcare environment, as the current available financial resources are tight. According to OECD Health Statistics (2014a), the total UK healthcare expenditure on pharmaceutical products was 12.3% ($367 per person) in 2012, while 25.2% ($599 per person) of Greek healthcare expenditure covered the pharmaceuticals expenses in 2012 (OECD Health Statistics, 2014b). Unfortunately, the information related to the specific financial resources that are allocated to each healthcare organisation is not accessible; however the interviewees provided an indication of this amount.

As a UK hospital pharmacist, 7/UK, explained "*a budget of approximately £40 million is allocated to our organisation every year. We have to purchase and manage the required pharmaceutical products against this budget and try to be as effective as possible within those financial limits*". A similar situation was described by a hospital pharmacist working in Greece, 18/Gr; he stated that "*hospitals are funded by the government in order to cover their annual expenses; the funding is limited and often is not enough to provide high quality services, especially during those days of austerity, […] the specific allocated budget to our hospital is approximately €30 million per annum*".

The limited financial resources available for healthcare organisation in both countries have influenced their decision to innovate. Pharmacists in both countries assume that the implementation of any new or significantly improved delivery practices requires a particular investment, which cannot be supported by the healthcare organisation as there is no additional funding for them. Particularly, a Greek hospital pharmacist, 15/Gr, highlighted that "*according*

to my perspective, in order for innovative initiatives to be implemented successfully a particular amount of money has to be invested either for purchasing new equipment or providing a series of seminars to staff for knowledge development […], I am afraid that the Greek government is currently unable to fund these actions, considering that our country is in the middle of an economic crisis". He continued explaining that "*the only thing that we are able to do in order to be more productive providing better healthcare services is some improvement based on our day to day experience*". A UK hospital pharmacist, 2/UK, agreed with this statement, saying that "*we have spent a lot of effort trying to manage and use the available financial resources effectively in order to produce quality services […]; an introduction of new practices within our delivery system means that we should allocate a part of these resources into it, which might affect the whole system*".

Community pharmacists in both countries agreed with the hospital pharmacists' opinion regarding the financial aspects of innovation. A Greek community pharmacist, 17/Gr, explained that "*I personally believe that innovation can enhance the way that we produce our services, for example the software that we currently use enables me to contact my suppliers and order the required products on a real time basis […]; however we spent much money and time to buy it and learned how to use it*". This is in line with 21/UK's opinion, who stated that "*apart from the high cost of the innovative products that can be used within the pharmacy, there is also the additional cost for training the staff on how to use them, which is sometimes higher that the accrual purchase of the product*".

The data analysis revealed that both hospital and community pharmacists seem to be reluctant to undertake innovative initiatives because they believe that innovation is costly and risky. This is supported by D'Este *et al.'s* (2012) research, which found that capacity to access finance is considered, among others, as a barrier that organisations experience when they attempt to innovate. Organisations' financial resources need to support any innovative interventions (Davenport, 2013); the absence of funding might lead innovation activities to be abandoned or not be completed (Archibugi *et al.*, 2013). Reported evidence reveals a number of innovative attempts being unsuccessful due to financial obstacles (Savignac, 2008; Mancusi & Vezzulli, 2010). Paunov (2012) stated that the 2008 financial crisis had a negative impact upon organisations' willingness to invest in innovation. "*During a crisis many firms might focus more*

strongly on survival, and less on seeking out new opportunities", as suggested by Archibugi *et al.* (2013, p. 306). However, there are a number of initiatives that can be undertaken that require less or no financial investment and are still able to improve organisations' performance, such as Lean thinking or reverse logistics (Weingart *et al.*, 2012).

Communication Issues

The data analysis demonstrated that the weak communication and synchronisation between the stakeholders involved within the delivery process, in both European contexts, hinders an effective PSC. The main root-cause of the perceived miscommunication is associated with the low level of transparency during the delivery process. A UK pharmacist, 4/UK, pointed out "*the discontinuity in healthcare services existing between the different hospital departments and between the secondary and primary care".* This fact could be explained based on the significant gap existing between doctors, nurses and pharmacists' perceptions of their roles in producing healthcare services, including their different attitudes towards teamwork (NHS Confederation, 2002; Maddox *et al.*, 2016).

Bamford and Griffin (2008) and Akhtar *et al.* (2012) highlighted the importance of teamwork development for improving the service effectiveness and achieving the organisation's success. Similarly, Castka *et al.* (2003) found that knowledge and information exchange, improved communication, and understanding of the organisational vision are essential factors for developing teamworking within organisations. These elements are missing in the pharmacy environment as revealed by a Greek pharmacist, 17/Gr, who explained that "*the lack of a consistent explicit focus on information sharing causes a number of complications to the accurate delivery of medicines, such as: difficulties in addressing a prescription or identifying and distributing the correct product*". She continued by explaining that "*prescriptions often do not provide enough information for us to be able to translate them into products, something that creates delays and customer dissatisfaction*". These malfunctions were pointed out by previous research highlighting that ill-formed and incomplete prescriptions increase the explanatory contacts with physicians, cause delays in the completion of the orders and impact upon customers' satisfaction (Jimmerson *et al.*, 2005). In addition, miscommunication and lack of

information sharing between PSC stakeholders might cause a shortage of medicines, especially in cases where pharmacies are located at a considerable distance from their suppliers. This issue was emphasised by a UK community pharmacist, 23/UK, who highlighted that "*we struggle to communicate with our suppliers in real time […]; they use the online information system as the main communication tool, which is not convenient when we have to face an emergency situation*".

Fawcett *et al.* (2008) and Fayezi *et al.* (2012) stated that successful Supply Chain Management (SCM) requires systematic and strategic management of collaboration, information and knowledge, which fits with the particular political, social and cultural context. Scholars have focused on these elements, attempting to investigate the performance and flexibility development across the supply chain (e.g. Gligor & Holcomb, 2012; Fayezi & Zomorrodi, 2015). For example, Slack and Lewis (2011) found that although it is highly complex to effectively synchronise the different activities of an operation, the existence of a well-established organisational mission and vision, which is communicated to all actors of a supply chain, could facilitate this process. Hwang and Rho (2014) explained that actors of a supply chain need to invest in relationships between them, which could result in benefits of knowledge transfer, information sharing and the establishment of common strategies to explore and exploit potential opportunities. Successful improvements are subjected to an agreement that everyone within an organisation should work in one direction (Drummond-Hay & Bamford, 2009). However, Hwang and Rho (2014, p. 514) also pointed out that "*lack of quality in shared information and inter-organisation systems impedes the speedy and flexible working processes in supply chains*".

Bhakoo *et al.* (2012) concentrated on the PSC, examining the relationship between suppliers and hospital pharmacies. They found that the main issues preventing successful interactions between PSC stakeholders were: communication and trust issues; cultural inertia; and spatial complexity. Jaakkola and Renko (2007) indicated that lack of trust and information sharing has been observed within the PSC due to the nature of products involved within this supply chain. Disclosure of information and data regarding variable medicines usage could violate patients' privacy, which is against the pharmacies' policy (Bhakoo *et al.*, 2012). Besides, pharmacies seem to be rather reluctant to collaborate with supply chain partners, for fear of losing control over their delivery process. This is in line with Fawcett *et al.*'s (2014) research, which suggested

that synergies between organisations with diverse cultures, environments and commercial motives are hard to achieve.

Waste Issues

The analysis of the data of this thesis found that the complexity of the pharmaceutical delivery system caused significant issues of wastage. As mentioned previously, the critical role of pharmaceuticals in human health force pharmacies to retain a large inventory of stock, minimising the ability of the system to provide high quality healthcare services (Spear, 2005). In addition, functional rules derived from the particular legal context are evidence of the relatively centralised environment of healthcare organisations (Bamford, 2011), which does not allow pharmacists to operate interpedently and fully control their storage (Papalexi *et al.*, 2015). A UK hospital pharmacist, 2/UK, explained that "*according to the national guidelines, we have to store and keep some lines/types of medicines just in case they are needed, such as antidotes for poisoning […]; these products might only be used once a year or run out of date and as a result generate waste*". The same guidelines exist in Greece, forcing pharmacies to increase their storages, as reported by a Greek hospital pharmacist (15/Gr). These practices cause considerable operational problems such as the expiry of medicinal products stored for a long time or critical drug shortages (Kostagiolas *et al.*, 2008).

Besides, the data analysis concluded that waste within the PSC is generated due to the lack of communication and synchronisation between the PSC stakeholders (NHS Confederation, 2002). Hospital pharmacists operating in both geographical areas explained that the main waste comes from the wards, either due to the perceived discontinuity in services or due to the poor information sharing between the clinical staff and pharmacists. This matches with the previous literature supporting that physicians tend not to inform pharmacies when they have ceased to prescribe a medicines for a particular ailment (Bhakoo *et al.*, 2012). This is in line with a UK pharmacist's opinion, 6/UK, who stated that "*each part of the PSC works independently focusing only on its responsibilities, for example medicines are often returned to the hospital pharmacy because the patient has moved to a different department, which results in duplication in services and waste of time […]; we have to re-label and re-distribute the same medication*". He continued

by saying that "*we would like to cooperate with the clinical staff to avoid those issues, for example nurses could make sure that the medication follows the patients and inform us about the patients' status*". Although, according to Liu and D'Aunno (2011), developing collaborations among health professionals has been considered as one of the most effective strategies to manage patient care, challenges such as misunderstandings of each other's role (Heatley & Kruske, 2011), differing perceptions towards collaboration (Schadewaldt *et al.*, 2013a) and the existence of hierarchical structures (Schadewaldt *et al.*, 2013b), need to be faced.

Furthermore, the culture of clinical staff could impact upon the waste of pharmaceuticals. As a Greek hospital pharmacist, 15/Gr, pointed out "*nurses tend to order more products than needed to fill the wards' cupboards because they want to ensure they are at capacity […]; the result is that the majority of expired products are found within those cupboards […]; if the clinical staff knew the actual prices of medicines, their demand would be more reasonable*". Collin and Lorenzin, (2006), Kisperska-Moron and Swierczek (2009) and Fayezi *et al.* (2012), among others, highlighted the importance that each actor of a supply chain should fully understand the characteristics of the products that are delivered in order to manage them effectively. They continued by explaining that this process needs to be according to organisational strategy to avoid any operational issues and to satisfy the customers' needs.

Community pharmacies, in both European contexts, believe that the waste within the PSC derives from the healthcare system. A community pharmacist in Greece, 19/Gr, explained that "*patients do not always follow doctors' guidelines regarding their treatment, either because they feel better before they consume all of the prescribed medication or due to ineffectiveness and side effects*". This is supported by Leslie and Rosenheck (2002) and Pomerantz (2004), who found that patients often discontinue their prescribed medication and switch over to other treatment that they or their doctor believe better fits their condition. This is also in line with published reports identifying root causes of medicine waste, encompassing: "*patients recovering before their dispensed medicines have all been taken; therapies being stopped or changed because of unwanted side effects; patients' deaths; and factors relating to repeat prescribing and dispensing processes*" (DoH, 2011, p.6).

Besides, Kongar *et al.* (2014) suggested, that most of the time, the spare medicines are not returned into the system and in such cases they cannot be reused. This is also reported by a UK community pharmacist, 1/UK, who explained that "*patients tend to keep the spare medication, because having some medicines at home makes them feel more secure […]; however, if they decide to return them back to the pharmacy, according to national guidance, those medications cannot be reused because they cannot be attested regards source and control […], but they will be destroyed appropriately without occurring environmental effects*". A report published by the Healthcare Distribution Management Association (HDMA) estimated that the return rate for pharmaceuticals was 3-4% in 2010; these products were sent for recycling and disposal, and rarely for redistribution (Sartori, 2010). For this reason, the European Union (EU), in 2011, developed a public awareness campaign aiming to reduce the impact on the health and environment generated by hazardous waste, including expired or unwanted medicines, through their safe disposal (Kongar *et al.*, 2014).

Complexity Issues

As explained in the Findings Chapter of this thesis, complexity is a rather versatile and diverse term. For the purpose of this research, therefore, complexity is considered as "*the interrelatedness of components of a system*"; this definition was adopted by Kannampallil *et al.* (2011). Wilson and Holt (2001) explained that the analysis of the nature of the interactions between the components of a system is required to appreciate its complexity. They continued, highlighting the importance of this analysis by stating that these interactions are not linear and small inputs have significant effects on them. Plsek and Greenhalgh (2001) contributed to this statement by pointing out that the complexity of each system is unique and dependent on the organisational context.

Attempts to explain the complexity of the delivery system concluded that, from an operations point of view, the use of simplistic push logistics may be the answer to the current process inefficiency (Jamali *et al.*, 2010). Mehrsai *et al.* (2013) explained that a push-based supply chain is based on forecast demand, which provides direction on the quantity and type of products that need to be stored. A hospital pharmacist, 15/Gr, reported that "*we have to store a particular*

amount of products to meet the patients' needs […]; the way that we store medicines is based on their frequency of use in order to increase their accessibility and minimise the likelihood of a product expiring and as a result being useless". A UK hospital pharmacist, 7/UK, reiterated this explaining that "*on average, we tend to keep a two-week safety stock which is suggested from the national guidance in order to make sure that we are not going to run out of stock, […],however this varies based on how frequently we use the products and how often we receive them*". Managing medicines could be very challenging for the healthcare organisations. Hospital and community pharmacists in both geographical areas have to deal with quite sensitive items produced in diverse forms, such as tablets or liquid, with different uses. In addition to this, their cost and expiration dates vary, which influences the delivery practices. As Waters (2009) suggested there is a unique Supply Chain (SC) for almost every product that fits with its characteristics. The role of Supply Chain Management (SCM), therefore, is to synchronise the products' characteristics with the organisation's environment to satisfy the market demand (Fawcett *et al.*, 2014).

Bhakoo *et al.* (2012) and Shah (2004) suggested that, within the PSC, high demand uncertainty has been observed, not only due to the nature of the pharmaceutical products, but also due to the existence of the institutional and regulatory pressures. For example, when a medicine's patent protection reaches its end, its demand will be affected because of generics entering the marketplace, thus increasing the competition (Kiely, 2004). In addition, Scheller and Smeltzer (2006) indicated that pharmacists are also facing difficulties in understanding the patient mix, which affects the demand. They argued that it is hard to predict the patients' needs, specifically under certain emergency circumstances. Similarly, according to Bhakoo *et al.* (2012), an accurate demand for pharmaceuticals is challenging to predict as it depends on the patients' needs. Danas *et al.* (2006) stated that pharmacies tend to carry safety stocks due to uncertainties in demand and in order to avoid the risk of being unable to respond to daily demand fluctuations and supply bottlenecks. However, as Harrison *et al.* (2003) pointed out, variations in demand generate a number of problems, such as overstocking, bottlenecks and delays, product obsolescence and unacceptable service levels.

Moreover, as reasonably pointed out by the Department of Health (2012) and Papalexi *et al.* (2014), pharmaceutical products can be converted into dangerous or useless products; a fact that

has raised significant concerns for potential threat to ecological environment and human health. Tran *et al.* (2014) and Wang *et al.* (2015) stated that there are evidence revealing that pharmaceuticals have been detected in various environmental compartments, such as surface water and groundwater. These potential threats increase the complexity of the medicine delivery system and force healthcare providers to be more responsible by managing both the forward and reverse components of the logistics process minimising the level of wastage, as suggested by Cardoso *et al.* (2013) and Xie and Breen (2014).

Liddell *et al.* (2008) argued that standard logistics strategy models successfully applied by non-healthcare distribution industries are not easily adaptable to PSC. They explained that the key reason behind not adopting best logistics practices is the lack of standardisation of the delivery process; healthcare providers have a diverse set of requirements under which they operate. A hospital pharmacist, 2/UK, pointed out that "*it is difficult to test and adopt distribution practices derived from the manufacturing sector because the products that we manage are critical to individuals' health […]; a system's failure might have an impact on society that we are unable to predict or deal with*". Similarly, a Greek hospital pharmacist, 15/Gr, stated that *"our role is to ensure the availability of the required pharmaceutical products […]; experiments are difficult to undertake as there is no space for mistakes within our distribution system"*. Therefore, pharmacists operating within both the UK and Greek contexts have a very sceptical view of introducing new practices because they are afraid of losing control of the system, which might result in the occurrence of an unadjusted condition such as inability to provide the healthcare service or provide high quality services.

The availability and quality of medicines do not rely only on the pharmacists' ability to manage them properly but also on the role of suppliers; in other words, the availability and quality are based on how frequently they deliver the required products. Pharmacists in both geographical areas order the majority of products from wholesalers and the rest from pharmaceutical companies. According to Hakansson *et al.* (2009), managing the relationships between organisations and their suppliers is critical for the SCM because this influences the organisations' performance. Efficient Supply Chains (SC) aim to overcome the five diverse types of gap between suppliers and customers as defined by Waters (2009, p.16): i) space gap; ii) time gap; iii) quantity gap; iv) variety gap; and v) information gap. Fayezi and Zomorrodi (2015)

explained that organisations need to identify which of those gaps represents their supply chain weakness and adapt the appropriate strategy to overcome them. Although well-developed Supply Networks (SN) enhance the quality of services (Brown *et al*., 2013), there are difficulties in controlling them as one organisations' activities are dependent on other organisations' practices (Christopher *et al*., 2006).

Hospital pharmacies in both European contexts set up contracts with their suppliers annually in order to ensure the frequency of the medicine supplies and a better offer. A hospital pharmacist, 18/Gr, explained that "*we can get up to 50% discount for the items that are under a contract*". A similar situation was revealed by a UK hospital pharmacist, 8/UK, who stated that "*we tend to have an official agreement with our suppliers as through it the responsibilities and expectations are defined, avoiding any unpleasant incidences such as unsuccessful delivery of a product*". He continued by saying that "*the bad side of an annual agreement is that we cannot predict the cost or availability of the required products for the next year […]; every year we have to set up new contracts under different regulations*". This is in line with Qrunfleh and Tarafdar's (2013) research, which found that setting clear and defined responsibilities and expectations throughout the SC enhances the delivery process with respect to customers. They expanded this further, saying that elements of the delivery system, such as price, quantity and time, are standardised for a particular period of time. As a result, this approach can overcome three of the five gaps defined by Waters (2009) between suppliers and customers: time gap, quantity gap and variety gap; the frequency of the delivery, the quantity and type of the required products are well-defined in advance. In addition, Klein *et al.* (1978) and Barney (2015) stated that guarantees and contracts can increase the reputation of organisations among customers and suppliers, leading to the development of a sustained competitive advantage.

Apart from the role of suppliers, numerous stakeholders are involved in the production of the healthcare services (Radnor *et al.*, 2012; Page, 2014). Particularly, stakeholders, including: General Practitioners (GPs), Nurse Practitioners (NPs), secondary care doctors, pharmacists, government and patients, have diverse roles within the PSC that influence the distribution of pharmaceuticals. Figures 4.1 and 4.2, presented in the Findings Chapter, refer to those stakeholders attempting to illustrate the system's complexity. Especially, Figure 4.2 shows the various distribution lines that exist within the PSC. The complexity of the interactions between

the stakeholders in the healthcare sector has attracted the attention of scholars who are interested in studying the value-chain concept in healthcare (e.g. Pitta & Laric, 2004; de Vries & Huijsman, 2011). Interestingly, de Vries (2011) suggested that in order for a system, involving myriad stakeholders, to be operated effectively, building a high level of trust and communication between them is vital. Especially, a high level of trust is required in a healthcare environment where the information shared between different actors could violate patient privacy (Brown *et al*., 2013).

Focusing on the PSC, physicians in both geographical areas are the key decision-makers regarding the procurement of prescription medicines. Bhakoo *et al.* (2012) supported this statement, highlighting that their role is crucial for adequate patient treatment to be achieved. They explained this based on the fact that patients are unable to assess themselves, and, thus they have to follow healthcare providers' instructions. However, Scheller and Smeltzer (2006) reported that physicians' knowledge regarding Operations Management (OM) and SCM practices is limited, which increases the complexity of the delivery system. Although clinicians' role is to focus on patients care rather than administrative functions (Danas *et al.*, 2002), critical management skills are required in order to deliver high quality services (Breen *et al.*, 2015). Uthayakumar and Priyan (2013) suggested that these skills could solve inventory management problems and as a result improve the healthcare operations. It is apparent, therefore, that the stakeholders involved within the PSC require expert knowledge in order to be able to best use the healthcare organisational resources and as a result improve customer satisfaction (Woosley, 2009). Besides, following guidelines formulated based on SCM principles could improve the level of communication between the PSC stakeholders and information sharing (Veral & Rosen, 2001), which is a matter of paramount importance in order that duplication in services is avoided, as Radnor and Boaden (2008) pointed out.

Summary of the first sub-research question (S-RQ1)

From the analysis of the data, it was established that a number of similar issues have been observed in the pharmaceutical delivery systems implemented by the two diverse contexts. These issues cause considerable operations problems, preventing an effective and efficient PSC. The

following table (Figure 5.3) presents the emerging issues, which are associated with the four primary themes: i) cost; ii) communication; iii) waste; and iv) complexity. By discussing those issues, it became apparent that there is a multi-dimensional relationship between an issue and a theme. For example, the lack of synchronisation and continuity of services primarily emerged as a communication issue; however it also increased the complexity of the system and impacted on the level of wastage.

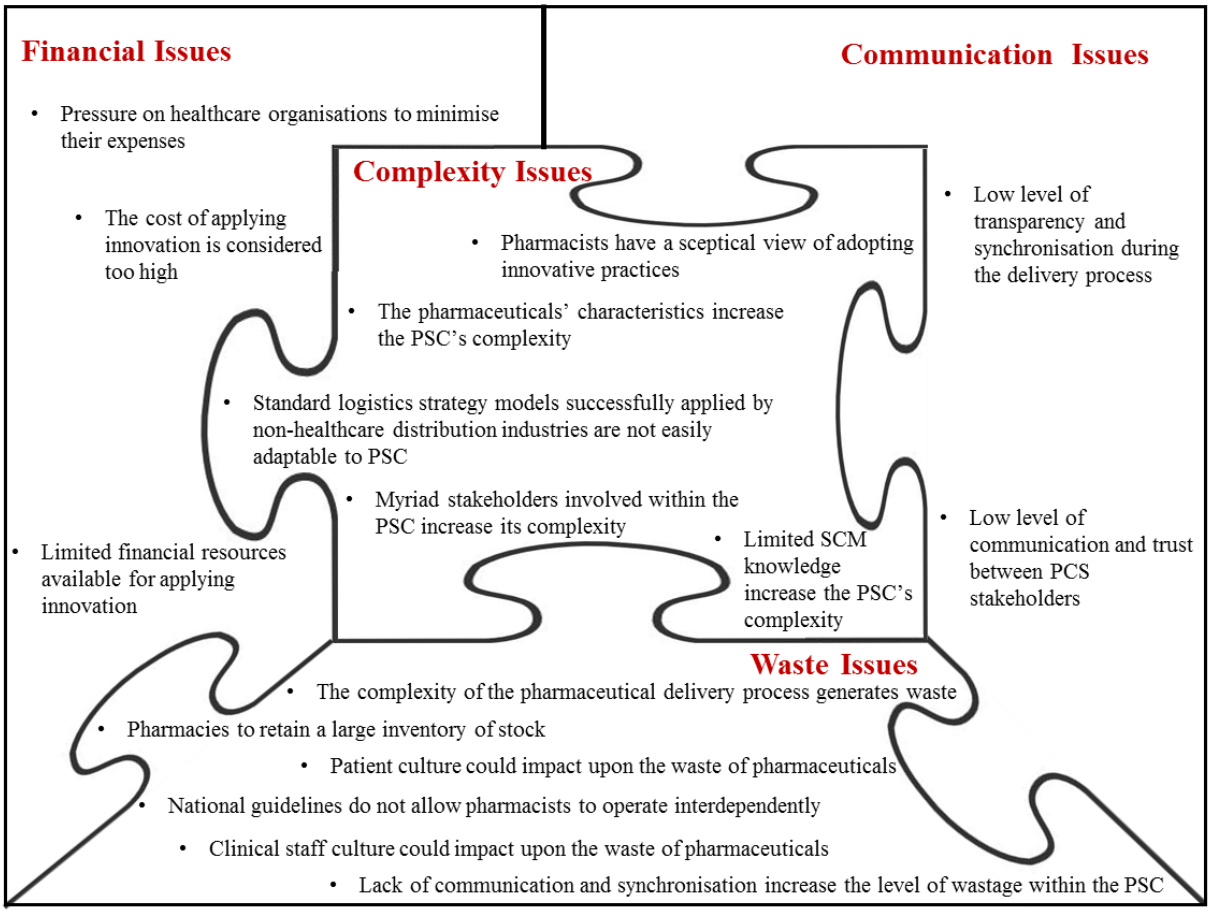


Figure 5.3: The issues observed within the PSC in both European contexts

By analysing all the sets of data, it became clear that the complexity of the delivery system applied in both European contexts was the main element preventing an accurate and robust PSC. The constant pressure on healthcare organisations to deal with their financial issues in conjunction with the critical products that they manage and the lack of an effective communication system are factors that pressurise the delivery process, increasing its complexity. Therefore, as explained in the Findings Chapter, the theme related to the complexity of the

delivery system includes aspects that are associated with the three other themes, which explains its unequally lengthy nature when compared with the other three themed sections. In addition, Complexity Issues is considered as a multidimensional theme, which provides explanations regarding its on-purpose position as the last theme to be analysed.

This thesis explains, analyses and confirmes the nature of the problems which can be used by healthcare organisations to underline their issues and define a set of solutions that will lead to the implementation of improvements. Before discussing the suitable improvement approach for hospital and community pharmacies operating within the two diverse contexts, identifying and discussing the region-specific issues existing in the Greek and the UK delivery systems is of paramount significance.

5.3.1.2 S-RQ2: What are the region-dependent factors observed within the downstream domain of the Pharmaceutical Supply Chains?

Al-Balushi *et al.* (2014) and Cheng *et al.* (2015), among others, indicated that healthcare organisations have to deal with a number of challenges in order to comply with the national requests, asking them to minimise their expenses, whilst maintaining or improving the service quality. From the data analysis, it is apparent that pharmacists, operating within the Greek and the UK healthcare system seek solutions to address these challenges and as a result are more productive with fewer resources. Taking this forward, the issues associated with PSC ineffectiveness have to be identified. This process would enable pharmacists to look at the bigger picture of the PSC and identify areas for improvement.

Despite the issues observed throughout the PSC in both European contexts, which have been discussed in the previous section, the two delivery systems have also some distinctive features that lead to a number of region-specific issues. Based on the data analysis, there are some issues that are unique to each geographical area, which perhaps are not generalisable to countries other than those studied. The following section presents and discusses those region-specific issues.

The UK context

The healthcare system in the UK, attempting to minimise the NHS expenditure on pharmaceuticals, decided to develop the primary healthcare provision. According to Martin *et al.* (2011), this decision enables the majority of the patients to be treated at this level; therefore the demand on hospital outpatient departments has been reduced, as Roland *et al.* (2006) stated. A UK nurse practitioner, 12/UK, explained that "*the healthcare system in the UK suggested to keep the patients at the primary healthcare level because people seem to feel better quicker when they are recovering in a familiar environment and also because being bedridden in a hospital is too expensive*". In order for this practice to be implemented successfully, the NHS in the UK has educated the clinical staff, such as the nurse practitioners, to be able to assess patients' condition and prescribe medication (Gielen *et al.*, 2014). According to the Department of Health (2010b), nurse practitioners are qualified independent prescribers whose role is related to the establishment of a diagnosis and decisions about the appropriateness of medication. As Creedon *et al.* (2009) and Kroezen *et al.* (2011) explained, the introduction of nurse prescribing was aimed at improving the access quality and continuity of care. They also suggested that this approach has improved the provision of healthcare services, as the more healthcare providers there are, the better the satisfaction rate.

However, Sandø *et al.* (2010) highlighted that the existence of multiple prescribers within the UK healthcare system increases the complexity of the pharmaceuticals delivery process. They explained this further, saying that those healthcare providers have different perspectives and experiences, which influences their decisions and, as a result, they might prescribe different medication to deal with the same health problem. Van Ruth *et al.* (2008) and Houweling *et al*. (2009) reiterated this, saying that although prescribing usually takes place based on the same national protocols or guidelines, differences in prescribing practices between nurse practitioners and physicians have been reported.

The data analysis found that the differences in prescribing not only increase the complexity of the system as diverse prescribers prescribe different medication based on their assessment of the patient's condition, but also the spending on pharmaceuticals and the perceived level of wastage. The Department of Health (2011, p.6) reported that one of the main root causes of medicine

waste derived from therapies being stopped or changed because of ineffectiveness and side effects, which is one of the reasons why medicine optimisation is such a huge agenda. The waste of pharmaceutical products might be generated not only because treatments are changed due to the prescribers' different opinions, as Sandø *et al.* (2010) pointed out, but also due to patients' attitude. Nunes *et al.* (2009) found that approximately one-half of the medication prescribed for long-term conditions is not taken as recommended. Patients, therefore, sometimes decide not to follow the guidelines provided, either because they feel better or they believe the medication is not appropriate for their condition.

Considering the lack of communication and synchronisation existing between the PSC stakeholders and in particular between the physicians and the clinical staff (Bhakoo *et al.*, 2012), one could appreciate the communication issues occurring due to the involvement of multiple prescribers in the system. As detailed above, this also generates financial and waste issues because providing different medication means that patients need to buy different medicines and that the spare medication is no longer useful. Finally, the current UK delivery practices increases the complexity of the delivery system as diverse delivery routes exist.

The Greek context

Focusing on the Greek healthcare system, only physicians can prescribe medication, which reveals a rather fragmented and centralised system, as Thomas & While (2007) reported. A Greek pharmacist, 14/Gr, stated that "*keeping the patients at the secondary healthcare level is considered too expensive, but unfortunately the primary healthcare provision has not been developed in Greece […]; we do not have the capacity to provide 'home care' services"*. Considering that the Greek healthcare system involves one of the highest ratios of physicians and one of the lowest ratios of nurses in Europe, one could conclude that the emphasis has been placed on curative services rather than disease prevention, health promotion and home care services, which is something supported by Lionis *et al.* (2009).

As the NHS in Greece has not developed a well-established primary care, patients tend to place more trust in the private primary care providers. Lionis *et al.* (2009, p.2) stated that "*the Greek*

healthcare system is one of the most 'privatised' among European Union (EU) countries". In 2013, the private expenditure of overall health spending in Greece, accounted for 34% (OECD Health Statistics, 2015b); this percentage is double that (17%) covering the relative services produced in the UK (OECD Health Statistics, 2015a). According to Souliotis and Lionis (2005), this practice has greatly contributed to the discontinuity of healthcare services, because patients are free to select and consult with any specialist, who may provide different guidelines. Theodorou *et al.* (2009) found that apart from the patient's condition, there are other factors that could affect the prescribing behaviour of physicians, such as their educational background, their experience and a number of social factors.

As highlighted by a Greek pharmacist, 19/Gr, "*the majority of the patients in Greece use the private primary care providers […], as GP practices have not been introduced effectively, patients try to identify the specialist who could assess them […]; sometimes they might visit more than one physician until they find the treatment that could cure them […]; obviously, each of these doctors would prescribe different medication*". Although there is only one type of prescribers (i.e. physicians), high level of wastage is still generated, as Pappa and Niakas (2006) reported. Gress *et al.* (2006) suggested that the non-existence of family physicians serving as gatekeepers to more specialised care, and the miscommunication between the healthcare providers increases spending on pharmaceuticals and associated waste. This is because more medicines are likely to be prescribed and therapies stopped or changed. The pharmaceuticals delivery process, therefore, is characterised as highly complex, similar to the UK delivery system discussed in the previous section; however, this complexity is generated by applying different practices.

Answering the second sub-research question (S-RQ2)

The data analysis revealed some key region-dependent issues, observed in the healthcare system structure implemented in the two diverse contexts, which specifically affect the pharmaceuticals delivery process. Powell Davies *et al.* (2008) explained that the healthcare system in the UK focuses more on developing the primary healthcare settings in order to minimise the NHS expenditure and increase patients' experience. Conversely, the healthcare system in Greece

concentrates more on the secondary healthcare provision because there is not enough capacity to offer developed primary healthcare services, as highlighted by Papanikolaou and Zygiaris (2012). These different structures cause some specific issues during the medicine delivery process in both geographical areas. The following table (Table 5.1) presents the emerging issues associated with the different healthcare systems that influence the PSC's effectiveness.

The issues associated within the Pharmaceutical Supply Chain	
The UK Context	**The Greek Context**
Strong Primary Healthcare Structure	Weak Primary Healthcare Structure
Existence of multiple prescribers	Existence of only one prescriber – Physicians
Differences in prescribing process • Differences in prescribing practices between nurse practitioners and physicians	More 'Privatised' healthcare system • Non-existence of family physicians serving as gatekeepers to more specialised care
Increasing complexity of the PSC	
Increasing spending on pharmaceuticals	
Increasing level of wastage	
Difficulties in the healthcare providers' communication system	

Table 5.1: A summary of the key differences between the Greek and UK PSCs

As can be concluded from Table 5.1, although the UK and Greek healthcare systems have been structured in a different manner, based on the available resources and capacity, the issues emerging are similar and related to the primary themes identified: i) cost; ii) communication; iii) waste; and iv) complexity. One could conclude that the issues related to systems do not stem from the system itself but from the way of managing it, which is also supported by Boyer *et al.* (2005). Sirmon *et al.* (2011) and Brandon-Jones *et al.* (2014) suggested that orchestrating

resources and capabilities across the supply chain could be very challenging, but at the same time creates opportunities of developing an effective system and being competitive.

Macinko *et al.* (2003) explained that well-established primary care is associated with better population health, lower socioeconomic inequality and higher rates of satisfied patients. Although developing the primary care provision can lead to less expensive healthcare services through better controlling the overall healthcare costs (Ansari *et al.*, 2003), maintaining a strong primary care structure requires great investments (Rosano *et al.*, 2011). Kringos *et al.* (2013) highlighted that sustaining a high-performing primary care system is costly because developments have to be promoted, such as: decentralisation of services delivery, educational system for primary care professionals and protection of patients' rights.

Appropriate primary care provision needs to be introduced within the Greek healthcare system in order for the identified issues to be overcome. Lionis *et al.* (2009) emphasised its importance focusing on the need for introducing and implementing a general practitioner's practice. However, this initiative has to fit with the Greek context, considering the Greek healthcare organisations' characteristics in order to be successfully implemented. Similarly, improvements within UK primary care have to be undertaken based on the available sources and capabilities. Barney (2001, 2015), who focused on organisational systems' effectiveness, suggested that internal weaknesses and external threats can be avoided through establishing strategies that fit with organisations' environmental conditions. Potential improvements that could be implemented to improve the delivery of medicines throughout the two diverse systems will be thoroughly discussed in a later section of the chapter.

5.3.1.3 The overview of the first research question (RQ1)

Based on the analysis of the qualitative data of this research, the main issues associated with the PSC in two diverse European contexts, Greece and the UK were identified and discussed. The bespoke characteristics of the products involved within the PSC – expensive and at the same time quite hazardous products to human life and the environment – as well as the high pressure on healthcare organisations to minimise their expenses, represent evidence indicating the need

for operational improvements. The data analysis explained and confirmed the nature of the identified issues, which allowed a set of solutions and changes to be defined. In particular, it was apparent that the complexity of the system in conjunction with the lack of communication and synchronisation and the existence of a high level of wastage were emerging as being the root-cause problems of the medicine delivery process. Although the healthcare systems in the two geographical areas are different, the issues that emerged are quite similar.

In order for these issues to be overcome, this thesis suggests the implementation of innovative programmes within the downstream domain of the PSC. However, it was critical to assess the level of innovation applied and identify the factors influencing this level in order for the most suitable innovative actions to be proposed. The following section discusses the factors that impact upon pharmacies' decision of whether to be innovative or not; this work is primarily based on the data analysis.

5.3.2 RQ2: How can the implementation of innovative programmes within the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece be promoted?

Having identified and discussed the main issues associated with the PSC, that can prevent an effective and efficient delivery process, it seems relevant to focus on the factors influencing the implementation of innovation within the delivery system applied in both European contexts. Identifying those factors would allow the development of a better understanding of the system, which would lead to the most suitable solutions or changes being suggested and eventually designed and implemented by the associated providers in both countries.

5.3.2.1 S-RQ3: What are the factors that influence the level of innovation within the downstream domain of the Pharmaceutical Supply Chain?

The aim of the quantitative analysis was, firstly, to capture the level of innovation applied during the delivery of medicines in both countries and, secondly, to identify the factors that have a

positive or negative impact upon the decision of hospital and community pharmacies to be innovative and to investigate the moderating effects of these factors on the PSC. As explained in the Findings Chapter, the quantitative analysis has a supporting role in this study, but provides important information that might direct potential future research.

Initially, a Linear Regression Analysis (LRA) was conducted considering the total sample and then two data analyses were undertaken focusing on the Greek and UK samples separately. The reason for this was to evaluate the extent to which the identified factors influence the downstream domain of the PSC applied in a European environment and subsequently to compare and contrast their impact on the two diverse contexts: the UK and Greece. In particular, the hypotheses tested are listed below:

Hypothesis 1(H1): Reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patient satisfaction (c) are positively related to the innovation level regarding the use of technology.

Hypothesis 2 (H2): Economic risk (a), cost of innovation (b) and lack of finance (c) are negatively related to the innovation level regarding the use of technology.

Hypothesis 3 (H3): Access to information (a) and external/internal collaboration (b) are positively related to the innovation level regarding the use of technology.

Hypothesis 4 (H4): Reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patients satisfaction (c) are positively related to the innovation level regarding the introduction of new/improved products/services.

Hypothesis 5 (H5): Economic risk (a), cost of innovation (b) and lack of finance (c) are negatively related to the innovation level regarding the introduction of new/improved products/services.

Hypothesis 6 (H6): Access to information (a) and external/internal collaboration (b) are positively related to the innovation level regarding the introduction of new/improved products/services.

Discussing the outputs stemming from the quantitative analysis

Hypothesis 1 (H1) assumed a positive relationship between reduced time to respond to customers/suppliers (a), improved staff communication (b), enhanced staff/patient satisfaction (c) and the innovation level regarding the use of technology. Only the positive relationship between reduced time to respond to customers/suppliers (a) and the innovation level regarding the use of technology were confirmed in the total sample.

Blackstone (2010) supported that the use of technology and especially information systems (IS) enhances supply chains' performance through creating net value, synchronising supply with demand and leveraging worldwide logistics. However, Barney (2015) argued that this can only be achieved if the information sharing through the adopted systems is considered as a valuable source. This is an issue that has been pointed out at the early stage of adopting IS; for example Hayes and Wheelwright (1984) explained that computer hardware and software by themselves cannot be considered as a valuable source for supply chain systems. Particularly, as Forslund and Jonsson (2007) indicated, an effective and efficient delivery process requires access to accurate information regarding product usage and inventory levels. However, Magal and Word (2011) explained that these data are often fragmented by functional silos. They analysed it further, saying that a number of functions within organisations are often less communicative and collaborative, which does not support information sharing. Considering the defined issues associated with the PSC, which mainly refer to the high complexity of the system, sharing information and knowledge is considered a very challenging process for healthcare organisations (Danese, 2006). Information not only represent a large number of items, but also consists of various data types, including product details, historical sales information and forecasts, which implies a high level of complexity. Figure 4.1, presented in the Findings chapter, illustrates this highly complex system detailing the elements that need to be considered throughout the medicines delivery process.

According to Kimpel (2013, p.376), technology can be used as a tool for establishing information systems (IS) to integrate and organise "*key operational data in a form that is consistent, reliable, timely, and readily available, wherever and whenever needed*". In particular, Mattsson (2002) explained that, by using IS, organisations can minimise the time taken to

respond to customers or suppliers though information exchange, which synchronises the customers' and suppliers' needs with the demand. It can also enhance the customers' and suppliers' satisfaction and improve the communication between them, because the information sharing is accurate and available, as Seifert (2003) suggested. In addition to this, Forslund and Jonsson (2007) found that reductions in errors and the time spent asking for additional information could be achieved through utilising IS. However, Cederlund *et al.* (2007) argued that the existence of technology is not enough to develop a robust supply chain; only if it is combined with a well-established IS could it result in the benefits described above.

Participants revealed that they are quite satisfied with the software that they utilise to manage pharmaceuticals, but they also stated that this is not an integrated system. In more detail, the stakeholders involved within this process do not share the same IS, and so its capabilities are limited and focused only on internal practices. This can explain why pharmacists in both countries do not believe that the use of technology can improve their performance through enhancing the communication between them and their customers' satisfaction. Although the respondents in the total sample recognised that the use of technology reduces the time to respond to customers and suppliers, this is something that is highly dependent on the knowledge and information sharing between the key stakeholders, as Mattsson (2002) explained.

Hypothesis 2 (H2) assumed a negative relationship between economic risk (a), cost of innovation (b) and lack of finance (c) and the innovation level regarding the use of technology. The data analysis did not confirm this negative relationship. Bubalo *et al.* (2013) and Archibugi *et al.* (2013) reported that the cost of innovation and the lack of financial funds prevent innovation. In particular, Bubalo *et al.* (2013) investigated the aspects of technology and its effect on medication errors. Although they found that the application of Computerised Provider Order Entry (CPOE), Electronic Medical Record (EMR) and other similar software for placing pharmaceutical orders electronically has multiple benefits, the cost of implementing those types of technology were one of the limitations. Besides the actual cost of the implementation, Bubalo *et al.* (2013) also considered the cost of maintaining the system and the cost associated with the time spent by healthcare specialists in utilising it. In addition, Davenport (2013), who also focused on the financial aspects of innovation, suggested that organisations often hesitate to

undertake an innovative approach, fearing the economic risk associated with this type of initiative specifically when attempts to be innovative fail.

However, the respondents do not believe that investments in computer hardware and software are too expensive. Considering that the cost of pharmaceuticals is too high (Cherrett *et al.*, 2012), pharmacies do not consider that purchasing and maintaining this type of technology requires huge investments. For community pharmacies, which are often small businesses, the cost of implementing IS is considered affordable, as it is a small-scale application. Wietholter *et al.* (2009) found that the cost of introducing, implementing and maintaining IS is dependent on the organisation's size. Therefore, attempts to implement this type of technology in a hospital environment could be very costly. However, the data analysis indicated that hospital pharmacists still do not consider this particular cost as a barrier to being innovative. The reason for this may be that they focus only on the pharmacy department without taking into account the possibility of integrating the system within or outside the organisation. On the contrary, more emphasis has been placed on selecting and adopting the appropriate information system (IS) to fit with the organisation's needs, which is revealed by the output related to hypothesis 3.

Hypothesis 3 (H3) assumed that access to information (a) and external/internal collaboration (b) positively influenced the innovation level regarding the use of technology. The data analysis of the total sample appears to confirm the positive effect of external and internal collaboration on innovation level regarding the use of technology (H3b) and reject this positive relationship between access to information and the innovation level regarding the use of technology. Developing external and internal collaboration might encourage, particularly, Greek pharmacists to adopt technology.

Anderson and Eshima (2013) and Drucker (2014) suggested that the development of collaborations and synergies between stakeholders of a supply chain enables organisations to successfully adopt innovative ideas and as a result increase their performance. They found that when partners of a system focus in the same direction, setting up common objectives, there is more likelihood of identifying the weaknesses of the system and supporting each other in order to improve it. As Leonard-Barton (1995) explained, the success of those collaborations is based on the creation of knowledge within organisations' boundaries and also the ability to adapt

innovation from their external environment. Generating and recombining knowledge and skills promote innovation as best practices and their associated benefits are communicated (Helfat & Raubitschek, 2000). Dhanaraj and Parkhe (2006) supported this statement, highlighting that innovation can be achieved through orchestration and facilitation. Kostopoulos *et al.* (2002) stated that implementing innovative approaches enables organisations to deal with different market conditions, determining their competitive success against their competitors. Bamford *et al.* (2015b) highlighted the importance of external collaboration to organisations' innovativeness. They stated that technology and knowledge transfer appear to improve organisations' effectiveness and enhance their competitive advantage. Exploring external knowledge has a positive impact on innovative activities (Provan & Kenis, 2008).

Besides, internal collaborations appear to be more conductive to innovative activities than external ones (Goduscheit, 2014). The reason for this might be the lack of a common framework applied by diverse stakeholders of a network; "*knowledge and technology transfer can be so widely defined and interpreted*", as Bamford *et al.* (2015b, p.2) pointed out. In addition, this could also be explained by the existence of information asymmetries between the actors of a supply chain (Archibugi *et al.*, 2013). Stakeholders involved within the PSC appear to operate quite independently (NHS Confederation, 2002) using technology, and in particular information systems (IS), that fit within their organisational environment (Kim *et al.*, 2012). This means that these systems are often incompatible, which explains the lack of promotion of teamworking (Jimmerson *et al.*, 2005).

Chopra and Meindl (2007) indicated that the creation of collaborations between stakeholders of a supply chain requires the adoption of an integrated IS, which can be used as a communication tool. This would enable accurate and real-time data and information to be exchanged, enhancing the delivery process. As mentioned previously, although this is supported by the participants in total and the Greek sample in isolation, the data analysis based only on the UK sample concluded that pharmacists operating in the UK might have a different view. They do not appear to believe that the development of collaborations enhances the use of technology. This can be explained based on the existence of technology asymmetries observed within the PSC (Cederlund *et al.*, 2007). As Williams and Dickinson (2008) and Bamford *et al.* (2015a) explained, the adoption of innovation tends to be dependent on organisational context, including the organisations'

characteristics, such as: the type of waste that has to be addressed; needs and demands of customers and employees; or functional rules due to the different legal context. In addition, considering that healthcare organisations are generally functionally centralised (Bamford, 2011), any change or innovative initiative is considered to be a relatively slow process (Greenhalgh, 2004).

Regarding the assumed positive relationship between the access to information and the use of technology (H3a), the data analysis indicated that pharmacies operating in both European contexts do not support it. They do not believe that the knowledge regarding the existing available technology that could be applied in their organisation could enhance the level of innovation. The explanation for this could be based on the fact that healthcare organisations are functionally centralised (Williamson *et al.*, 2014), which means that those type of decisions are made by the top hierarchy (Greenhalgh, 2004). Even if hospital pharmacists are aware of innovative approaches that could facilitate the delivery process, they appear not to be part of decision making processes regarding innovative initiatives. Considering that public hospitals in both European countries are funded by the central government, which significantly affects hospitals' structure and functioning (Ifanti *et al.*, 2013), hospital pharmacists have often little authority to make any changes within the system. However, community pharmacists might be able to undertake innovation more easily, as some of them run their own business, and they have to consider a number of regulations associated with pharmaceuticals. According to Kastanioti *et al.* (2013), various direct and indirect regulatory and policy mechanisms have been introduced within the healthcare sector to control and reduce costs. They also stated that the existing laws and regulations seem to hinder the adoption and diffusion of innovation, which could benefit the delivery system.

Besides the potential implications of centralised and highly controlled healthcare policies, the adoption and diffusion of innovation are influenced by the organisational behaviour, as Cappellaro *et al.* (2009) explained. They found that healthcare personnel have limited experience in undertaking innovation and, thus, it is often hard for them to appreciate its benefits. Similarly, Lluch (2011) and McMackin and Pittel (2005) stated that healthcare professionals struggle to adapt technology into their practice, as there is little understanding of the advantages that could be gained through its adoption. In addition, Meade *et al.* (2009) and Ekeland *et al.* (2010),

among others, suggested that lack of qualified personnel and relevant training result in ineffective use of technology. The organisational culture also influences the use of technology and unwillingness to take a chance (Shortliffe, 2005; Finch *et al.*, 2007); for example face-to-face interaction between the patient and the healthcare professionals is the prefered way for delivering healthcare services (Lluch, 2011). Wears (2005) and Black *et al.* (2011) found that there is insufficient evidence supporting the adoption of technology within the healthcare sector. It can therefore be concluded that access to information related to available technology has no impact upon pharmacies' decision to be innovative.

Hypothesis 4 (H4) assumed that reduced time to respond to customers/suppliers (a), improved staff communication (b) and enhanced staff/patients satisfaction (c) positively influenced the innovation level regarding the introduction of new/improved products/services. From the data analysis, a rejection of this hypothesis was concluded. Omachonu and Einspruch (2010), Rostamy-Malkhalifeh and Mollaeian (2012), and Chauhan and Singh (2013) supported that the main reason for introducing new or relatively improved products and services is related to customer and staff satisfaction. They explained it further, saying that this could be achieved, on one hand, through adopting improved services, such as communication systems, that enable an effective response to customers' and suppliers' demands, and on the other hand, through introducing new products, which could enhance customer satisfaction. Chassin (2013) and Page (2014) suggested that the increasing number of demanding patients has forced the healthcare organisations to improve the received quality of healthcare products and services. They stated that patients tend to assess the level of healthcare quality services based on the range of available products and services and their accessibility. In addition, the increased pressure on healthcare organisations to minimise their expenses, at the same time as maintaining or improving the service quality, demonstrates that there is a need for improvement (Lainez *et al.*, 2012; Al-Balushi *et al.*, 2014). However, participants in both samples stated that introducing new or improved products and services is not the appropriate approach for meeting this request.

Simon *et al.* (2007) and Walker and Carayon (2009) found that healthcare organisations with strong hierarchical organisational systems, such as those in hospital settings, have difficulties supporting new or significantly improved processes due to the current inefficiency of the system. Grol and Wensing (2004) supported this, explaining that disconnection between evidence and

practice obverved within the PSC has caused a slow uptake of innovation. The role of the physician as the main decision-maker (Bhakoo *et al.*, 2012) in conjunction with autonomy issues and general healthcare organisations' cultural barriers (Levenson *et al.*, 2008) appear to prevent the introduction of new or improved products and services. Healthcare personnel appear to be sensitised to changes, which means that they are more likely to perceive them as threat and react negatively (Burnes & Jackson, 2011). Brown *et al.* (2013) stated that organisations characterised by high risk, such as healthcare organisations, are more sceptical to changes due to perceived risk of failure which is not acceptable.

Based on Hypothesis 5 (H5), economic risk (a), cost of innovation (b) and lack of finance (c) would be negatively related to the innovation level regarding the introduction of new/improved products/services. According to the Linear Regression Analysis (LRA) performed in Chapter Four, although the negative relationship between economic risk and innovation level related to the introduction of new or improved products and services (H5a) was confirmed in the total sample, the negative effects of the cost of innovation (H5b) and lack of finance (H5c) on this innovation level were rejected. Particularly, pharmacists operating in the Greek environment, which has to deal with the effects of the economic crisis, appear to recognise economic risks as a barrier to innovation.

Mancusi and Vezzulli (2010) and D'Este *et al.* (2012) suggested that one of the main factors influencing the successful implementation of innovative initiatives is the capacity to access finance. This is also supported by Savignac (2006), who reported that the presence of financial constraints could negatively affect organisations' willingness to be innovative. However, pharmacists, and in particular those who operated in Greece, recognised only the economic risk associated with the application of innovative programmes. It is assumed that they emphasise this element as there is no space for financial waste in the healthcare sector; considering the extensive pressure put on healthcare organisations to minimise their expenditure (Lainez *et al.*, 2012; Hester & Harrison, 2015). This is the main issue for countries facing economic crises, such as Greece (Lionis *et al.*, 2009).

The indication of rejection of the H5b and H5c parts of Hypothesis 5 could be explained based on the lack of transparency within the PSC (e.g. Bhakoo *et al.*, 2012). In other words, healthcare

personnel are often not informed about the selected criteria of the products and services applied and the associated cost because they are not involved in the decision-making process, as Lluch (2011) pointed out. This is in line with a pharmacist's opinion, 4/UK, stating that "*clinical staff, such as nurses, do not know the cost of medicines and as a result they cannot understand the economic aspect of their use; this is a fact that increases the level of waste within the PSC*". They can therefore only assume the economic aspects of innovation, as has been indicated from the qualitative analysis, but they do not have evidence to support them.

Finally, Hypothesis 6 (H6) assumed a positive relationship between access to information (a) and external/internal collaboration (b) and the innovation level regarding the introduction of new/improved products/services. The data analysis of the total sample confirmed this positive relationship. However, there was an indication suggesting that the participants in the Greek sample did not agree with this assumption and the participants in the UK sample recognised only a positive relationship between access to information and the innovation level related to the introduction of new or improved products and services.

The outputs of the total sample match with the previous literature supporting a positive effect of the existence of collaborations and information sharing between the actors of a supply chain on the successful implementation of innovation (Brandon-Jones *et al.*, 2014; Drucker, 2014), which enables organisations to gain and sustain their competitive advantage (Kostopoulos *et al.*, 2002; Hitt *et al.*, 2016b). However, this is not supported by the pharmacists operating in Greece. The reason for this might be the fact that pharmacists are not involved in the decision-making process related to the introduction of new or significantly improved products and services, which was reported by Greenhalgh (2004). In addition, as Porter and Teisberg (2006) explained, there are particular regulations and guidelines that need to be followed to undertake any changes within the healthcare sector. Although participants recognise that collaborations between the PSC stakeholders and information sharing can improve their performance and customer satisfaction, as has been concluded from the qualitative analysis, they do not consider their impact upon the innovation level.

In contrast, pharmacists operating in the UK environment suggested that only access to information influences this level of innovation. This is in line with previous research highlighting

the importance of information and knowledge sharing between diverse stakeholders of a system in order for innovative initiatives to be successfully applied (Leonard-Barton, 1995; Provan & Kenis, 2008). However, as Bhakoo *et al.* (2012) indicated, sharing information within the PSC is quite challenging because it is related to medicine usage and might violate patients' privacy, which is protected by healthcare organisations. Furthermore, the organisations involved within the PSC seem to act interpedently, having a different perception of their role in producing healthcare services, which prevents the development of teamworking (NHS Confederation, 2002).

It has been apparent that pharmacists operating in Greece have a slightly different view of the factors that influence the level of innovation applied, to those operating in the UK. Although neither of them recognises the assumed positive relationship between the development of collaboration and the introduction of new or improved products and services, the UK pharmacists tend to support that information and knowledge sharing could influence their innovativeness. The general pharmacists' opinion, as measured by the data analysis of the total sample, appeared to confirm Hypothesis 6.

Summary of the third sub-research question (S-RQ3)

From the quantitative data analysis, a better understanding of the level of innovation, regarding the use of technology and the introduction of new or improved products and services, applied in the selected European contexts, was achieved. In addition, the factors that positively or negatively affect this innovation level were identified by conducting a Linear Regression Analysis (LRA). The same assumptions regarding the relationship between those factors and the two forms of innovation were tested and discussed.

Although Rowley *et al.* (2011), focusing on innovative interventions categorised them into two diverse types of innovation: i) technical innovation (e.g. Lai *et al.,* 2008) and ii) product/service innovation (e.g. Lewis *et al.,* 2010), Camison and Lopez (2010) argued that a clear distinction between them is not always possible. This statement is supported by the current study, as the application of technology facilitates the introduction of new or relatively improved products and

services, and vice versa. For example, sophisticated IS can enhance the delivery practices and perhaps the introduction of new products, because the knowledge and information exchanged are accurate, which minimises the associated risk of such initiatives. In addition, the organisational environment influences equally the introduction of both forms of innovation. For example, elements such as the centralised environment, the limited involvement of pharmacists in the decision-making process and the organisational culture, have been considered as barriers to implementing both types of innovation.

Table 5.2 summarises the results from the quantitative analysis. Although, as detailed in Chapter Four, the multi-group analysis is considered as an indication of the UK and Greek delivery systems' innovativeness, it provides a preliminary insight into this phenomenon that enables an initial comparison to be conducted. As Table 5.2 illustrates, there appear to be similarities and differences between the two regional contexts related to pharmacists' perspective on innovation.

Hypothesis	Total Sample	Greek Sample	UK sample
H1			
H1a	√	X	X
H1b	X	X	X
H1c	X	X	X
H2			
H2a	X	X	X
H2b	X	X	X
H2c	X	X	X
H3			
H3a	X	X	X
H3b	√	√	X
H4			
H4a	X	X	X
H4b	X	X	X
H4c	X	X	X
H5			
H5a	√	√	X
H5b	X	X	X
H5c	X	X	X
H6			
H6a	√	X	√
H6b	√	X	X

Table 5.2: Results from the Quantitative Analysis

Generally, pharmacists operating in both geographical contexts highlighted the importance of knowledge and information sharing, related to the delivery process, between the diverse stakeholders involved in the PSC. They believe that innovation cannot be adopted appropriately without being accompanied by the required information in order to improve the organisations' performance, which could be used as an incentive for enhancing the innovation level. The participants in the Greek sample supported the assumed positive relationship between the development of internal and external collaboration and the use of technology. On the other hand, UK pharmacists emphasised more the importance of access to information in introducing new or significantly improved products and services. From the data analysis, it is apparent that pharmacists do not consider the economic aspects of innovation, partially because they are not fully involved in the decision-making process related to the adoption of innovation and partially due to the lack of knowledge and information related to the cost of innovative initiatives.

The identification and analysis of the factors that impact the UK and Greek pharmacies' innovativeness contributed towards the development of a better understanding of the current delivery process practices applied within the PSC. This has enabled a number of improvements and changes to be recommended, which are presented and discussed in the following sub-section, answering the fourth sub-research question of the thesis.

5.3.2.2 S-RQ4: What innovative programmes should be implemented to improve the downstream delivery of medicines?

In Chapter Two of this thesis, the concept of competitive advantage was extensively discussed, in terms of its importance and of how it can be achieved. Porter (1980) established this notion, attempting to explain that firms have to consider both their capacity and the market demand in order to differentiate themselves from the competition. Hill and Hill (2012), and Yoo *et al.* (2006) stated that organisations gain an advantage over their competitors through providing greater value to customers. Barney (2001) reiterated this by stating that competitive advantages can be obtained through establishing strategies that exploit organisations' internal strengths and on the other hand, facing the challenges created from the external threats, avoiding internal weaknesses.

In addition, the Literature Review Chapter emphasised the role of innovation in organisations' effectiveness and how the introduction of this element could possibly develop and sustain a competitive advantage (e.g. Wu & Chiu, 2015; Ferlie *et al.*, 2016). Kostopoulos *et al*. (2002) explained that organisational resources and capabilities impact organisations' capacity to innovate. Orchestrating those resources and capabilities increases the success rate of innovation (Anderson & Eshima, 2013; Drucker, 2014) and creates an advantage over organisations' competitors (Martín-Peña & Díaz-Garrido, 2008).

However, according to Cockburn *et al.* (2000) and Barney (2015), gaining a competitive advantage has been characterised as a complex process because it requires organisations to manage their resources in such a way to pursue actions that could enhance their overall performance. It has therefore been, apparent that issues and factors preventing an effective and efficient system need to be prioritised and managed under the umbrella of Operations Strategy (OS) in order for the strategic aims and objectives to be achieved, as Bamford and Forrester (2010) reported.

The findings of the current research demonstrated that although healthcare organisations, in the two European contexts, are operating under a different structure, they agreed that financial, communication, waste and complexity issues are responsible for the weak delivery process performances of medicines. In addition, the factors that are related to the implementation of innovation within the PSC were identified. The research findings, therefore, framed the Greek and UK healthcare organisations' environment in order for the innovative programmes fitting within these contexts to be identified, which would enable improvement of the medicines delivery process to be undertaken. Bamford *et al.* (2015a) suggested that the adoption of innovative tools and techniques is dependent on organisations' characteristics such as: type of waste which has to be addressed; needs and demands of patients and employees; and functional rules due to the different legal context.

At this stage, it is important to re-establish the definition of innovation, which relies on the purpose of this research. Innovation is perceived as the introduction of new or improved products and services within a production system aiming to improve the organisations' performance (Omachonu & Einspruch, 2010). This is in line with the research's aim, which attempts to

demonstrate that innovative interventions being successfully implemented in other sectors can support healthcare organisations in being more productive, hence minimising the perceived waste. This thesis suggests the implementation of theoretical innovation (Lewis *et al.,* 2010), such as Lean thinking and reverse logistics, and technical innovation (Lai *et al.,* 2008), such as integrated IT systems, in order for a more effective and efficient PSC to be applied.

As was introduced in Chapter Two, there are two diverse categories of innovation: i) radical innovation, which refers to the adoption of new practices that are different from the existing ones (Dewar & Dutton, 1986); and ii) moderate innovation, which is related to the introduction of those practises that are new to the organisation but have been applied to different contexts (Tidd *et al.,* 2005). Yamamoto and Bellgran (2013) suggested to organisations the use of their model, related to the different types of innovation, in order to facilitate their decision-making process of strategic directions. Figure 5.4 illustrates this model.

Based on the analysis of the data, the most suitable innovation to be implemented within the PSC is represented by the Type II innovation, as this appears in the following matrix. This type of innovation refers to an infrastructural change, which can be achieved through applying moderate innovation. In particular, the change would affect the infrastructural areas, such as: organisational structure and culture, delivery processes and material flows (Hayes & Wheelwright, 1984; Weber, 2016). As a result, this change attempts to improve the intangible assets of the organisation, such as: leadership, knowledge and alignment of people in the organisation (Teece, 1980; Arrighetti *et al.,* 2014). According to Yamamoto and Bellgran (2013), and Alange *et al.,* (1998), such initiatives require constant investments, but their cost and benefits are difficult to evaluate traditionally. However, as Rowley *et al.* (2011) highlighted, an obvious overlap exists between the different types of innovation as an innovative intervention in the infrastructural area of the organisation might impact upon the structural area, such as design and production capacity.

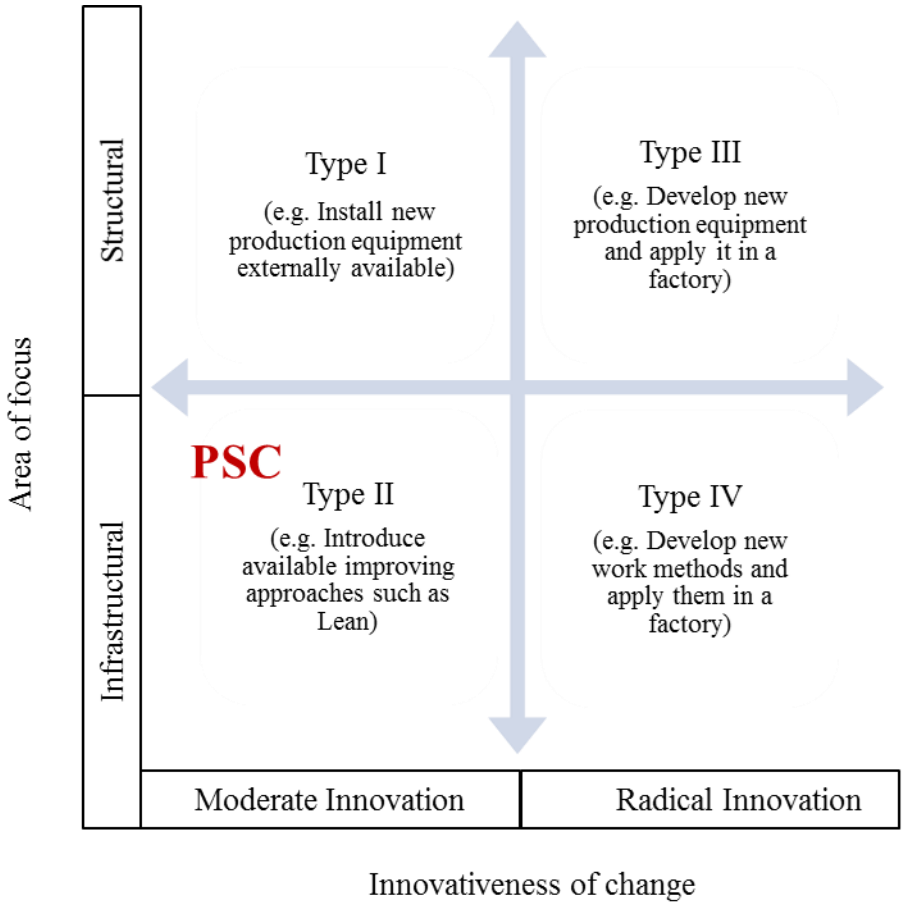


Figure 5.4: The four types of manufacturing innovation model (adapted from Yamamoto & Bellgran, 2013)

Waters (2009) explained that a series of small adjustments are more likely to be adopted by healthcare organisations as healthcare personnel may not be familiar with major changes. Burnes and Jackson (2011) reiterated this suggesting that radical changes can be very disruptive and they might be perceived as threast. Alternatively, as Waters (2009) stated incremental changes are accepted, absorbed and, if necessary, reversed more easily. Through this approach, small improvements can be achieved, leading to 'continuous improvement' (Hall, 2013). The norm of continuous improvement is supported by innovative initiatives, such as Lean and Reverse Logistics (RL). The following sub-sections further analyse the type of innovation suggested and how this could be implemented through the adoption of Lean and RL approaches. Each of these innovative programmes is discussed on an individual basis and their recommendations are justified.

Reverse Logistics (RL)

As demonstrated in Chapter Four, one of the core issues related to the PSC is associated with the complexity of the delivery process. This complexity is mainly derived from the particular characteristics of the products managed within this supply chain. Cherrett *et al.* (2012) explained that pharmaceuticals are considered as highly expensive and sensitive products; their inappropriate use can convert them into dangerous or useless products due to their short expiration dates. The existence of expired and unwanted medication increases the potential threat to human health and the ecological environment, as suggested by Papalexi *et al.* (2014) and Wang *et al.* (2015). In addition, those products are perceived as waste, which means that they need to be disposed of. This action increases the cost within the PSC; it was estimated that worldwide $14.5 billion was spent in on medical waste management practices in 2012 (Transparency Market Research, 2014). It has therefore been apparent that there is a need for innovative initiatives to be implemented in order to minimise the pharmaceutical waste, and this is a process of considerable significance for healthcare organisations and wider society.

Xie and Breen (2014), and Papalexi *et al.* (2014) highlighted the importance of managing both the forward and reverse components of the delivery process in order to reduce the waste associated with pharmaceuticals and prevent their negative effect on society. However, the literature indicates that the management of those products could be very challenging due to their variety and variation (McKone-Sweet *et al.*, 2005). In particular, Tran *et al.* (2014) stated that these products are produced in diverse forms and as a result their cost and expiration dates vary. In addition, Mustaffa & Potter, (2009) reported that the main root of the medicine delivery process's inefficiency is related to the existing difficulties in predicting the exact demand. They explained this further stating that those difficulties are derived from the lack of standard nomenclature and the fact that those products are stored in several areas within healthcare organisations. Pharmacies, therefore, need to develop and improve not only the forward but also the reverse components of the logistics process in order to synchronise the products' characteristics with the organisation's environment and as a result satisfy their customers' needs (Cardoso *et al.*, 2013; Fawcett *et al.*, 2014).

The aim of Reverse Supply Chain Management (RSCM) is to effectively manage the activities required in order to retrieve useless products from the market and subsequently to dispose of them or recover their value (Prahinki & Kocabasoglu, 2006; Defee *et al.,* 2009). In particular, RSCM supports organisational sustainability focusing on three primary components: economic, social, and environmental components (Robins, 2006). Those factors are in line with main issues associated with the PSC and identified throughout the data analysis. By implementing RSCM within the PSC, a minimisation of product waste and the associated cost could be achieved, which leads to a reduction in storage space (Papalexi *et al.,* 2014). Blumberg (1999) highlighted that the quality of the provided products and services could also be enhanced through those initiatives. As a result, healthcare organisations would be able to meet the request of reducing the healthcare spending on pharmaceuticals and increasing the quality of healthcare services by applying return policies. In addition, as reported by the Department of Health (2008a), the returns service for medication could prevent the negative impact of the expired medication on human health and the environment, which would benefit wider society.

The data collected from this action could actively inform the supply and replenishment of medicines; Bamford (2010) pointed out that the ability to predict provides an ability to control. Breen and Xie (2009) highlighted that these data could also be used to inform and assess the efficiency of the prescribing and dispensing process. Therefore, one output of this data analysis could be the effective prediction of the market demand and the associated cost. However, Kumar *et al.* (2009) found that return actions associated with pharmaceuticals are often handled through third-party providers, which explains the limited availability of relevant information.

The success rate of this initiative requires effective communication and, knowledge and information sharing between the PSC stakeholders. Breen (2006) reported that enhancing communication can positively influence the management of returns. A hospital pharmacist, 4/UK, stated that "*we have introduced return policies within our delivery system, but we are facing a couple of issues mainly related to the lack of communication and limited information and knowledge sharing between the pharmacy and clinical staff […]; for example, on one hand clinical staff need to inform us about patients' condition (e.g. prescription changes) and on the other hand we have to let them know the cost of medicines in order to use them in an appropriate manner*". Similarly, a community pharmacist, 17/Gr, explained that "*there have been a number*

of initiatives related to reverse logistics, such as the introduction of the green bins in pharmacies where the expired or unwanted medication can be collected […], but those practices have not been implemented effectively, either because patients are not aware of them or they are not willing to return their medication, or because these initiatives are not supported by the local authorities; at the end, the healthcare parties do not communicate them with the consumers and also they rarely collect the return medicines".

The analysis of the data revealed a number of return actions that have been undertaken, but apparently they need further development. Erol *et al.* (2010) found that the main reason for adopting RSCM within the PSC is mostly due to legislative liabilities. Álvarez-Gil *et al.* (2007) stated that pressures from the external stakeholders, such as the government, affect organisations' decisions to apply return policies. Breen and Xie (2015, p.89) explained that "*in the case of recycling engagement, performance can be influenced by organisational policies and procedures informed by strategy, but also by the personal principles and convictions held by staff*". Therefore, there is a need for integrating the RSCM practices within an overarching operational strategy in order for them to be communicated effectively across the PSC, influencing the staff and customers' culture. This could be achieved by providing the required knowledge and information related to those practices, highlighting their importance. Chen *et al.* (2012) stated that knowledge and education raise the recycling consciousness.

According to Cheng *et al.* (2015) and Govindan *et al.* (2015), the adoption of Lean approaches can overcome the issues of lack of communication and limited knowledge and information sharing within organisations. Based on the data analysis, these are key issues that prevent a robust and accurate forward and reverse PSC. Brandão de Souza (2009) and Martínez-Jurado and Moyano-Fuentes (2014), among others, defined Lean as an improvement philosophy aiming to reduce the perceived waste existing in a system, while improving the quality of products and services. There are a number of Lean tools and techniques that can be chosen and adopted to fit with the organisations' needs and environment, such as Value Stream Mapping (VSM), Just-In-Time (JIT), Kanban, Benchmarking and PDSA cycles (Baczewski, 2005; Bamford & Greatbanks, 2005). The following sub-section discusses further the concept of Lean philosophy, highlighting the benefits for healthcare organisations derived from its adoption.

Lean Thinking

From the data analysis, it can be concluded that there are a number of perceived issues related to the PSC that prevent an effective and efficient delivery process. In addition to this, a number of factors that influence the pharmacies' decision to innovate were suggested. The need was apparent, therefore, for undertaking changes that would lead to improvements, overcoming the identified issues, was apparent. Chassin (2013) and Page (2014) suggested that improvements can be achieved by adopting and implementing innovation. However, Williams and Dickinson (2008), and Bamford *et al.* (2015a) argued that the innovative approaches have to fit with the organisational environment and be selected according to the organisational needs and the areas that require improvement.

As demonstrated from the data analysis, pharmacists operating in both European contexts are rather sceptical of undertaking those initiatives and applying innovation. As mentioned previously, the reasons of this scepticism are associated with a number of sector-related factors. Grol and Wensing (2004) suggested that the organisational culture and structure often generate difficulties in undertaking any improvements. Bamford (2011) commented on this stating that the healthcare organisations are considered to be relatively centralised, which explains the lack of experience in implementing innovation when compared with other sectors. Young *et al.* (2016) reported that actors of the healthcare supply chain perform independently, which hinders the supply chain's operation as a system, having common objectives. Furthermore, de Vries (2011) highlighted the complexity of the pharmaceuticals delivery system, which is generated mainly due to the involvement of myriad stakeholders throughout the delivery process. As Waters (2009) and Greenhalgh *et al.* (2012) indicated, highly complex delivery systems do not support innovation, which might determine the best Supply Chain structure. The perceived complexity is increased due to the weak communication and limited knowledge and information sharing throughout the PSC (Williams & Dickinson, 2008), which increases the fragmentation and duplication in services (Radnor & Boaden, 2008). Interestingly, Williams (2011) suggested that high-cost institutions, such as healthcare organisations, are facing difficulties in adopting best practices. In attempting to explain this element, Davenport (2013) highlighted the potential economic risk involved in applying innovation, which was reported, especially by the Greek sample due to the economic crisis that this country is currently experiencing (Lionis *et al.*, 2009).

The current thesis suggests the adoption of Lean philosophy within the PSC to overcome the underlying issues. According to Brown *et al*. (2013) and Hall (2013), Lean supports continuous improvements, which can be achieved through conducting small and constant changes. Its application does not require huge investments, as it focuses on managing the available tangible and intangible resources to improve the overall organisational performance (Brandão de Souza, 2009; Karim & Arif-Uz-Zaman, 2013). However, Morrow *et al.* (2014) pointed out the significance of leadership in Lean implementation. They found that a successful adoption of Lean approaches requires the support of leadership at multiple levels, which needs to be accompanied by developed Lean skills and knowledge. This was re-enforced by Drotz and Poksinska (2014), who emphasised the effects of Lean philosophy on the role and responsibilities of healthcare personnel. They concluded that the adoption of Lean techniques, such as improvement in team rotation, standardisation and flow orientation, facilitated the management of daily tasks and the realisation of the benefits that could be obtained through such initiatives. However, as Ulhassan *et al.* (2014) suggested, the likelihood of a Lean intervention being successful can be increased where the norm of teamwork is well-established.

Interestingly, Timmons *et al.* (2014), who examined aspect of Lean within a healthcare environment, found that under a Lean umbrella, the level of engagement and enthusiasm by the professionals was significantly high, which indicates the acceptability of such interventions. In addition, Hayes *et al.* (2014) suggested that patients' satisfaction and trust regarding the occupational expertise can be increased within a Lean environment. Overall, by implementing Lean, the benefits stemming from its philosophical principles, as defined by Womack and Jones, (1997) and Hines and Rich (1997), include: i) minimising the non-added value activities; ii) eliminating waste by supporting a pull delivery system; iii) being customer-patient orientated; and iv) creating and developing a continuous improvement roadmap.

To provide a more parsimonious analysis, the following table, Table 5.3, presents the amound of operational process waste occurring within pharmacies, which was concluded from the medicine delivery process map and the data analysis. The classification of the PSC operational process waste is based on the list of the types of waste created by Taiichi Ohno in the Toyota Production System (Ohno, 1988).

Duplication	• Lack of communication, and knowledge and information sharing • Low level of transparency during the delivery process • Lack of team-working spirit • Duplication during the prescribing and dispensing processes • Re-labelling and discharging returned medication • Separation of the medicines that can be reused from those that have to be destroyed
Waiting	• Providing the required information • Receiving medication
Defect/Error	• Unclear prescription • Unlabelled medicines • Inappropriate packaging of medication
Inappropriate processing	• Lack of communication, and knowledge and information sharing • Low level of transparency during the delivery process • Lack of team-working spirit • Wards do not manage their stock properly • Discharged medication has been issued to the wards when patients have already left - approximately £36,000 per annum of stock is re-used • Complying with the national guidance and regulations
Unnecessary inventory	• Different storage policies • Safety stock • Complying with the national guidance and regulations • Staff and patients culture, following a 'just in case' not 'just in time' approach • Periodic lack of adequate storage capacity
Unnecessary transportation	• Unnecessary delivery of medicines
Unnecessary motion	• Lack of communication, and knowledge and information sharing • Clinical staff or patients ask for required medication

Table 5.3: Operational process waste identified within the PSC (adapted from Papalexi et al., 2014)

In particular, these types of waste include: duplication in service, which is caused mainly due to the lack of a team-working environment; waiting to receive the required information and products; waste generated due to a number of defects; inappropriate processing, which is generated mainly due to the lack of transparency in the system; unnecessary inventory caused by applying push logistic systems; unnecessary transportation and motion, which exist mainly due

to the weak communication system. Table 5.3 analyses these categories of waste in details. Unfortunately, evidence regarding the financial aspects of these elements was not available either because some of this information did not exist or it was not publishable. Healthcare organisations could use this classification as guidance to identify the waste occurring within their systems, recognising the problem causes that generated them; as a result this action would enable them to undertake the required improvement, achieving delivery process perfection (Jones *et al.*, 1997).

Having identified the waste associated with the PSC and the root problems that generate them, the next step for solving them is the use of the available Lean tools and techniques, which have been developed to facilitate continuous improvement approaches (Baczewski, 2005; Brandão de Souza, 2009). Benchmarking and Just-In-Time (JIT) approaches are the Lean tools and techniques recommended by the current research as they appear to fit with the pharmacy environment.

Benchmarking

The data analysis revealed a lack of communication, synchronisation and knowledge, and information sharing throughout the PSC in both countries. Especially, participants in the total and UK sample recognised that the availability of information related to new or significantly improved products and services, increases the innovation level. These organisational areas, therefore, require a number of improvements to be undertaken in order for a smoother and more robust delivery process to be applied. These improvements could be achieved through the adoption of Benchmarking practices.

Benchmarking is a Lean technique that aims to improve the overall organisation performance and reduce the associated cost (Wong & Wong, 2008; Zhang *et al.*, 2012). Marwa and Zairi (2008) and Adebanjo *et al.* (2010), among others, defined it as the search for and adaptation of best practices that lead to performance improvement. Those best practices are used as guidance for enhancing the organisational learning and understanding (Adebanjo *et al.*, 2010) and creating the conditions under which innovative initiatives and changes towards continuous improvement

would be successfully implemented (Marwa & Zairi, 2008). According to Forker and Mendez (2001), Benchmarking requires the collection of those data related to organisational issues, such as high cost and low quality of the delivery process, and subsequently the analysis of those data, which would lead to improvements and changes being undertaken during this process, gaining and sustaining a competitive advantage. This is in line with the aim of the thesis, which refers to the holistic understanding of the current medicines delivery systems through collecting and analysing the relevant data, and recommend changes based on best practices to overcome the systems imperfections.

Fowler and Campbell (2001) suggested that healthcare organisations could improve their performance through adapting best practices applied in the same or different sectors. A series of evidence-based practice guidelines have been announced from national and international institutes for health in both European countries under study here (WHO, 2004), providing new ideas and experiences of best improvement tools and techniques that can be implemented (Perez-Araos *et al.,* 2006). These evidence-based practice guidelines aim to direct healthcare organisations toward undertaking small changes, leading to continuous improvement. For example, the UK Department of Health (2012) has developed guidelines on best practice waste management, which are directly related to the return policies analysed in the previous sub-section. In a similar vein, the National Organisation for Medicines (2016) in Greece offers useful information related to the best use of medicines in order to guide healthcare organisations toward a more rational use of pharmaceuticals considering their social and economic dimensions.

However, healthcare organisations often struggle to follow those guidelines either because the information required for undertaking those initiatives is not available (Adebanjo *et al.,* 2010), or due to the existence of structural and cultural barriers within the organisations (Levenson *et al.,* 2008; Burnes & Jackson, 2011) that appear to prevent the introduction of those improvements. For example, as discussed in one of the previous sections in this chapter, the perceived fragmentation in delivery practices caused by the lack of communication and synchronisation within the PSC is a reason healthcare organisations may face problems in adopting innovation, as Liddell *et al.* (2008) and Williams (2011) suggested. In addition, Böhme *et al.* (2013) reported that characteristics of the healthcare sector, such as organisational politics, personal agendas, unavailability of data and lack of standard operational procedures, posed a number of challenges

during their research. Particularly, they explored the use of the Quick Scan Audit Methodology (QSAM), which is a tool for planning and evaluating Business Process Improvement (BPI) programmes, to benchmark the pharmaceutical value streams. They based their study on primary data due to barriers existing within this sector. Koskela and Ballard (2012), and Brown *et al*. (2013) highlighted the importance of the development of an Operations Strategy (OS) that supports those innovative initiatives in order for healthcare organisations to be able to orchestrate the operations' capabilities, achieving an effective and efficient delivery process.

The application of Benchmarking can be beneficial for healthcare organisations aiming to improve their performance, because it provides the necessary information on how best innovative approaches can be implemented (Perez-Araos *et al.,* 2006). By adopting this technique, knowledge and information sharing within the PSC will be enhanced, allowing a comprehensive and effective communication between the actors involved in the delivery process. However, as detailed above, exchanging knowledge and information throughout the PSC can be a very challenging process due to the low level of transparency during the delivery process. Healthcare professionals tend to operate independently, without fully understanding each other's role, as Heatley and Kruske (2011) stated. Bamford and Griffin (2008), and Akhtar *et al.* (2012) argued that the development of team-working is essential for healthcare organisations willing to adopt and implement best practices to overcome the root-causes of the system's inefficiency. Team-working helps healthcare professionals to understand the organisational vision, identify the issues associated with the delivery process and undertake innovative initiatives aiming to improve this process (Castka *et al.,* 2003).

If healthcare professionals decide to work collectively, significant improvement could be achieved by implementing innovative programmes that have been successfully applied within the same or diverse sectors. The analysis of the data indicated one main difference between the pharmaceutical delivery process applied in the UK and that in Greece, which is related to the healthcare structure. On one hand, the UK healthcare system focuses on primary healthcare provision, attempting to prevent disease, promote health and home care services (Lionis et al., 2009), and also to manage and control healthcare spending more effectively (Kringos *et al.,* 2013). On the other hand, the Greek healthcare care system concentrates more on curative services (Souliotis & Lionis, 2005) without having introduced the GP practices. Research

conducted by Kringos *et al.* (2013), on a European basis, concluded that countries that have developed a strong primary care structure are able to provide better healthcare services and more successfully control healthcare spending.

The Greek healthcare system could evaluate the UK healthcare system and adopt those practices that fit with the organisations' environmental conditions. Greece can further develop primary healthcare provision, providing GP practices; family physicians are the gatekeepers to more specialised care (Gress *et al.*, 2006). By providing well-established primary care, the population's health will be enhanced, achieving lower socioeconomic inequality, and patient satisfaction will be increased (e.g Macinko *et al.*, 2003) as they will not be confused searching for the best treatment. In addition, the waste associated with pharmaceuticals will be minimised as the healthcare providers will follow the same treatment practice (e.g. Ansari *et al.*, 2003).

At this stage, the introduction of Nurse Practitioners' (NP) practices (e.g. Gielen *et al.*, 2014) within the Greek primary healthcare provision is not recommended because this requires great investments in order to educate the clinical staff to be able to provide high quality services, as Rosano *et al.* (2011) suggested. Considering the critical situation that Greece is currently undergoing due to the economic crisis, the Greek government is looking for cost savings rather than opportunities for investments, as Ifanti *et al.* (2013) detailed. Besides, Lionis *et al.* (2009) reported that the capacity of the Greek healthcare system prevents the introduction of NP practices. Statistics disclosed by OECD Health Statistics (2014b) support this statement; the Greek healthcare system includes a significantly lower number of nurses when compared with other OECD members. As a result, apart from the cost related to education purposes, the introduction of NP practices in the Greek primary healthcare setting might require additional investment for recruitment purposes.

Focusing on community pharmacies, as demonstrated form the data analysis, Greek pharmacies receive the required products five or six times per day, which enables them to store fewer items, use less space and put less effort into managing and controlling the products. They have achieved this by having created local warehouses that supply the associate pharmacy members with the required pharmaceutical products (www.sofla.gr). On the other hand, UK pharmacies operate quite independently, having their own warehouses. They receive their orders twice a day, which

means that they need to store more items and spend more time controlling them. UK pharmacies can adopt the described Greek delivery system by cooperating and creating similar local warehouses. This will enable them to improve their performance and flexibility, and respond to their customers' demand more quickly, enhancing their satisfaction. These are the benefits that Hakansson *et al.*'s (2009) study highlighted, attempting to investigate the relationship between suppliers and customers.

Besides the best practices that the Greek healthcare system can adopt by exploring the UK healthcare system and vice versa, both can identify and implement innovative programmes applied in manufacturing which meet their needs and provide adequate solutions to medicine delivery process inefficiency. Based on the data analysis, a JIT system seems to be the most suitable Lean technique to implement in order to improve the pharmaceutical delivery process in both European contexts under study here.

Inventory Management Approaches

From an operations point of view, the inefficiency of the pharmaceutical delivery process, in both geographical areas, can be explained based on the use of simplistic push logistics (e.g. Jamali *et al.,* 2010), which are revealed by analysis of the collected data. Mehrsai *et al.* (2013) explained that a push-based supply chain is informed through a forecasting process, which provides information related to the quantity and type of medicines that need to be stored in order to meet the market demand. However, as Bhakoo *et al.* (2012) reported, healthcare organisations face difficulties in predicting the exact demand for medicines due to the perceived high demand uncertainty observed within the PSC. The demand uncertainty stems from the variations in demand (Harrison *et al.,* 2003), the institutional and regulatory pressures (Shah, 2004), and the lack of standard nomenclature and control of stored items (Mustaffa & Potter, 2009). For all of these reasons, pharmacies tend to retain a large inventory of stock to minimise the likelihood of medicine shortages and the inability of the system to respond to the market demand, as Spear (2005) and Danas *et al.* (2006) suggested. Harrison *et al.* (2003) and Kostagiolas *et al.* (2008) argued that keeping a large inventory of stock causes considerable operational problems, such as difficulties in controlling the items and the associated cost, a high level of wastage, delays in the

delivery process, bottlenecks and product obsolescence. Therefore, the need for the introduction of logistics strategy models that support a pull-based supply chain within the PSC is of paramount importance.

Whitson (1997) and Junior and Filho (2010) suggested the use of JIT, which is a Lean technique that supports the implementation of a pulling system, aiming to develop a robust and accurate PSC through successfully managing the inventory levels and the delivery of components. Gong *et al.* (2014) also supported this technique, highlighting its focus, which is to control the proper quantity and time of the delivery of required products and services. In particular, as Kniberg, (2009), explained JIT seeks to create stability and predictability in inventories. However, Liddell *et al.*, (2008) and Rosseti *et al.*, (2011) among others, argued that this Lean technique is not easily adaptable to the PSC. The apparent reason for this argument is "*the creation of a web of contingencies, interdependencies, and uncertainties due to the number of consumption points and, the role and number of intermediaries*" (Papalexi *et al.*, 2015, p.5). PSC restrictions, such as non-standardised operations, the great variety of items and unpredicted demand might prevent JIT approaches, as Sjoberg *et al.* (2012) and Lin *et al.* (2013) pointed out. Pharmacies need to overcome these issues in order to be able to successfully adopt such innovative initiatives, aiming to improve the healthcare services and subsequently sustain a competitive advantage (e.g. Stavrulaki & Davis, 2010).

Naufal *et al.* (2012), Fayezi *et al.* (2012) and Bamford *et al.* (2015a) explained that JIT approaches do not require specialised equipment, but organisations have to reassess and implement them in a way that fits with the particular political, social and cultural context. In order for a successful JIT application to be achieved, the agreement and cooperation of the stakeholders involved with the PSC are necessary; the development of this level of agreement is quite challenging, but the potential exists, as Sanchez-Rodrigues *et al.* (2010) and Sjoberg *et al.* (2012) suggested. Ryals *et al.* (2010) supported this statement, saying that the wider PSC should be linked with the implementation of such innovative initiatives to increase the so-called 'arc of integration', avoiding sub-optimisation.

In addition, Papalexi *et al.* (2015) highlighted the importance of the availability of data required for adopting JIT practices, such as accurate stock figures and the determination of

pharmaceuticals. They explained it further by saying that those data are useful if an effective management and control of medicines is desired. Rivard-Royer *et al.* (2002) and Danas *et al.* (2006) stated that there are a number of tools that facilitate the classification of items into categories based on their demand and cost, such as the Pareto analysis or ABC classification method (Bamford & Forrester, 2010). The medicines characterised by steady demand and low-volume can be distributed using JIT practices and those characterised by casual demand and high-volume can be delivered directly to the point of each patient care unit, as Rivard-Royer *et al.* (2002) and Papalexi *et al.* (2015) suggested. By adopting these approaches, pharmacies will be able to control the stock and the associated cost more effectively, achieve a more reliable product flow and eliminating waste during the delivery process. This will create greater flexibility, as a continuous flow during the delivery process will be achieved with smaller runs and less need to rely on the inventory (Bamford *et al.,* 2015a).

Knowledge and information sharing related to the products managed throughout the PSC is of paramount importance because it sets the foundation for implementing JIT approaches (Ding *et al.,* 2014). Pharmacies need to be able to know their customers' needs and respond to them automatically without the use of documents, such as: orders and invoices. Stakeholders involved with the PSC, which will agree to implement JIT practices, will become more responsible as they will appreciate that their practices affect their partner organisation's operations. As a result, the communication between them will be enhanced, creating a friendlier working environment (e.g. Junior & Filho, 2010; Lin *et al.,* 2013).

Information Technology (IT) Systems

The use of integrated Information Technology (IT) for exchanging information can not only facilitate the communication across the PSC (Danese, 2006), but also improve healthcare services by analysing the healthcare data to identify patterns and trends (Raghupathi & Raghupathi, 2014). The data analysis revealed a partial use of IT systems by pharmacies in both geographical areas; the hospital pharmacies employ them only for internal purposes, while community pharmacies utilise them additionally for checking the availability of the required items in their suppliers' warehouse; but they still need to create and confirm the orders.

The need for compatible and integrated IT systems is apparent in order for the PSC stakeholders to be able to capture, store and manipulate the large volumes of data related to the use of pharmaceutical products (Feldman *et al.*, 2012). This will allow them to receive real-time data, to respond faster to market demand and to deal with any potential problem effectively, as Raghupathi and Raghupathi (2014) suggested. Tsiknakis and Kouroubali (2009) supported this statement, indicating that the use of integrated IT systems provides greater flexibility, accessibility and continuity of patient care, reducing duplications in service. They explained it further, stating that the use of such technology is necessary, especially within complex supply chain forms, such as the PSC, where control of the delivery process can easily be lost. The medicine delivery process will be conducted on a paperless basis, avoiding additional communication between pharmacies and healthcare providers or suppliers, requiring additional information. The healthcare data stored and analysed through IT systems can be used to inform the prescription process, which, based on the data analysis, is one of the main processes that generates waste within the PSC. They can also support the return policies discussed in the previous section of this chapter. In addition, Ashurst *et al.* (2012) and Zhu *et al.* (2012) suggested that the innovative use of IT systems supports organisations' attempts to gain and sustain a competitive advantage.

Summary of the fourth sub-research question (S-RQ4)

The last research question focused on identifying the most suitable innovative programmes for improving pharmacies' performance. The current thesis suggests moderate changes to be undertaken within the infrastructure area of the healthcare organisations, such as organisational structure and culture, delivery processes and material flows (Yamamoto & Bellgran, 2013). In order for these changes to be achieved, the current thesis recommends the implementation of Lean and Reverse Logistics (RL) approaches. The following figure, Figure 5.5, summarises the benefits derived from the application of these approaches within the PSC.

As Figure 5.5 illustrates, a number of improvements can be achieved by adopting the suggested innovative practices. Figure 5.5 also shows that the suggested innovative programmes need to be supported by integrated IT systems that can facilitate the delivery process through enhancing the

communication between the PSC partners, the information and knowledge exchanged and minimising the time to respond to suppliers' and patients' demands. These improvements can be undertaken through orchestrating the organisational resources and capabilities (Drucker, 2014) without significantly disrupting the way that healthcare personnel tend to operate. On the contrary, those innovative initiatives can improve the communication, synchronisation and transparency throughout the PSC; enhance knowledge and information sharing, which will positively affect the prescribing and dispensing processes; minimise the perceived waste and as a result lead to continuous improvements and subsequently to a competitive advantage.

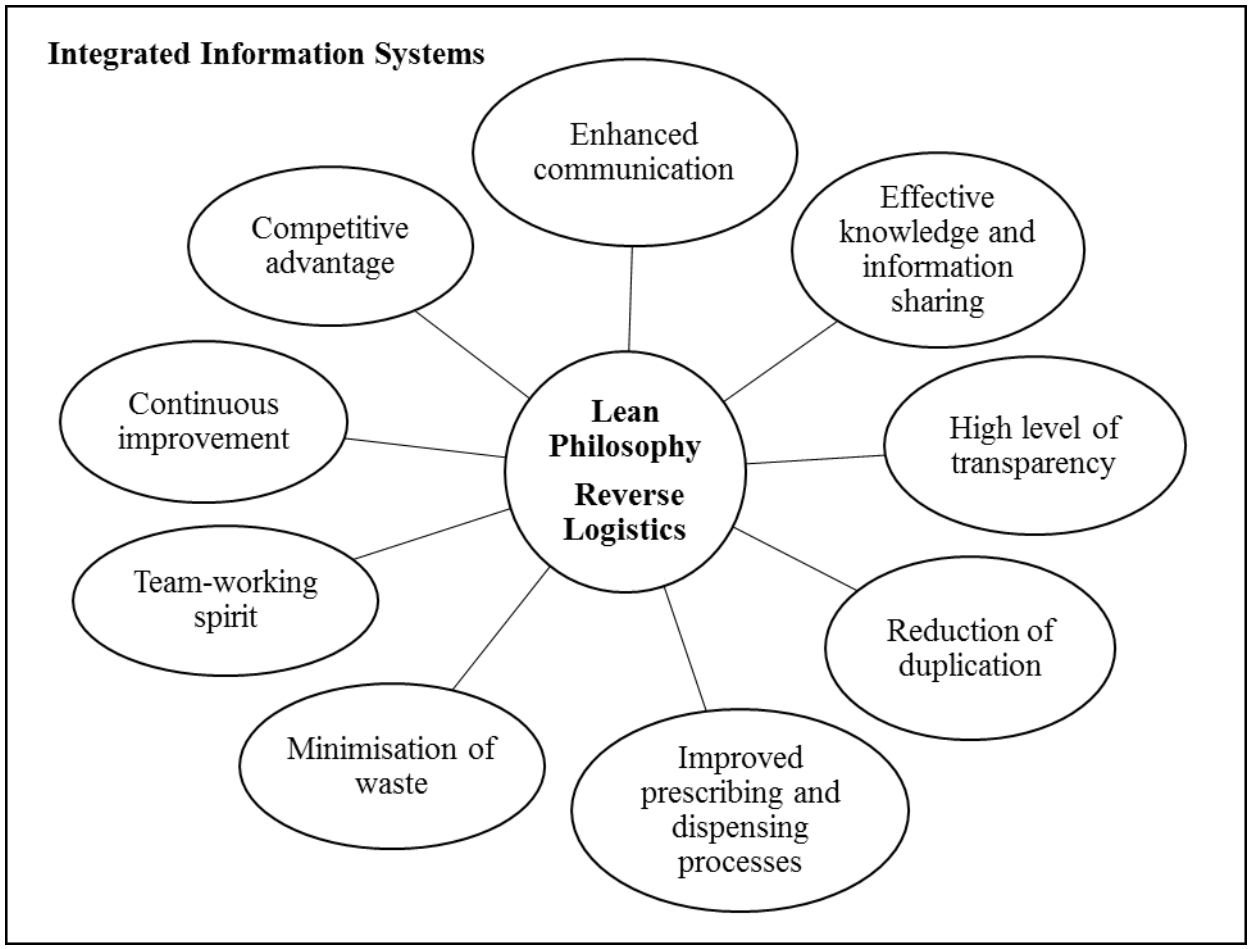


Figure 5.5: The benefits of implementing Lean and RL approaches in the PSC

In particular, the combination of Lean and RL approaches can benefit pharmacies in both European contexts because, on one hand, they seek to deal with the issues identified from the data analysis in Chapter Four, and on the other hand, they do not require great investments. As discussed in the previous sub-section, pharmacies in both countries have the capacity and capabilities required, such as staff and equipment, to adopt and fit these approaches to their own needs. The only challenge that they have to face refers to the integration of the new practices across the PSC. They need to involve these approaches into their organisational strategy and communicate their mission and vision with their supply chain partners. Benchmarking can help them to take this forward, as it provides best practices for implementing innovative programmes, highlighting the associated benefits.

5.3.2.3 The overview of the second research question (RQ2)

The second research question of this thesis concentrated on identifying the factors that support or prevent the implementation of innovative initiatives within the downstream domain of the PSC. The data analysis of the total sample indicated that a faster response to patients' and suppliers' needs, and the development of external and internal collaborations could influence their decision on an innovative use of technology. In addition, access to information and similarly the creation of external and internal collaborations appear to positively affect their decision to introduce new or significantly improved products and services, while the perceived economic risk might prevent this initiative.

These factors, in conjunction with the identified issues, that are responsible for the medicine delivery process ineffectiveness, have been considered during the determination of the innovative programmes that may be suitable for implementation within the downstream domain of the PSC. Based on the outputs of the data analysis, a strategic plan can be formed of how best pharmacies can undertake small changes leading to continuous improvements. Lean and RL approaches, suggested by the current thesis, can help those organisations to manage the perceived uncertainty, creating a less complex and patient-oriented environment. This can be achieved by: i) improving the communication, knowledge and information sharing between the partners of the PSC; ii) managing more effectively the large inventory of stock; iii) implementing

return policies iv) integrating the IT systems of the different parties; and v) supporting team-working.

Apart from the recommended innovative approaches that can be adopted within the complex PSC environment, there are other improvement methods that one could consider as being appropriate. For example, Simchi-Levi *et al.* (2008) and Bhakoo *et al.* (2012), among others, suggested the implementation of the Vendor Managed Inventory (VMI) system, where suppliers are responsible for controlling and monitoring a retailer's inventory. Mustaffa & Potter (2009) indicated that significant improvements could be achieved through VMI application, such as high service quality and waste and cost reduction. However, as Bhakoo *et al.* (2012) explained, the success rate of this intervention lies in the availability of data and the level of trust that exists between the supply chain actors.

From the data analysis, it was apparent that one of the main reasons why pharmacists tend not to undertake any innovative initiative is the fear of losing control. They acknowledge that the products that they manage are quite sensitive and have an extensive impact on society. Giving the management of pharmaceuticals to the suppliers could make them nervous and uncertain of the quality of service that they produce. In addition to this, the level of trust between the PSC appears to be low, as an output of this research is the weak communication and lack of transparency throughout the PSC. Based on the discussion above, at this stage, VMI systems are not recommended; they could however be useful when the identified issues are solved.

Another innovative approach that could be implemented within the PSC environment is the Radio Frequency Identification (RFID) technology. According to Sarac *et al.* (2010) and Sheng *et al.* (2011), RFID is an automatic data capture technology that promotes communication and real-time information sharing. Ferrer *et al.* (2010) and Lee *et al.* (2011) underlined the benefits that could be derived from this application, such as process improvement, quality service improvement, inventory control improvement and, time and cost reduction. However, as McFarlane *et al.* (2003) explained, the successful adoption of this technology requires particular equipment, such as a tag formed by a chip, a reader and middleware, which can be very costly. Kuo and Cehn (2008) emphasising the identification of potential issues associated with the RFID application, found that not only is vast investment required, but also elements such as privacy,

data security and trust, need to be considered. In addition, Cakici *et al.* (2011) suggested that, during this intervention, operational redesign to fit with the RFID technology would be inevitable. Based on the described issues, therefore, RFID technology is not recommended to the downstream domain of the PSC in the study countries. Similarly to VMI systems, RFID technology could be applied in the future, when the delivery process of medicines might be more standardised and developed.

5.4 Conclusion

In this chapter, the literature presented in Chapter Two and the outputs of the data analysis presented throughout Chapter Four are combined to frame the discussion. In particular, this chapter initially provided a summary depicting the main conceptual models developed in this thesis. Subsequently, the two research questions and their associated sub-research questions were discussed and addressed. Finally, a conceptual framework that bridges the theory and the practice has been developed and presented by Figure 5.6 below.

From an Operations Management perspective, the pharmaceutical delivery process can be represented by an input, transformation and output operation. Figure 5.6 presents the transformation process for improving the pharmaceutical delivery process and subsequently the quality of healthcare services. This figure describes how pharmacies can overcome the issues associated with delivery process inefficiency, presents the areas that can be improved through implementing Lean and RL practices and highlights the benefits that can be achieved. Particularly, if the recommended innovative programmes are implemented throughout the pharmaceutical delivery process, the emphasis will be placed on improving the communication system, exchanging knowledge and relevant information, promoting standardised processes and operating under a team-working umbrella. The outputs of adopting this innovative approach will be the minimisation of any type of perceived waste of the delivery system, a continuous improvement philosophy, a high level of service quality and, as a result, healthcare organisations will be able to compete with and sustain an advantage over their competitors. As Figure 5.6 shows, Lean and RL approaches need to be supported by integrated ISs, which facilitate the communication between the PSC stakeholders, enabling them to exchange real-time data and

respond faster to the market demand. In addition to this, Benchmarking is also a useful tool for healthcare organisations, as they can use it to assess different supply chains and adopt the best practices that fit within their environment. It is believed that the adoption of this framework supports the optimisation of the medicine delivery process in both European contexts.

The following and final chapter of this thesis, Chapter Six, presents and discusses the contribution of this research to the existing literature, drawing together the study's conclusions. In addition, the limitations of the current research are detailed, leading to recommendations related to potential future research.

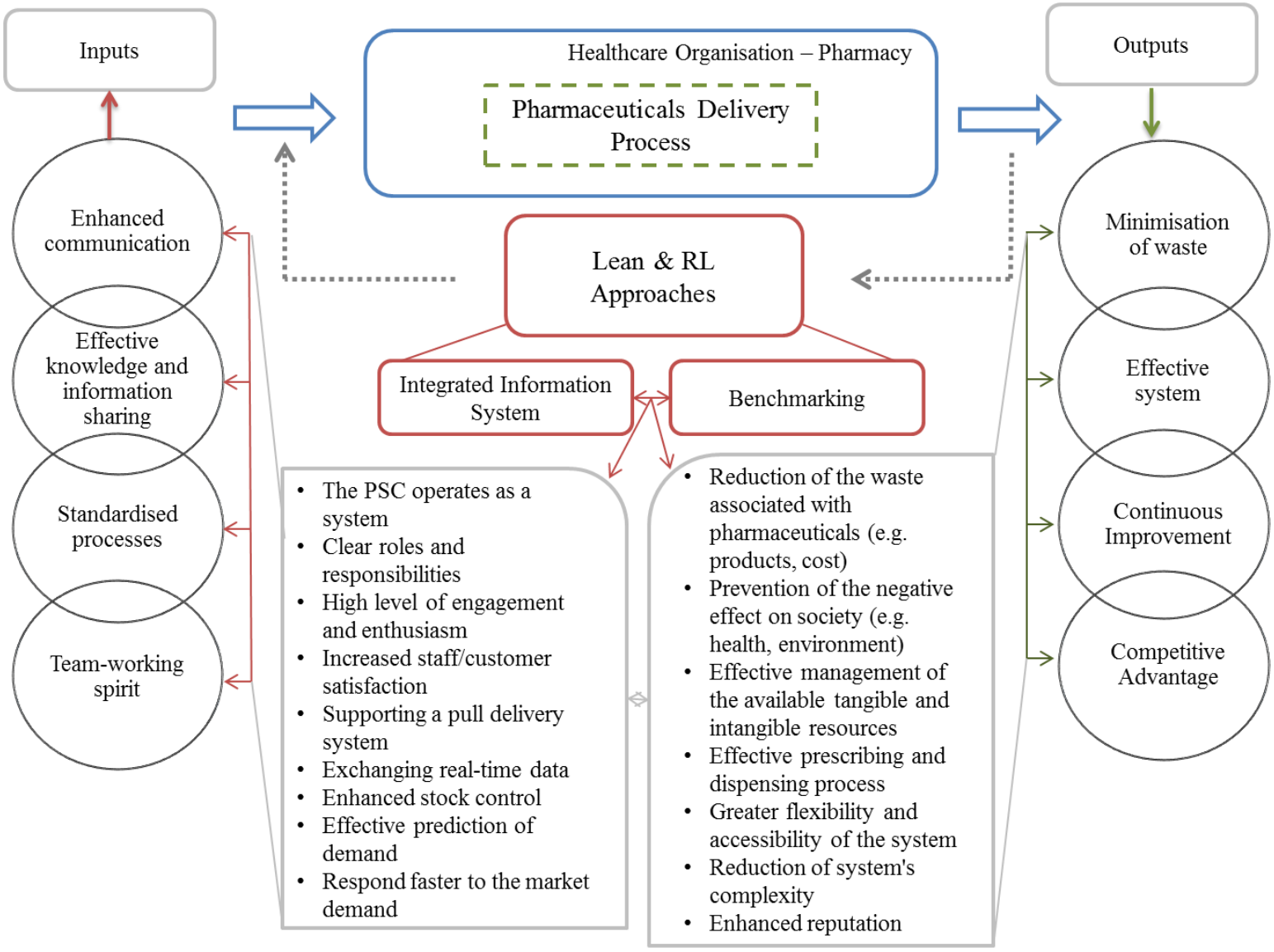


Figure 5.6: The Conceptual Framework of the discussion

6 Chapter Six: Conclusion

6.1 Introduction

This final chapter of the thesis will draw together the conclusions of this research in which the overall picture regarding the reality of the pharmaceutical delivery system applied in the two selected European contexts of the UK and Greece will be summarised. Particularly, the Innovative Pharmaceutical Supply Chain Framework (IPSCF), which directs pharmacies towards continuous improvements, will be presented and discussed. This chapter will also review how the original aims and objectives were approached, and succinctly address the two main overarching research questions. Subsequently, it is built to outline and defend the original contributions to knowledge. In addition, the research recommendations for practice, the limitations associated with this study and the opportunity for potential, further research will be detailed. Finally, the chapter will provide a commentary that reflects upon the overall research journey.

6.2 Reviewing the original research aims and objectives

The uniqueness of this research is that it aims to investigate the medicines delivery processes applied in two specific European countries: the UK and Greece. Specifically, it concentrates on assessing the current delivery practices involved within the downstream domain of the Pharmaceutical Supply Chain (PSC) in the selected contexts. As detailed in the Literature Review chapter, the main challenge that healthcare organisations have to face is related to the intense pressure exerted on them to minimise their drugs spending, but at the same time providing enhanced healthcare services (Al-Balushi *et al.*, 2014; Castano, 2014; Xie & Breen, 2014). Besides this general pressure, the data analysis revealed that although the selected countries have to comply with the same regulations related to the management of such products, influences derived from the country-specific environment, such as financial, structural and cultural influences, affect the system's effectiveness. Healthcare organisations seeking to find solutions to deal with these challenges focus on improving their supply chains through implementing innovative approaches (Smits *et al.,* 2009; Lainez *et al.*, 2012). However, the unique characteristics of the downstream domain of the PSC referring to the sensitive and expensive products managed, which have an extensive impact on society, and the myriad stakeholders involved having their own perspective, generates high levels of complexity that act as a barrier to adopting innovation (Mustaffa & Potter, 2009; Bhakoo *et al.,* 2012). The research's aims, therefore, were to:

i. Identify and appreciate the main issues associated with complex downstream delivery processes that healthcare organisations in both selected countries have been facing.
ii. Develop suitable innovative approaches that could be implemented within such a complex environment to enhance the performance of the medicine downstream delivery systems.

To achieve the described aims, the researcher employed an exploratory mixed-methods approach. This approach, as thoroughly detailed in the Methodology chapter, was conducted under a pragmatic paradigm, including two research phases. The first, main phase was related to the analysis of a set of rich qualitative data collected through 30 interviews with key professionals working within the downstream domain of the PSC in both geographical areas.

Regarding the second, supportive phase, a survey questionnaire was designed and distributed to hospital and community pharmacy professionals; the total survey sample was 130, which consisted of 81 Greek and 49 UK responses.

This twin data collection process supported by an extensive literature review enabled the researcher to reach the saturation level and, meet and discuss the main objectives of this research, which were:

i. The establishment of an inclusive review of the relevant literature on Operations and Supply Chain Management, Innovation and the specific healthcare environment emphasising the downstream domain of the PSC.
ii. The development of a clearer understanding of the current pharmaceutical downstream delivery practices applied in both European contexts.
iii. The identification of the issues preventing the effective delivery of medicines in both European contexts and those that are region-dependent.
iv. The identification of the factors that influence the innovativeness of the downstream domain of the PSC in the UK and Greece.
v. The development of a conceptual model to optimise the pharmaceutical downstream delivery practices.

The synthesis of the main bodies of knowledge related to this research enabled the identification of the research gaps and the theoretical justification of the research questions. Through the analysis of the qualitative data, a better understanding of the current delivery practices employed by hospital and community pharmacies in both selected countries was achieved. In addition, the qualitative analysis enabled the researcher to identify not only the main issues associated with the delivery system's inefficiency in both European contexts, but also in many cases to distinguish them in those that are region-dependent. On the other hand, the quantitative data analysis contributed in identifying the factors that might inspire or prevent the implementation of innovation within this complex system. Based on the research aims and objectives, more emphasis was given to the qualitative analysis as it addressed three of the four sub-research questions, while the quantitative analysis answered only the third sub-research question. Overall, the analysis of the collected data contributed to the development of the Innovative

Pharmaceutical Supply Chain Framework (IPSCF), as is presented in Figure 6.1 that follows, which optimises the downstream domain of the PSC in terms of quality, visibility, speed and cost.

6.3 Addressing the main research questions

The aim of this section is to provide succinctly a brief overview of the overarching research questions, which will enable the main findings and discussions of the study to be recapitulated. This section will be structured using as sub-headings the two main research questions.

6.3.1 RQ 1: What are the issues associated with the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece?

The qualitative data analysis revealed that the current simplistic push logistics used in both European contexts, which are informed by forecast demand (e.g. Jamali *et al.*, 2010; Mehrsai *et al.*, 2013), generate the root-cause problems associated with inefficiencies and infectiveness observed throughout the medicine delivery process. It appears that these practices are not suitable for highly complex delivery systems, such as the PSC, which are characterised by high demand uncertainty caused by daily demand fluctuations (Bhakoo *et al.*, 2012). The complexity of the system is increased due to the involvement of numerous stakeholders in the PSC, which means that medicines are stored in many different areas (Mustaffa & Potter, 2009). Besides, it was demonstrated that the current delivery practices applied did not favour appropriate communication between the actors of the PSC; limited knowledge and information exchange cannot promote a robust and accurate delivery of pharmaceutical products. Pharmacies, therefore, tend to carry safety stocks in order to be able to satisfy the patients' needs and reduce the likelihood of medicine shortage. In addition, international and national guidelines force them to store particular types of medicine, supporting a just-in-case approach. However, these practices generate a number of operational problems, such as delays, product obsolescence, unacceptable service levels and increased cost (Harrison *et al.*, 2003).

Considering that pharmaceuticals are expensive and sensitive (short expiration date) products, and their improper use has an extensive impact on society, developing solutions that could overcome the issues observed within the downstream domain of the PSC is of paramount importance. However, the misalignment between the organisational objectives and the stakeholders' strategies in conjunction with the lack of partnership between them drives towards knowledge and information asymmetry, which hinders the development of improvements that could optimise the delivery process. In addition, the challenge that healthcare organisations are facing to provide high quality of services using the limited financial recourses available (e.g. Lainez *et al.*, 2012; Page, 2014) is inhibiting innovative initiative from being taken, as participants believe that successful interventions need to be supported by particular investments (e.g. Archibugi *et al.*, 2013; Davenport, 2013).

Despite the issues that are associated with the pharmaceutical delivery system's inefficiency being applied in both selected countries, the qualitative data analysis indicated that this weak performance is heightened by a number of region-specific issues. Those specific issues are generated from the structure of the healthcare systems employed in each geographical area. Particularly, the healthcare system in the UK involves multiple prescribers, which on one hand enhances the access to healthcare service (Gielen *et al.*, 2014) and, on the other hand, increases the complexity of the pharmaceutical delivery process (Sandø *et al.*, 2010). Considering that the prescribing practices are influenced by prescribers' perspectives and, the weak communication and limited data exchange between them, it is more likely that different medication is provided to deal with the same health problem. The existence of fragmentation and duplication in services affects the cost spending on pharmaceuticals and generates waste (for example, therapies being stopped or changed).

Regarding the Greek healthcare system, it involves only one type of prescriber: the physicians. However, due to the absence of family physicians acting as gatekeepers to more specialised care, patients have access to any specialist that they believe can cure their health condition. Similar to the UK healthcare system, therefore, aspects of miscommunication and duplication in services appear to exist; hence, directly and negatively impacting drugs spending and the level of wastage (Gress *et al.*, 2006). As a result, one could appreciate that diverse healthcare structures generate similar issues and, thus, emphasis needs to be given to managing and orchestrating resources and

capabilities across the downstream domain of the PSC (e.g. Sirmon *et al.*, 2011; Brandon-Jones *et al.*, 2014).

6.3.2 RQ 2: How can the implementation of innovative programmes within the downstream domain of the Pharmaceutical Supply Chain in the UK and Greece be promoted?

Having identified the issues that are responsible for the weak medicines delivery system, the quantitative data collected provide a direction regarding the factors that could inspire or prevent the implementation of innovative initiatives within the downstream domain of the PSC. Specifically, it was apparent that reducing the time to respond to customer and supplier requests is one of the factors that could encourage hospital and community pharmacies operating in both European contexts to adopt integrated Information Systems (IS). Those systems could facilitate the communication between the PSC stakeholders and provide more accurate and real-time data (Blackstone, 2010; Kimpel, 2013), which is one of the delivery system's weaknesses as detailed in the previous section. In addition, pharmacists, and particularly those operating in the Greek environment, recognise that external and internal collaboration could positively affect their decision to adopt sophisticated IS. Besides, there is an indication suggesting that working as one system promotes the introduction of new or relatively improved products and services. Developing synergies within supply chains supports the establishment of common objectives and increases the likelihood of innovative initiatives become successful, generating mutual benefits (Anderson & Eshima, 2013; Drucker, 2014).

Furthermore, access to relevant information regarding the available products and services that could enhance the delivery process appears to influence pharmacies' decision to innovate, especially those involved within the UK healthcare system. Formal guidelines by which pharmacists could be made aware of the existing best practices that have been successfully implemented within delivery processes could be inspired. However, the economic risk associated with such innovative initiatives might negatively affect their implementation within the pharmacy environment. Considering the limited financial recourses available and the difficulties that pharmacies are facing in order to manage them, one could appreciate the aspects of such a

risk; especially for the Greek pharmacies who have to deal with the economic crisis effects as well.

To overcome the identified issues, taking into account the factors that appear to impact upon the delivery system's innovativeness, Lean and Reverse Logistics (RL) approaches were suggested as being the most suitable innovative programmes for optimising the downstream domain of the PSC in both European contexts. The adoption of these initiatives could help pharmacies to provide greater value to customers through orchestrating their resources and capabilities, which will create an advantage over organisations' competitors (Martín-Peña & Díaz-Garrido, 2008; Wu & Chiu, 2015; Ferlie *et al.,* 2016). Lean and RL are considered as moderate innovations, which attempt to enhance the intangible assets of organisations, including: leadership, knowledge and alignment of people (Teece, 1980; Arrighetti *et al.,* 2014), as presented by Figure 5.4 in the Discussion chapter. Their implementation does not require any specific equipment; however, constant small investments might be needed to familiarise the participants with the particular tools and techniques (Yamamoto & Bellgran, 2013; Papalexi *et al.,* 2015). By adopting those innovative approaches, therefore, healthcare organisations would not only be able to address the challenge of being productive with less resources, but also they might not perceive the change as a threat as it would be achieved through applying a series of small adjustments (e.g. Waters, 2009; Burnes & Jackson, 2011).

Particularly, RL practices could facilitate the management of reverse components of the medicine delivery process, which would lead to a significant reduction in the level of wastage, preventing a negative impact on the society (Xie & Breen, 2014; Papalexi *et al.*, 2014). It is worth noting that medical waste management practices worldwide cost $14.5 billion in 2012 (Transparency Market Research, 2014). However, managing pharmaceuticals and returning them to the system or appropriately disposing of them could be incredibly challenging. The current delivery system applied in conjunction with the identified issues does not support such interventions. In particular, the weak communication and limited knowledge and data exchange between the PSC stakeholders act as barriers for applying RL. It is suggested that the adoption of Lean approaches can overcome those obstacles, as these develop a continuous improvement roadmap, which requires the contribution of all actors of the supply chain (e.g. Brown *et al.*, 2013; Hayes *et al.,* 2014; Ulhassan *et al.,* 2014). Lean can optimise the PSC by minimising the

waste as detailed in Table 5.3 in Chapter Five. The use of the Lean tools and techniques, such as Just-In-Time (JIT) approaches, promote standardised processes and facilitate the collection and sharing of relevant data (e.g. Kniberg, 2009; Gong *et al.*, 2014). For example, data collected from return policies could be used to inform the forward supply chain practices, such as the prescribing and dispensing processes (Breen & Xie, 2009). As the IPSCF shows, Lean and RL approaches need to be supported by Benchmarking to inspire the continuous improvement mechanism, and integrated IT systems to facilitate the knowledge, information and data sharing.

6.4 The Innovative Pharmaceutical Supply Chain Framework (IPSCF)

This exploratory mixed-methods research has generated the Innovative Pharmaceutical Supply Chain Framework (IPSCF) (Figure 6.1), which is the final conceptual model that represents the research recommendations, linking them with the research's contribution to knowledge. Particularly, the IPSCF suggests the adoption, development and implementation of Lean and Reverse Logistics (RL) practices, which are supported by integrated Information Technology (IT) systems, to optimise the medicines delivery process and improve the PSC's effectiveness and efficiency. The IPSCF is tailored to the specific delivery practices undertaken within the downstream domain of the PSC in the two selected European contexts: the UK and Greece. However, it is believed that it can be adapted by the rest of the European countries as it has been apparent that the two study contexts operate similarly. This final framework has been developed by combining the relevant literature with the research findings. As a result, it supports that by adopting the best practices that have been successfully applied in the manufacturing setting, and transferring the knowledge that accompanies them into the PSC context, the delivery system can be enhanced in terms of quality (product and service quality), visibility (knowledge and information sharing), speed (response to customers' and suppliers' needs) and cost (minimisation of cost and waste).

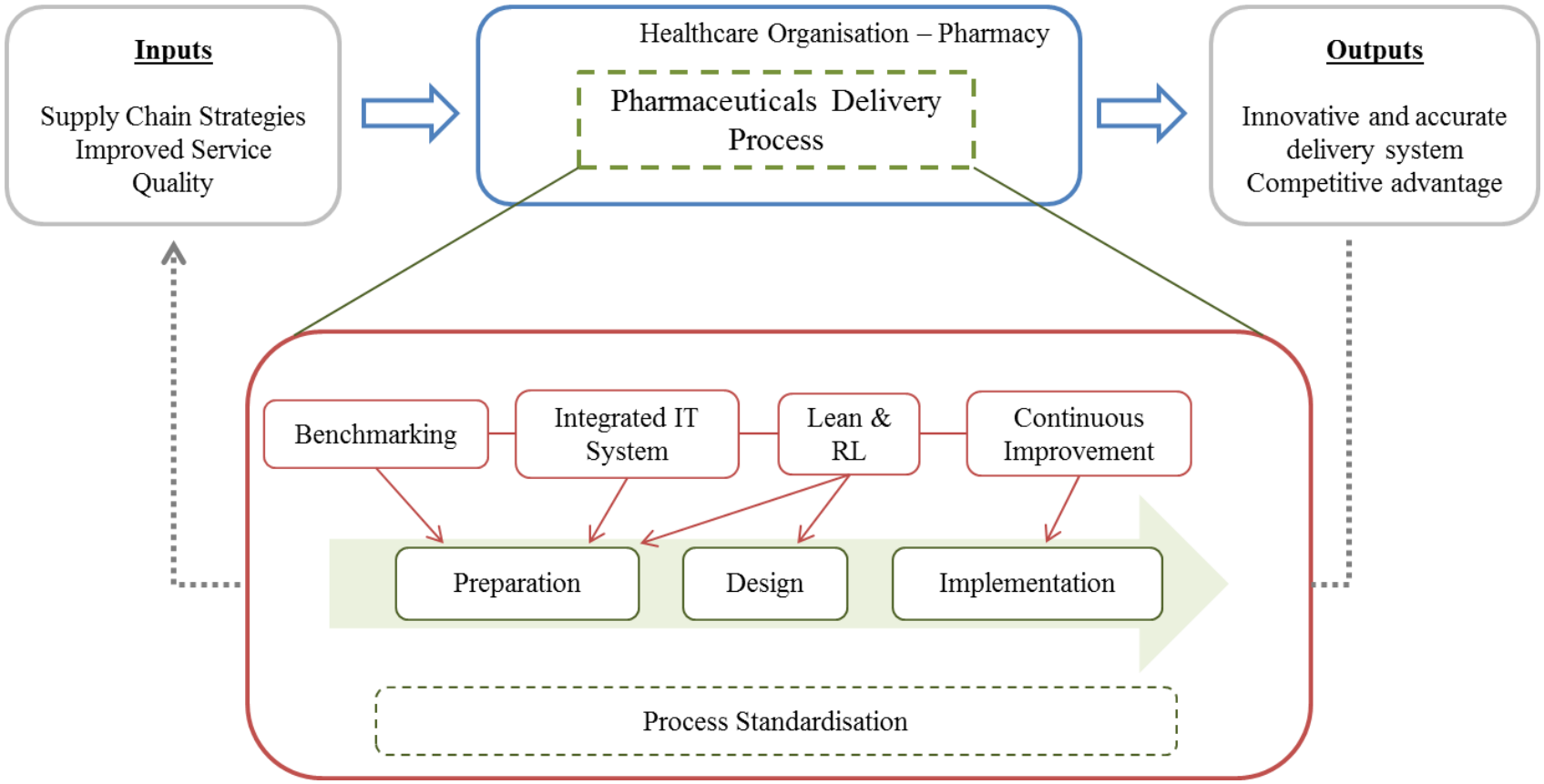


Figure 6.1: The Innovative Pharmaceutical Supply Chain Framework

The IPSCF can act as guidance to pharmacies and healthcare organisations and direct them to develop supply chains strategies according to which a waste reduction and quality service improvement can be achieved. Benchmarking can be used to collect relevant data and inform the system about the best practices. An integrated IT system can be utilised to speed up the delivery process. Lean and RL practices can be implemented to prepare and design an innovative, robust and accurate pharmaceutical delivery system, which leads toward continuous improvements. Although the IPSCF is based on the downstream domain of the PSC, the benefits generated can be greater if the suggested framework is implemented throughout the PSC as a whole.

6.5 The contribution of this research

This section will review and highlight the contribution of this research study to existing knowledge, which will enable the justification of the PhD level of the thesis. The three forms of motivation underpinning the current research, detailed in the Introduction chapter, are connected to the key claimed contributions that this study offers. The main areas, therefore, where the thesis contributes to knowledge are: i) academic literature, ii) practice and iii) methodology. Particularly, it provides more clarity to the pharmaceutical delivery process applied in the European context and the elements of the Pharmaceutical Supply Chain (PSC) that characterise it as one of the most complex systems when compared to those existing in other sectors. Thus, this thesis focuses on filling the gap in the academic literature through proposing innovative developments in the delivery process of medicines. This was achieved by thoroughly investigating the issues associated with the current delivery process inefficiency, examining the downstream domain in two European countries: the UK and Greece. Additionally, this study provides some tentative evidence about the factors that might influence the delivery systems' innovativeness. This investigation enabled the researcher to suggest moderate innovative programmes that could overcome the identified issues and thus, enhance the medicines delivery practices.

Contribution to academic literature

This study fills the gap in literature on the subject of Supply Chain Management (SCM) not only in hospitals, but also in community pharmacies. More specifically, this research extends earlier work conducted by Bhakoo *et al.* (2012) on inventory management in hospitals. Their study's outputs related to contingent factors that affect the PSC performance were considered and applied within the two selected European contexts. In addition to this, the current research identifies additional issues that influence the PSC's effectiveness, such as the limited information exchange and the perceived high level of wastage, which increase the delivery system's complexity. Moreover, the insights provided by this thesis, related to the factors that could influence innovation adoption within the healthcare organisations match Westrick and Mount's (2009) recommendations for further research.

From another perspective, the current study contributes to the academic literature by investigating the downstream domain of the PSC, using hospital and community pharmacies as the focal organisations. Previous research examining the aspect of PSC mainly focused on the upstream domain of the PSC that includes the pharmaceutical manufacturers (e.g. Danese, 2006; Narayana *et al.*, 2014). Furthermore, the focus of this thesis on country comparison answers the call for research suggested by Bravo and Carvalho (2015), who looked at optimisation of supply chains through return policies. Consequently, the combination of improvement approaches, such as Lean, with computerised methods that are considered as the most effective ways to manage the PSC is the response to the call made by Kang Sherman Heng and Loosemore (2013), and Riezebos *et al.* (2009).

Finally, the research attempted to address a critical issue for academics and practitioners, which is related to the challenge of how healthcare organisations could be more productive, whilst using fewer resources (Scheller & Smeltzer, 2006; Mustaffa & Potter, 2009; Xie & Breen, 2012; Al-Balushi *et al.*, 2014). This was achieved by suggesting the implementation of Lean and Reverse Logistics (RL) practices for optimising the downstream domain of the PSC, using the available resources and capabilities, as presented by the conceptual framework (Figure 5.5) in the Discussion chapter. Typically, researchers tend to select one particular improvement approach to deal with similar issues.

Contribution to Practice

The IPSCF offers a new contribution to practice through providing a suggested solution of how best healthcare organisations could adopt innovation to improve the medicine delivery systems without increasing their expenses. This conceptual model visualises the medicine delivery process, when Lean and RL are implemented. It uses the benefits provided from Lean and RL practices, which improve the transportation process, and presents the outputs that the organisations could claim. Although the recommended improvements are based on theoretical evidence, it is believed that they could overcome the identified issues and they would not disrupt the current practices. Besides, those improvements could support healthcare organisations to meet their goal of becoming world class institutes by promoting a team-work environment, enhancing their operational efficiency, setting up processes for continuous improvement and eventually gaining an advantage over their competitors (e.g. Bamford *et al.*, 2015a).

Contribution to Methodology

The adoption of mixed-methods approaches has contributed to demonstrating that qualitative and quantitative data can be mixed under a pragmatic paradigm in order to provide a more parsimonious analysis and, subsequently, effectively address the research aims and objectives. The researcher acknowledges that the research approach borrowed is not original but it has not yet been established. As Davis *et al.* (2010) and Golicic and Davis (2012) explained, mixed-methods research design is relatively rare in published supply chain management-related studies. Specifically, this research provides evidence that the two diverse types of data are compatible within a research, while addressing different research questions. Although the qualitative data were the main source for developing the current research, useful information related to the level of innovativeness could not have been captured through interviews and, thus, quantitative data were collected and analysed as an additional primary source.

6.6 Recommendations

This thesis has recommended that the downstream domain of the PSC in the two selected European countries can be enhanced by adopting innovative approaches, referring to Lean and RL practices. As IPSCF detailed, implementing Lean and RL in hospital and community pharmacies could assist them overcome the identified issues through operating towards a continuous improvement roadmap. Specifically, the recommended improvement programmes suggest a more systematic and formal way of delivering pharmaceutical products, which needs to be supported by effective communication and information sharing between the PSC stakeholders. As a result, healthcare organisations could claim the benefits of i) waste minimisation – by reducing the duplication in service and supporting return policies, and ii) service quality enhancement – by encouraging healthcare providers to operate as a team, creating value to patients. The IPSCF, therefore, could provide guidelines to healthcare organisations in order to achieve an innovative and fit-for-purpose process, leading to shaping and, subsequently, sustaining a competitive edge.

6.7 Research Limitations

This section will discuss the limitations of the current research. One of the major challenges that the researcher faced conducting the current study was related to accessing the required data. Considering that professionals working within the PSC have a relatively heavy work load, a number of the potential participants were reluctant to be involved in this research. In addition to this, as explained throughout this thesis, the study focuses only on the downstream domain of the PSC, which excludes those specialists operating within the upstream and central PSC domain. Moreover, some individuals were also excluded due to their limited knowledge of Operations Management (OM) and Supply Chain Management (SCM) practices. While pharmacists are involved in OM and SCM activities, those practices are part of the everyday routine process, which might explain why pharmacists have not come across the theories that support them. Furthermore, as detailed in the Methodology chapter, a snowball sampling technique was adopted in order to identify and approach the potential respondents. The final sample, therefore, was small in number when compared with studies reflecting the views of the general population.

The author acknowledges that some of her quantitative research findings might not be easily generalisable or transferable, but because of the systematic nature of the work that took place involving among others comparisons with similarly positioned studies from the relevant literature and combination with a robust qualitative analysis, these findings can provide accurate indications of what the right answers might be. Finally, another obstacle faced particularly during the qualitative data collection was related to the geographical distance; the researcher approached only the potential participants that could be reached; thus the choice of UK and Greek pharmacies.

The initial idea behind the study was to adopt a mixed-methods approach where the qualitative and quantitative data analysis would contribute equally to the interpretation. Although regarding the qualitative data the saturation level was reached, the quantitative sample size was considerably small to support a robust analysis. The collection of more quantitative data would have strengthened the comparison between the two selected European contexts and allowed generalisation of the research findings. It was decided, therefore, to use quantitative analysis to answer only one of the four sub-research questions (S-RQ 3) and provide some useful directions that facilitated the development of the recommendations. As a result, the current research can be considered as being mainly qualitative.

Besides, the limited access or availability of delivery process data, such as the time spent in receiving and despatching medication, did not support the collection of quantitative data. In addition to this, the lack of financial data available[1] had an impact on the research's contribution to practice. Considering that the main emphasis of healthcare organisations has been placed on reducing their drug spending, it is believed that the collection of financial data would have added value to the current thesis. The researcher, therefore, assessed the medicine delivery process based on the respondents' viewpoints and experiences. Furthermore, it needs to be mentioned that the extensive literature review helped to overcome, to a certain extent, this limitation.

Finally, the last limitation of this research stemmed from the way the researcher conducted the qualitative analysis. The thematic analysis undertaken was driven by the researcher's theoretical and analytic interest, which might have influenced the interpretation. The researcher acknowledges that ultimate objectivity was difficult to achieve, as this is the case in most

[1] Due to the sensitive nature of financial data, access to it was restricted by the participants

qualitative social research studies. However, she managed to address this limitation through transcribing all interviews and using respondents' direct quotes to support the research findings. The researcher also recognises that the qualitative data could have generated different data patterns that could be used for inspiration for conducting further future research.

6.8 Opportunities for Future Research

The aim of this research was to assess the medicine delivery process and recommend improvements through implementing innovation. Nevertheless, despite the value of the current study to the PSC downstream practices, it will be valuable to focus on and investigate the PSC as a whole to understand the influences generated by other stakeholders' actions, such as the pharmaceutical companies. It is believed that the supply chain strategies of these companies could play a proactive role in perhaps accelerating the adoption of innovation within this complex system. While this research provides insights into the factors that might affect the pharmacies' innovativeness, concentrating on the whole PSC could add more information, based on which a more reliable research could be achieved.

In addition, as explained throughout this thesis, the current study is mainly considered as being qualitative, therefore, a more quantitative strategy is a possible evolution of the study. The researcher is interested in analysing the issues that emerged using structural equation modelling. The use of tools such as the Analytical Hierarchy Process (AHP) will allow the prioritisation of the four main issues identified, based on their relative weight of importance (e.g. Singh *et al.*, 2013). This approach will help healthcare organisations to emphasise those component parts that are responsible for the highly complex delivery system and, thus, it will facilitate the decision-making process on synthesising a solution. The theoretical perspective of this study generates also another avenue of future research, which would be to target and examine the performance of PSCs where innovative approaches, such as Lean and RL practices, have been considered and implemented. The organisations involved within those PSCs could act as in-depth case studies, which will allow researchers to bridge the gap between the actual practical use of innovation and the academic world.

Furthermore, although in this research the delivery practices applied within two diverse geographical areas were compared, future research is required on the PSC strategies that are adopted by different European countries and across European boundaries. For example, a comparison between the PSC employed in Europe and that existing in the USA or Australia is suggested to determine the similarities and differences. In addition to this, future studies could improve the generalisability of the research findings if they are conducted in other sectors, such as the food industry. Food products are considered to have similar characteristics to pharmaceuticals, considering their short expiration date and their impact on society.

Finally, researchers in the future could look at the financial aspects of the PSC, collecting evidence-based data. This focus could help healthcare organisations and especially healthcare personnel to appreciate the value of pharmaceuticals and subsequently reduce the perceived level of wastage. To conduct the suggested research the use of another theory set than the Resource Based View (RBV) might be required, such as the Total Cost Economics (TCE) or complexity theory.

6.9 Reflective Commentary

The development of the current thesis allowed the researcher to start establishing her expertise in the field of innovative supply chains. This was achieved through combining her academic interests, including Supply Chain Management (SCM), innovation and the healthcare sector. Although synthesising those three core bodies of literature, identifying the gaps that could be filled and developing a conceptual framework was a relatively challenging process, it enabled her to build a substantial amount of theoretical knowledge. Subsequently, the process of selecting a suitable research approach provided her with the opportunity to explore and learn about research philosophy, the different paradigms and the diverse techniques available for collecting the required data. While gathering and analysing qualitative and quantitative data was a difficult and time-consuming task, it proved to be worthwhile, as the required practical knowledge to support the development of this research was developed.

The particular focus of the research on innovation has inspired the researcher to investigate further the different innovative approaches that could optimise supply chains and in particular

those employed within the healthcare sector. Therefore, the contribution of this thesis to knowledge can strengthen the research in the area of innovation within the delivery process. Finally, the knowledge and experiences gained throughout this journey have set strong foundations upon which the researcher could build her future academic career.

References

Adams, R. (2006) Innovation management measurement: A review. *International Journal of Management Reviews*. 8(1), 21-47

Adebanjo, D. & Mann, R. (2000), Identifying problems in forecasting consumer demand in the fast moving consumer goods sector. *Benchmarking: An International Journal*, 7 (3), 223-230.

Adebanjo, D., Abbas, A. & Mann R. (2010). An investigation of the adoption and implementation of benchmarking. *International Journal of Operations & Production Management*, 30(11), 1140-1169.

Akenroye, T.O. (2012). Factors Influencing Innovation in Healthcare: A conceptual synthesis. *The Innovation Journal: The Public Sector Innovation Journal.* 17(2).

Akhtar, N., Lindenmeyer, A., Cooke, M. & Perkins, G. (2012). Influence of in-hospital cardiac arrest team dynamics on team performance: Mixed method case study. *Resuscitation*, 83, 28-42.

Alange, S., Jacobsson, S. & Jarnehammar, A., (1998). Some aspects of an analytical framework for studying the diffusion of organizational innovations, *Technology analysis & strategic management*, 10, 3-21.

Al-Araidah, O., Momani, A., Khasawneh, M. & Momani, M. (2010) Lead-time reduction utilizing lean tools applied to healthcare: the inpatient pharmacy at a local hospital. *Journal for Healthcare Quality*. 32(1) 59–66.

Al-Balushi, S., Sohal, A.S., Singh, P.J., Al Hajri, A., Al Farsi, Y.M. & Al Abri, R. (2014), Readiness factors for lean implementation in healthcare settings – a literature review, *Journal of Health Organization and Management*, 28(2), 135-153

Alderson, W. (1954). *Factors governing the development of marketing channel*, in Clewett R.M. (editor). Marketing channel for manufactured products, Richard D. Irwin, Homewood, IL.

Allen, M., Bromley, A., Kuyken, W., & Sonnenberg, S. J. (2009). Participants' experiences of mindfulness-based cognitive therapy: It Changed Me in Just about Every Way Possible. *Behavioural & Cognitive Psychotherapy*, 37, 413-430.

Al-Mudimigha, A.S., Zairib,M., Ahmedc, A.M.M. (2004). Extending the concept of supply chain: the effective management of value chains. *International Journal Of Production Economics* 87(3), 309–320.

Álvarez-Gil, M., Berrone, P., Husillos, F., & Lado, N. (2007). Reverse logistics, stakeholders' influence, organizational slack, and managers' posture. *Journal Of Business Research*, 60(5), 463-473. http://dx.doi.org/10.1016/j.jbusres.2006.12.004

Alves, D., Mendes, I., Gonc¸alves, M., Neimeyer, R. A. (2012). Innovative moments in grief therapy: Reconstructing meaning following perinatal death. *Death Studies*, 36, 795-818

Anand, K.S., & Girota, K., (2007). The strategic perils of delayed differentiation. *Management Science* 53 (5), 697–712.

Andel, T. (1997). Reverse logistics: a second chance to profit. *Transportation and Distribution*, 38(7), 61.

Anderson, B., & Eshima, Y. (2013). The influence of firm age and intangible resources on the relationship between entrepreneurial orientation and firm growth among Japanese SMEs. *Journal Of Business Venturing*, 28(3), 413-429.

Anderson, D. (2014). *Design for manufacturability: How to use concurrent engineering to rapidly develop low-cost, high-quality products for lean production*. Portland: Productivity Press.

Andrews, K.R. (1971). *The concept of corporate strategy*. Homewood, IL: Dow Jones Irwin.

Ansari. Z., Barbetti. T., Carson. N.J., Auckland, M.J. & Cicuttini, F. (2003) The Victorian ambulatory care sensitive conditions study: rural and urban perspectives. *Soz Praventivmed*. 48(1), 33-43.

Antony, J., Antony, F.J., Kumar, M. & Cho, R.B. (2007). Six Sigma in service organisations benefits, challenges and difficulties, common myths, empirical observations and success factors. *International Journal of Quality & Reliability Management*, 24(3), 294-311.

Archibugi, D., Filippetti, A. & Frenz, M. (2013). Economic crisis and innovation: Is destruction prevailing over accumulation? *Research Policy*. 42 (2), 303-314

Argyrous, G. (2011). Statistics for social research with a quide to SPSS. UK, London: Sage.

Arrighetti, A., Landini, F., & Lasagni, A. (2014). Intangible assets and firm heterogeneity: Evidence from Italy. *Research Policy*, 43(1), 202-213. http://dx.doi.org/10.1016/j.respol.2013.07.015

Ashurst, C., Freer, A., Ekdahl, J. & Gibbons, C. (2012). Exploring IT-enabled innovation: a new paradigm? *International Journal of Information Management*. 32 (4), 326–336.

Atkinson, R., & Flint, J. (2001). Accessing hidden and hard-to-reach populations: Snowball research strategies. *Social research update*, 33(1), 1-4.

Augsdorfer, P. (1996) Forbidden Fruit. Aldershot: Avebury

Augulo, A., Nachtmann, H. & Waller, M.A. (2004). Supply chain information sharing in a vendor managed inventory partnership. *Journal of Business Logistics*, 25(1), 101-20.

Baczewski, R.A. (2005). Four methods for improving performance: A comparison. *Healthcare Financial Management*, 59(7), 101-103.

Baker, G. (2014). Improving Healthcare Using Lean Processes. *Healthcare quality*, 17(2), 18-19.

Baker, M. J. & Foy, A. (2008) *Business and Management Research: How to complete your research project successfully*. Argyll: Westburn Publications.

Ball, J.C. & Ross, A. (2012). *The effectiveness of methadone maintenance treatment: patients, programs, services, and outcome*. Springer-Verlag New York.

Balnaves, M. & Caputi, P. (2001) *Introduction to Quantitative Research Methods: An Investigative Approach.* London, UK: Sage.

Baltacioglu, T., Ada, E., Kaplan, M.D., Yurt, O. & Kaplan, Y.C. (2007). A new framework for service supply chains. *The Service Industries Journal*, 27(2), 105-24.

Bamford, D. & Forrester, P. (2010). *Essential guide to operations management*. Hoboken, NJ: John Wiley & Sons.

Bamford, D. & Greatbanks, R. (2005). The use of quality management tools and techniques: a study of application in everyday situations. *International Journal of Quality & Reliability Management*, 2(4), 376-392.

Bamford, D. & Griffin, M. (2008). A case study into operational team-working within a UK hospital. *International Journal of Operations & Production Management*, 28(3), 215-237.

Bamford, D., (2011) *The Lean Leadership Paradigm. Session at Lean Management Journal* Annual Conference. Birmingham.

Bamford, D., Forrester, P., Dehe, B. & Leese, R. (2015a). Partial and iterative Lean implementation: Two case studies. *International Journal of Operations and Production Management*. 35(5), 702-727.

Bamford, D., Forrester, P., Reid, I., Dehe, B., Bamford, J. & Papalexi, M. (2015b). *Where is the competitive edge in Knowledge Transfer?: the impact of KTPs*. In: 22nd European Operations Management Association (EurOMA) Conference 2015, 26th June - 1st July 2015, Neuchâtel, Switzerland.

Banks, J., Hanny, D., Pachano, M. A., & Thompson, L. G. (2007). *RFID applied*. John Wiley & Sons, Inc.

Barman, S., Tersine, R. & Buckley, M. (1991). An empirical assessment of the perceived relevance and quality of POM-related journals by academicians. *Journal Of Operations Management*, 10(2)194-212.

Barney, J. (1986). Organizational Culture: Can It Be a Source of Sustained Competitive Advantage?

Academy of Management Review. 11, 656-665.
Barney, J. (2012). Purchasing, Supply Chain Management and Sustained Competitive Advantage: The Relevance of Resource-based Theory. *Journal of Supply Chain Management*, 48(2)3-6.
Barney, J. (2015). Firm resources and sustained competitive advantage. In *International Business Strategy: Theory and Practice*. Routledge, New York
Barney, J. B. (2002). *Gaining and Sustaining Competitive Advantage*, 2nd ed. Reading, Mass.: Addison-Wesley.
Barney, J., (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17, 99-120
Barney, J.B. (2001). Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view. *Journal of Management*, 27, 643-650.
Barney, J.B. and Hoskisson, R. (1989). Strategic groups: Untested assertions and research proposals. *Management and Decision Economics*. 11, 187-98
Bar-Yam, Y. (2006). Improving the effectiveness of health care and public health: a multiscale complex systems analysis. *American Journal of Public Health*. 96, 459–66
Basit, T. (2003). Manual or electronic? The role of coding in qualitative data analysis. *Educational Research*, 45(2), 143-154. http://dx.doi.org/10.1080/0013188032000133548
Battini, D., Faccio, M., Persona, A., & Sgarbossa, F. (2013). Modelling the Growing Process of Integrated Healthcare Supply Networks. *International Journal Of System Dynamics Applications*, 2(1), 1-13.
Baumol, W.J. (2002). Entrepreneurship, Innovation and Growth: The David-Goliath Symbiosis. *Journal of Entrepreneurial Finance and Business Ventures*. 7,1-10.
Bell, J. (2005) *Doing your researc project*. 4th edn. UK, Bunckingham: Open University Press.
Bem-Tovim, D., Bassham, J., Bolch, D., Martin, M.A., Dougherty, M. & Szwarcbord, M. (2007) Lean thinking across a hospital: redesigning care at the Flinders Medical Centre. *Australian Health Review*, 31, 10-15.
Bennett, S., McRobb, S., & Farmer, R. (2010). *Object-oriented systems analysis and design using UML*. Fourth edition. London: McGraw-Hill.
Bergkvist, L., & Rossiter, J. R. (2009). Tailor-made single-item measures of doubly concrete constructs. *International Journal of Advertising*, 28(4), 607–621
Bernard, H. R. (2012) *Social research methods: Qualitative and quantitative approaches*. USA, Washington: Sage.
Berwick, D.M. (2003). Disseminating innovations in health care. *Journal of American Medical Association.* 289(15), 1969-1975.
Besanko, D., Dranove, D. & Shanley, M. (2000). Economics of Strategy. (2nd Edition) John Wiley & Sons, New York.
Bettley, A., Mayle, D., & Tantoush, T. (2005). *Operations management*. London: SAGE Publications.
Bhakoo, V. & Choi, T. (2013). The iron cage exposed: Institutional pressures and heterogeneity across the healthcare supply chain. *Journal Of Operations Management*, 31(6), 432-449. http://dx.doi.org/10.1016/j.jom.2013.07.016
Bhakoo, V., Singh, P., & Sohal, A. (2012). Collaborative management of inventory in Australian hospital supply chains: practices and issues. *Supply Chain Management: An International Journal*, 17(2), 217-230. http://dx.doi.org/10.1108/13598541211212933
Bhutta, K.S. & Huq, F. (1999). Benchmarking – best practices: An integrated approach. *Benchmarking: An International Journal*, 6(3), 254-268.
Birks, M. & Mill, J. (2011). *Grounded Theory: A Practical Guide*. London: SAGE publication.
Black, A., Car, J., Pagliari, C., Anandan, C., Cresswell, K., & Bokun, T. et al. (2011). The Impact of eHealth on the Quality and Safety of Health Care: A Systematic Overview. *Plos Med*, 8(1),

e1000387. http://dx.doi.org/10.1371/journal.pmed.1000387
Black, N. (2006) The Cooksey review of UK health research funding. *British Medical Journal*, 333, 1231-1232.
Blackhurst, V.J., Scheibe, P.K., Johnson, J.D. (2008). Supplier risk assessment and monitoring for the automotive industry. *International Journal of Physical Distribution & Logistics Management*. 38(2), 143–165.
Blackstone, J. H. (ed.) (2010). *APICS Dictionary*, 13th Edition. [Online]. Retrieved from: http://www.apics.org/industry-content-research/publications/apics-dictionary [Accessed 2013-01-29].
Blair, J., Czaja, R. F. & Blair, E. A. (2013) *Designing surveys: A guide to decisions and procedures.* USA, Washington: Sage.
Bloom, N., Draca, M. & Van Reenen, J. (2015). Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity. *Review of Economic Studies*. Oxford University Press
Blumberg, D.F. (1999). Strategic examination of reverse logistics and repair service requirements, needs, market size, and opportunities. *Journal of Business Logistics*, 20(2), 141–159.
Boer, H. & During, W.E. (2001). Innovation, what innovation? A comparison between product, process and organizational innovation. *International Journal of Technology Management*. 22(1-3), 83-107.
Böhme, T., Williams, S., Childerhouse, P., Deakins, E., & Towill, D. (2013). Methodology challenges associated with benchmarking healthcare supply chains. *Production Planning & Control*, 24(10-11), 1002-1014. http://dx.doi.org/10.1080/09537287.2012.666918
Booth, S. A. (2015). *Crisis management strategy*. London: Routledge Revivals.
Boulet, S., Boudot, E., & Houel, N. (2016). Relationships between each part of the spinal curves and upright posture using Multiple stepwise linear regression analysis. *Journal Of Biomechanics*. http://dx.doi.org/10.1016/j.jbiomech.2016.02.054
Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development.* Thousand Oaks, CA: Sage
Boyer, K., Swink, M. & Rosenzweig, E. (2005). Operations strategy research in the POMS journal. *Production and Operations Management*, 14(4), 442-449.
Braga, M., Tyler, M., Rhoads, J., Cacchio, M., Auerbach, M., Nishisaki, A., & Larson, R. (2015). Effect of just-in-time simulation training on provider performance and patient outcomes for clinical procedures: a systematic review. *BMJ Simulation And Technology Enhanced Learning*, bmjstel-2015-000058.
Brandao de Souza, L. (2009) Trends and approaches in lean healthcare. *Leadership in Health Services*. 22(2), 121-39.
Brandon-Jones, E., Squire, B., Autry, C., & Petersen, K. (2014). A Contingent Resource-Based Perspective of Supply Chain Resilience and Robustness. *Journal of Supply Chain Management*, 50(3), 55-73
Braun, V. & Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3, 77-101.
Braun, V. & Clarke, V. (2013) S*uccessful qualitative research: A practical guide for beginners*. London: Sage.
Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research In Psychology*, 3(2), 77-101.
Bravo, A. & Carvalho, J. (2015). Challenging times to pharmaceutical supply chains towards sustainability: a case study application. *International Journal of Procurement Management*, 8(1/2), 126. http://dx.doi.org/10.1504/ijpm.2015.066292
Breen L. & Xie Y. (2009) Examining the role of the customer in facilitating reverse logistics system

in NHS community pharmacy in the UK. *Proceeding of the Logistics Research Network annual conference*, Cardiff, UK, 588-591.
Breen, L. (2006). Give me back my empties or else! A preliminary analysis of customer compliance in reverse logistics practices (UK). *Management Research News*, 29(9), 532-551. http://dx.doi.org/10.1108/01409170610708989
Breen, L., & Xie, Y. (2015). Waste not, want not. What are the drivers of sustainable medicines recycling in National Health Service hospital pharmacies (UK)?. *International Journal of Project Management*, 8(1/2), 82. http://dx.doi.org/10.1504/ijpm.2015.066289
Breen, L., Roberts, L., Dimble, M. Tariq, Z., Arif, I., Mubin, F., Manu, B., Aziz, F. (2015) Identification of critical management skills in healthcare operations management: The case of pharmacists in the National Health Service (UK). *Euroma 2015 Conference*, Switzerland, June.
Bright, A. (1949) *The Electric Lamp Industry: Technological Change and Economic Development.* New York: Macmillan
Briks, M & Mills, J. (2011). *Grounded Theory: A Practical Guide*. London: Sage publication.
Brown, S., Bessant, J. & Lamming, R. (2013) *Strategic Operations Management*. third edition, Routledge
Brown, S., Blackmon, K., & Squire, B. (2007). The contribution of manufacturing strategy involvement and alignment to world class manufacturing performance. *International Journal of Operations & Production Management.* 27(3), 282-302.
Bryman, A. (2001), *Social Research Methods*, Oxford University Press, Oxford.
Bryman, A. (2012) *Social research methods*. Oxford, UK: Oxford University Press.
Bubalo, J., Warden, B., Wiegel, J., Nishida, T., Handel, E., & Svoboda, L., (2013). Does applying technology throughout the medication use process improve patient safety with antineoplastics? *Journal Of Oncology Pharmacy Practice*, 20(6), 445-460.
Buchanan, D., Fitzgerald, L. & Ketley, D. (2005). No going back: a review of the literature on sustaining organisational change. *International Journal of Management Reviews*. 7(3), 189-205.
Buchanan, D.A., Addicott, R., Fitzgerald, L., Ferlie, E. & Baeza, J.I. (2007). Nobody in charge: Distributed change agency in healthcare. *Human Relations*, 60(7):1065–90.

Buffa, E.S. (1982). Research in operations management. *Journal of Operations Management*, 1(1), 1-7.
Burgess, N., & Radnor, Z. (2013). Evaluating Lean in healthcare. *International Journal Of Health Care Quality Assurance*, 26(3), 220-235.
Burghard, C. (2012). *Big Data and Analytics Key to Accountable Care Success*. IDC Health Insights.
Burnes, B. (2011). Introduction: Why does change fail, and what can we do about it? *Journal of Change Management*, 11(4), 445–450.
Burnes, B. (2014). Understanding Resistance to Change – Building on Coch and French. *Journal Of Change Management*, 15(2), 92-116. http://dx.doi.org/10.1080/14697017.2014.969755
Burnes, B., & Jackson, P. (2011). Success and failure in organizational change: An exploration of the role of values. *Journal of Change Management*, 11(2), 133–162.
Burns, R. B., & Burns, R. A. (2008) *Business research methods and statistics using SPSS*. Sage
Çakıcı ÖE, Groenevelt H, Seidmann A (2011) Using RFID for the management of pharmaceutical inventory—system optimization and shrinkage control. *Decision Support Systems*. 51(3):627–637
Camison, C. & Lopez, A.V., (2010). An examination of the relationship between manufacturing flexibility and firm performance. *International Journal of Operations & Production Management.*30, 853-878.
Cappellaro, G., Fattore, G., & Torbica, A. (2009). Funding health technologies in decentralized systems: A comparison between Italy and Spain. *Health Policy*, 92(2-3), 313-321.

http://dx.doi.org/10.1016/j.healthpol.2009.05.004
Cardoso, S., Barbosa-Póvoa, A., & Relvas, S. (2013). Design and planning of supply chains with integration of reverse logistics activities under demand uncertainty. *European Journal Of Operational Research*, 226(3), 436-451.
Carnall, C. (1991). *Managing change*. Routledge, London.
Castano, R. (2014). Towards a framework for business model innovation in health care delivery in developing countries. *BMC Medicine*, 12(1).
Castka, P., Sharp, J.M. & Bamber, C.J. (2003), Assessing teamwork development to improve organizational performance, *Measuring Business Excellence*, 7(4), 29-36.
Cederlund, J. P., Kohli, R., Sherer, S. A. & Yao, Y. (2007). How Motorola put CPFR into action. *Supply chain management review*, 10, 28-35.
Cha, E. S., Kim, K. H. & Erlen, J. A. (2007) Translation of scales in cross-cultural research: Issues and techniques, *Journal of Advanced Nursing*, 58(4), 386-395
Chan, H. (2014). Lean techniques for the improvement of patients' flow in emergency department. *World Journal of Emergency Medicine*, 5(1), 24.
Chandler, A.D., (1962), *Strategy and structure*, Cambridge, MA: MIT Press
Chase, R. (1980). A Classification and Evaluation of Research in Operations Management. *Journal of Operations Management*, 1(1), 9-14.
Chassin, M. (2013). Improving The Quality Of Health Care: What's Taking So Long?. *Health Affairs*, 32(10), 1761-1765.
Chaston, I. (2015). *Resource-Based View (RBV)*. Wiley Online Library
Chauhan, G., & Singh, T. (2013). Resource flexibility for lean manufacturing: SAP-LAP analysis of a case study. *Lean Six Sigma Journal*, 4(4), 370-388.
Chen, D.Q., Mocker, M., Preston, D.S. & Teubner, A. (2010). Information systems strategy: reconceptualization, measurement, and implications. *MIS Quarterly*. 34 (2), 233–259.
Chen, J., Cheng, C. & Huang, P.B. (2013). Supply chain management with lean production and RFID application: A case study. *Expert Systems with Applications*. 40, 3389–3397.
Chen, X., Nils Peterson, M., Hull, V., Lu, C., Hong, D. & LiuHow, J. (2012). Perceived Exposure to Environmental Harm Influences Environmental Behaviour in Urban China, *Royal Swedish Academy of Sciences* [online] http://csis.msu.edu/sites/csis.msu.edu/files/www.springerlink.com_content_q5t161n15q882p38_fulltext.pdf, (accessed 26 January 2013).
Cheng, C. & Chang, P. (2012). Implementation of the Lean Six Sigma framework in non-profit organisations: A case study. *Total Quality Management & Business Excellence*, 23(3-4), 431-447. http://dx.doi.org/10.1080/14783363.2012.663880
Cheng, S., Bamford, D., Papalexi, M., & Dehe, B. (2015). Improving access to health services – challenges in Lean application. *International Journal Of Public Sector Management*, 28(2), 121-135.
Cherrett, T.J., Maynard, S., McLeod, F.N. & Hickford, A.J. (2012). *Reverse logistics for the management of waste*. In McKinnon, A., et al. (Eds), Green Logistics: Improving the environmental sustainability of logistics, London, GB, Kogan, pp 242-262.
Choi, K., Narasimhan, R., & Kim, S. (2012). Postponement strategy for international transfer of products in a global supply chain: A system dynamics examination. *Journal Of Operations Management*, 30(3), 167-179.
Choi, T.Y., Dooley, K.J. & Ruanglusanathan, M. (2001) Supply natworks and complex adaptive systems: Control versus emergence. *Journal of Operations Management*. 9, 351-66
Chopra, S. & Meindl, P. (2007). *Supply chain management: Strategy, planning, and operation*, Upper Saddle River, N.J. Pearson Prentice Hall.
Chopra. S. & Meindl, P. (2006). *Supply Chain Management: Strategy, Planning and Operation* (3rd

edition). Upper Saddle River, NJ: Prentice-Hall.
Christensen, L. B., Johnson, B. & Turner, L. A. (2011). *Research methods, design, and analysis*. Allyn & Bacon.
Christopher, A.B., Christopher, W.C., & Hanna, J.B., (2007). Postponement: an evolving supply chain concept. *International Journal of Physical Distribution & Logistics Management* 37 (8), 594–611.
Christopher, M., Peck, H. & Towill, D. (2006) A taxonomy for selecting global supply chain strategies. *International Journal of Logistics Management*. 17(2), 277-87
Claassen, M.J.T., Weele, A.J.v. & Raaij, E.M.v. (2008). Performance outcomes and success factors of vendor managed inventory (VMI). *Supply Chain Management: An International Journal.* 13(6), 406-14.
Clarke, V. & Braun, V. (2013) Teaching thematic analysis: Overcoming challenges and developing strategies for effective learning. *The Psychologist*, 26 (2). 120-123.
Classen, S., DS Lopez, E., Winter, S., Awadzi, K. D. & Ferree, N. (2008). Population-based health promotion perspective for older driver safety: Conceptual framework to intervention plan. *Clinical Interventions in Aging*, 2:677-693.
Closs, D., Speier C. & Meacham N. (2011) Sustainability to support end-to-end value chains: the role of supply chain management. *Journal of the Academy of Marketing Science*. 39, 101–116.
Cockburn, I.M., Henderson, R.M. & Stern, S. (2000). Untangling the origins of competitive advantage. *Strategic Management Journal*, 21, 1123-1145.
Coffey, A., Holbrook, B., & Atkinson, P. (1996). Qualitative data analysis: Technologies and representations. *Sociological Research Online* [On-line serial], 1(1), Retrieved from: http://www.socresonline.org.uk/1-1/4.html
Cole, J. & Radnor, Z. (2010). How healthy is the annual health check?. *International Journal Of Health Care Quality Assurance*, 23(6), 537-553. http://dx.doi.org/10.1108/09526861011060915
Collin, J. & Lorenzin, D. (2006), Plan for supply chain agility at nokia: lessons from the mobile infrastructure industry, *International Journal of Physical Distribution & Logistics Management,* 36(6), 418-430.
Collins, D.J. & Rukstad, M.G. (2008). Can you say what your strategy is? *Harvard Business Review.* 86(4), 82-90.
Cooksey D. (2006) *A review of UK health research funding*. London: Stationery Office.
Cooper, D. R. & Schindler, P. S. (2011) *Business research methods*. London: McGraw-Hill.
Cooper, J. R. (1998). A multidimensional approach to the adoption of innovation, *Management Decision*, 36, 493-502.
Cooper, M.C., Lambert D.M. & Pagh J.D. (1997) Supply chain management, *International Journal of Logistics Management*, 8(1), 2.
Couper, M. P., Traugott, M. W. & Lamias, M. J. (2001). Web survey design and administration, *Public opinion quarterly*, 65(2), 230-253.
Cousins, P., Lamming, R., Lawson, B. & Squire, B. (2008). *Strategic supply management: principles, theories, practice.* London: Prentice Hall.
Cousins, P.D. (2005). The alignment of appropriate firm and supply strategies for competitive advantage. *International Journal of Operations & Production Management*, 25(5), 403-428
Cranfield, S., Hendy, J., Reeves, B., Hutchings, A., Collin, S., & Fulop, N. (2015). Investigating healthcare IT innovations: a "conceptual blending" approach. *Journal Of Health Organization And Management*, 29(7), 1131-1148.
Creedon, R., O'Connell, E., McCarthy, G. & Lehane, B. (2009). An evaluation of nurse prescribing. *Part 1: a literature review. British Journal of Nursing*. 18, 1322–1327.
Cresswell, J.W. (2007), *Qualitative Inquiry and Research Design: Choosing Among Five Traditions,*

2nd ed., Sage, Thousand Oaks, CA.
Creswell J.W. & Plano Clark V.L. (2011) *Designing and Conducting Mixed Methods Research*. SAGE, Thousand Oaks, CA.
Creswell, J. W. & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research.* Thousand Oaks, California, London, Sage.
Creswell, J.W. (2013). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Fourth edition. Los Angeles: Sage.
Crowther, D. & Lancaster, G. (2008) *Research Methods: A Concise Introduction to Research in Management and Business Consultancy*. 2nd edn. Oxford, UK: Elsivier Butterworth-Heinemann.
Cubitt, B., (2000). Change: the final frontier?, *Logistics and Transport Focus*, 2(3), 39-42
D'Este, P., Iammarino, S., Savona, M., & von Tunzelmann, N. (2012). What hampers innovation? Revealed barriers versus deterring barriers. *Research Policy*, 41(2), 482-488.
Dahlgaard, J., Pettersen, J., & Dahlgaard-Park, S. (2011). Quality and lean health care: A system for assessing and improving the health of healthcare organisations. *Total Quality Management & Business Excellence*, 22(6): 673-689.
Daly, R., Harrington, T.S., Martin, G.D. & Hutchings, I.M. (2015). Inkjet printing for pharmaceutics – a review of research and manufacturing. *International Journal of Pharmaceutics.* Article first published online: 12th March.
Damanpour, F. (1987). The adoption of technological, administrative and ancillary innovations: impact of organizational factors. *Journal of Management*. 13(4), 675-88.
Danas, K., Ketikidis, P. & Roudsari, A. (2002). A virtual hospital pharmacy inventory: an approach to support unexpected demand. *International Journal of Medical Marketing*. 2(2), 125-9.
Danas, K., Rondsari, A. & Ketikidis, P.H. (2006). The applicability of a multi-attribute classification framework in the health care industry. *Journal of Manufacturing Technology Management.* 17(6), 772-85.
Danese, P. (2006). How contextual factors shape CPFR collaborations: A theoretical framework. Supply Chain Forum, 7, 16-26.
Danese, P. (2006). The extended VMI for coordinating the whole supply network. *Journal of Manufacturing Technology Managemen*t, 17(7), 888-907.
Dangayach, G. S. & Deshmukh, S. G. (2001). Manufacturing strategy: Literature review and some issues. *International Journal of Operations & Production Management*, 21(7), 884-932.
Davenport, T. H. & Short, J. E. (1990). The new industrial engineering: Information Technology and Business Process Redesign, *Sloan Management Review*, 31, 11-38.
Davenport, T.H. (2013). *Process innovation: reengineering work through information technology.* Harvard Business School Press.
Davies B. & Edwards N. (2013) *Sustaining knowledge use. In Knowledge Translation in Health Care: Moving from Evidence to Practice* (Straus S. E., Tetroe J. & Graham I.D., eds), Wiley-Blackwell, West Sussex, UK, pp. 165–173.
Davies, A. & Kochhar, A. (1999). Why British companies don't do effective benchmarking. *Integrated Manufacturing Systems*, 10(1), 26-32.
Davis, D. M. (2010). Mindfulness and supervision: What psychotherapists need to know? *Psychotherapy Bulletin*, 45, 9 –17
Davis, D., Golicic, S., & Boerstler, C. (2010). Benefits and challenges of conducting multiple methods research in marketing. *Journal of the Academy of Marketing Science*, 39(3), 467-479. http://dx.doi.org/10.1007/s11747-010-0204-7
Davis, J.A., Marino, L.D. & Vecchiarini, M (2013). Exploring the relationship between nursing home financial performance and management entrepreneurial attributes. *Advanced healthcare management*. 14, 1474-8231

Dawes, J. G. (2008). Do data characteristics change according to the number of scale points used? An experiment using 5 point, 7 point and 10 point scales. *International journal of market research*, 51(1).

De Brito, M.P. & Dekker, R. (2003) Modelling product returns in inventory control – exploring the validity of general assumptions. *International Journal of Production Economics.* 81-82, 225-41.

De Jong, M. G., Lehmann, D. R., Netzer, O. (2010). *State-dependence effects in surveys: A global investigation*. Working Paper

De Vries, J. & Huijsman, R., (2011). Supply chain management in health services: an overview. *Supply Chain Management: An International Journal*. 16(3), 159–165.

De Vries, J. (2011). The shaping of inventory systems in health services: a stakeholder analysis. *International Journal of Production Economics*. 133(1), 60-9.

De Wit, B. & Meyer, R. (2010). *Strategy process, content and context, an international perspective* (4th ed.). Hampshire: Cengage Learning.

Dehe, B (2014). *An empirical investigation in the decision-making processes of new infrastructure development Doctoral thesis*. University of Huddersfield.

Delbridge, R., Lowe, J. & Oliver, N. (1995). The process of benchmarking: a study from the automotive industry. *International Journal of Operations & Production Management*, 15(4), 50-62.

Deming, W.E. (1982). *Quality, productivity and competitive position*. Cambridge, MA: Massachusetts Institute of Technology.

Denscombe, M. (2007). *The good research guide.* Maidenhead: Open University Press.

Department of Health (DoH) (2011a), *Evaluation of the Scale, Causes and Costs of Waste Medicines*, Retrieved from: www.gov.uk/government/publications/making-best-use-ofmedicines-report-of-a-department-of-health-roundtableevent-hosted-by-the-king-s-fund (accessed 30 November 2013).

Department of Health (DoH) (2014), Corporate report 2013 to 2014, Retrieved from: https://www.gov.uk/government/publications/department-of-health-corporate-plan-2013-14/department-of-health-2013-14-corporate-plan

Department of Health [DoH]. (2010a). *Equity and excellence, liberating the NHS*. Crown Copyright. London: Her Majesty‟s Stationery Office [HMSO].

Department of Health, (2010b). *Nurse Prescribing FAQ*. Retrieved from: http://webarchive.nationalarchives.gov.uk/+/www.dh.gov.uk/en/Healthcare/Medicinespharmacyandindustry/Prescriptions/TheNon-MedicalPrescribing-Programme/Nurseprescribing/DH_4123003.

Department of Health, (2011b), *Commercial Medicines Unit*. Retrieved from: http://webarchive.nationalarchives.gov.uk/20110822131357/cmu.dh.gov.uk/ (Accessed 19 June 2013).

Department of Health, (2012) *Improving the use of medicines for better outcomes and reduced waste. An Action Plan.* Report and Action Plan of the Steering Group on Improving the Use of Medicines (for better outcomes and reduced waste). https://www.gov.uk/government/publications/action-plan-for-improving-the-use-of-medicines-and-reducing-waste. Accessed: 19th June 2013.

Department of Health. (2008) *Pharmacy Contractual Framework.* Briefing Paper for website. February 2008 – Gateway reference 9484, Retrieved from: http://www.dh.gov.uk/en/Healthcare/Medicinespharmacyandindustry/Communitypharmacy/Communitypharmacycontractualframework/index.htm (accessed 20 October 2008)

Devine-Wright, H. & Devine-Wright, P. (2009). Social representations of electricity network technologies: Exploring processes of anchoring and objectification through the use of visual research methods. *British Journal of Social Psychology*, 48, 357–373.

Dewar, R. D. & Dutton, J. E., (1986). The Adoption of Radical and Incremental Innovations: An Empirical Analysis, *Management Science*, 32, 1422-1433.
Dhanaraj, C. & Parkhe A. (2006). Orchestrating innovation networks. *Academy of Management Review*, 31 (3), 659–669
Diamantopoulos, A., Sarstedt, M., Fuchs, C., Wilczynski, P., & Kaiser, S. (2012). Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. *Journal of the Academy of Marketing Science*, 40(3), 434-449.
Dickson, E., Singh, S., Cheung, D., Wyatt, C. & Nugent, A. (2009) Application of Lean manufacturing techniques in the emergency department. *The Journal of Emergency Medicine*. 37, 177–182.
Dillman, D. A. (2000) *Mail and Internet Surveys: The Tailored Design Method*. NY: Wiley.
Ding, M.J., Ferry Jie, F., Kevin A. Parton, K.A. & Matanda, M.J. (2014). Relationships between quality of information sharing and supply chain food quality in the Australian beef processing industry. *The International Journal of Logistics Management*, 25(1), 85 - 108
Douglas, S. P. & Craig, C. S. (2007). Collaborative and iterative translation: An alternative approach to back translation, *Journal of International Marketing*, 15(1), 30-43.
Doyle, C., Howe, C., Woodcock, T., Myron, R., Phekoo, K., & McNicholas, C. et al. (2013). Making change last: applying the NHS institute for innovation and improvement sustainability model to healthcare improvement. *Implementation Science*, 8(1), 127.
Droge, C., Vickery, S., & Jacobs, M. (2012). Does supply chain integration mediate the relationships between product/process strategy and service performance? An empirical study. *International Journal Of Production Economics*, 137(2), 250-262.
Drotz, E. & Poksinska, B. (2014), Lean in healthcare from employees' perspectives, *Journal of Health Organization and Management*, 28(2), 177-195.
Drucker, P. (2014). *Innovation and entrepreneurship*. New York: Routledge.
Drummond-Hay, R. and Bamford, D., (2009). A case study into planning and change management within the UK National Health Service. *International Journal of Public Sector Management.* 22(4), 324-337
Easterby, M., Thorpe, R., Jackson, P. & Lowe, A. (2008). *Management Research*. in London: Sage.
Easterby-Smith, M., Thorpe R. & Lowe, A. (1991). *Management Research: An Introduction*. London: Sage.
Easton, G. (2002). Marketing: A critical realist perspective. *Journal of Business Research*, 55(2), 103-109.
Eden, C. & Ackermann, F. (2013). *Making Strategy: The Journey of Strategic Management*. Sage Publication Ltd.
Ekeland, A.G., Bowes, A. & Flottorp, S. (2010). Effectiveness of telemedicine: a systematic review of reviews, *International Journal of Medical Informatics* 79, 736–771
Ellram, L.M., Tate, W.L. & Feitzinger, E.G., (2013). Factor-market rivalry and competition for supply chain resources. *Journal of Supply Chain Management*, 49, 29-46.
Erol, I., Velioglu, M.N., Buyukozkan, G., Aras, N., Cakar, N.D. & Korugan, A. (2010) Exploring reverse supply chain management practices in Turkey. *Supply Chain Management: An International Journal*, 15(1), 43–54.
Esfahbodi, A., Zhang, Y. & Watson, G. (2016). Sustainable supply chain management in emerging economies: Trade-offs between environmental and cost performance. *International Journal of Production Economics*. doi:10.1016/j.ijpe.2016.02.013.
European Commission. (2015). *Legal framework governing medicinal products for human use in the EU.* Retrieved from: http://ec.europa.eu/health/human-use/legal-framework/index_en.htm
European Medicines Agency. (2014). The European regulatory system for medicines and the European Medicines Agency: A consistent approach to medicines regulation across the

European Union. *Science Medicines Health*. Retrieved from: http://www.ema.europa.eu/docs/en_GB/document_library/Brochure/2014/08/WC500171674.pdf
Eurostat. (2015a). *Healthcare statistics.* Retrieved from: http://ec.europa.eu/eurostat/statistics-explained/index.php/Healthcare_statistics
Eurostat. (2015b). *Healthcare personnel statistics - dentists, pharmacists and physiotherapists*. Retrieved from: http://ec.europa.eu/eurostat/statistics-explained/index.php?title=Healthcare_personnel_statistics_-_dentists,_pharmacists_and_physiotherapists&oldid=280119#Further_Eurostat_information
Fahrmeir, L., Kneib, T. & Lang, S. (2009). *Regression – Models, Methods and Applications*. 2nd edition. Berlin, Heidelberg: Springer
Fawcett, S., Magnan, G. & Mccarter, M. (2008), A three-stage implementation model for supply chain collaboration, *Journal of Business Logistics*, 29(1), 93.
Fawcett, S.E., Ellram, L.M. & Ogden, J.A. (2014). *Supply chain management: from vision to implementation.* Harlow : Pearson
Fayezi, S. & Zomorrodi, M. (2015). The role of relationship integration in supply chain agility and flexibility development: an Australian perspective. *Journal of Manufacturing Technology Management* 26:8.
Fayezi, S. & Zomorrodi, M. (2015). The role of relationship integration in supply chain agility and flexibility development. *Journal Of Manufacturing Technology Management*, 26(8), 1126-1157.
Fayezi, S., O'Loughlin, A. & Zutshi, A. (2012), Agency theory and supply chain management: a structured literature review, *Supply Chain Management: An International Journal*, 17(5), 556-570.
Feldman, B., Martin, E.M. & Skotnes, T. (2012). *Big Data in Healthcare Hype and Hope. Dr. Bonnie 360*, Retrieved from: http://www.west-info.eu/files/big-data-inhealthcare.pdf.
Feldon, D. F. & Kafai. Y. B. (2008). Mixed methods for mixed reality: understanding users' avatar activities in virtual worlds. *Educational Technology Research and Development* 56:575-593.
Ferlie, E., Crilly, T., Jashapara, A., Trenholm, S., Peckham A. & Currie, G. (2016). Strategic Management in the Healthcare Sector: The Debate About the Resource-Based View Flourishes in Response to Recent Commentaries. *International Journal of Health Policy Management*, 5(2), 145–14
Fernandes, L., O'Connor, M. & Weaver, V. (2012). Big data, bigger outcomes. *Journal American Health Information Management Association*, 38–42.
Ferrer, G., Dew, N., & Apte, U. (2010). When is RFID right for your service? *International Journal of Production Economics*, 124, 414–425.
Field, A. (2009) *Discovering Statistics Using SPSS*. 3rd edn. SAGE Publications.
Field, J.M. & Meile, L.C. (2008) Supplier relations and supply chain performance in financial services processes. *International Journal of Operations and Production management*. 28(2), 185-206
Fillingham, D. (2007) Can Lean save lives? Leadership in Health Services. 20 (4), 231-241.
Finch, T.L., Mair, & May, C.R. (2007). Teledermatology in the U.K.: lessons in service innovation, *British Journal of Dermatology*, 156, 521–527
Fogliatto, F., da Silveira, G., & Borenstein, D. (2012). The mass customization decade: An updated review of the literature. *International Journal Of Production Economics*, 138(1), 14-25.
Ford, D., Gadde, L-E, Hakansson, H. & Snehota, I. (2011) *Managing Business Relationships*. 3rd edition. Chichester: Wiley
Forker, L.B. & Mendez, D. (2001). An analytical method for benchmarking best peer suppliers. *International Journal of Operations & Production Management*, 21(1/2), 195-209.
Forslund, H. & Jonsson, P. (2007). The impact of forecast information quality on supply chain performance. *International Journal of Operations & Production Management*, 27, 90-107.

Fosso Wamba, S., Anand, A. & Carter, L. (2013). A literature review of RFID-enabled healthcare applications and issues. *International Journal of Information Management*, 33(5), pp.875-891.
Fowler, A. & Campbell, D. (2001). Benchmarking and performance management in clinical pharmacy. *International Journal of Operations & Production Management*, 21(3), 327-350.
Francis, D. & Bessant, J. (2005). Targeting innovation and implications for capability development. *Technovation*. 25(3), 171-83.
Freeman, C. & Soete, L. (1997) *The Economics of Industrial Innovation*, 3rd edition, Cambridge, MA: MIT Press
Freeman, S., Edwards, R. & Schroder, B. (2006a). How Smaller Born-Global Firms Use Networks and Alliances to Overcome Constraints to Rapid Internationalization, *Journal of International Marketing*, 14 (3), 33-63.
Freeman, T., Dickinson, H., McIver, S. and McLeod, H., (2006b). Innovation in service delivery: a literature review on the characteristics of innovation and improvement. *Health Services Management Centre*, University of Birmingham.
Freytag, P.V. & Hollensen, S. (2001). The process of benchmarking, benchlearning and benchaction. *The TQM Magazine*, 13(1), 25-34.
Frost & Sullivan. (2013). *Drowning in Big Data? Reducing Information Technology Complexities and Costs for Healthcare Organizations*. Retrieved from: http://www.emc.com/collateral/analyst-reports/frost-sullivan-reducing-information-technologycomplexities-ar.pdf.
Furman, C. & Caplan, R. (2007) Applying the Toyota Production System: Using a Patient Safety Alert System to Reduce Error. *The Joint Commission Journal on Quality and Patient Safety*. 33(7), 376-386.
Gartrell, C. D. & Gartrell, J. W. (2002). Positivism in sociological research: USA and UK (1966-1990), *British Journal of Sociology*, 53(4), pp. 639-657.
Gatignon, H., Gotteland, D. & Haon, C. (2016). Assessing Innovations from the Technology Perspective. *Making Innovation Last*. 1, 19-51
Georgiadis, P. & Besiou, M. (2010). Environmental and economical sustainability of WEEE closed-loop supply chains with recycling: a system dynamics analysis. *The International Journal of Advanced Manufacturing Technology*. 47(5-8), 475-493
Gerbl, M., McIvor, R., & Humphreys, P. (2016). Making the business process outsourcing decision: why distance matters. *International Journal Of Operations & Production Management*, 36(9), 1037-1064. http://dx.doi.org/10.1108/ijopm-04-2014-0192
Ghauri, P. N. & Gronhaug, K. (2010) *Research methods in business studies*. UK, Dorchester: Pearson Education.
Gielen, S., Dekker, J., Francke, A., Mistiaen, P., & Kroezen, M. (2014). The effects of nurse prescribing: A systematic review. *International Journal Of Nursing Studies*, 51(7), 1048-1061.
Gill, P., Stewart, K., Treasure, E., & Chadwick, B. (2008). Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal*, 204(6), 291-295.
Gligor, D.M. & Holcomb, M.C. (2012), Antecedents and consequences of supply chain agility: establishing the link to firm performance, *Journal of Business Logistics*, 33(4), 295-308.
Godsell, J., Martin, P., Johnson, M. & Guo, B. (2013). *Begging, borrowing and stealing: How should operations management scholars apply management theory in their research?.* In EurOMA 2013 Conference, Dublin, Ireland.
Goduscheit, R. (2014). Innovation promoters — A multiple case study. *Industrial Marketing Management*, 43(3), 525-534. http://dx.doi.org/10.1016/j.indmarman.2013.12.020
Goetsch, D.L. & Davis, S.B. (2014). *Quality management for organizational excellence* (Sixth Edition). Pearson.

Goffin, K. & Mitchell, R. (2005) *Innovation Management*. London: Pearson
Golicic, S. & Davis, D. (2012). Implementing mixed methods research in supply chain management. *International Journal Of Physical Distribution & Logistics Management*, 42(8/9), 726-741. http://dx.doi.org/10.1108/09600031211269721
Golicic, S. & Smith, C. (2013). A Meta-Analysis of Environmentally Sustainable Supply Chain Management Practices and Firm Performance. *Journal Of Supply Chain Management*, 49(2), 78-95. http://dx.doi.org/10.1111/jscm.12006
Gong, Q, Yang, Y. & Wang, S. (2014). Information and decision-making delays in MRP, KANBAN, and CONWIP, *International Journal Production Economics*, 156, 208-213.
Gonzalez-Torre, P.L. & Adenso-Díaz, B. (2006) Reverse logistics practices in the glass sector in Spain and Belgium. *International Business Review*. 15(5), 527-546.
Gonzalez-Torre, P.L., Adenso-Diaz, B. & Artiba, H. (2004) Environmental and reverse logistics policies in European bottling and packaging firms. *International Journal of Production Economics.* 88(1), 95-104.
Gordon, R.A. & Howell, J.E. (1959). *Higher education for business*. New York, NY: Columbia University Press.
Goroll, A. H., Simon, S. R., Tripathi, M., Ascenzo, C., & Bates, D. W. (2009). Community-wide implementation of health information technology: The Massachusetts eHealth collaborative experience. *Journal of the American Medical Informatics Association*, 16(1), 132–139.
Govindan, K., Azevedo, S.G. & Carvalho, H. (2015). Lean, green and resilient practices influence on supply chain performance: interpretive structural modelling approach. *International Journal of Environment Science and Technology*. 12, 15-34.
Granlien, M.F., Hertzum, M. & Gudmundsen, J. (2008). The gap between actual and mandated use of an electronic medication record three years after deployment, in: eHealth Beyond the Horizon-Get IT There, *Organizing Committee of MIE*, IOS Press, Goteborg
Grant, R. M. (2010). *Contemporary strategy analysis: Text and cases* (7th ed.). West Sussex: John Wiley & Sons, Inc.
Gravetter, F. & Wallnau, L. (2011). *Essentials of Statistics for the Behavioral Sciences*. USA, Belmont: Cengage Learning.
Greenhalgh T., Macfarlane F., Barton-Sweeney C. & Woodard F. (2012) "If we build it, will it stay?" A case study of the sustainability of whole-system change in London. *Milbank Quarterly* 90(3), 516–547.
Greenhalgh, T., Robert, G. and Bate, P. (2004).*How to Spread Good Ideas: A systematic review of the literature on diffusion, dissemination and sustainability of innovations in health service delivery and organization.* Report for the National Co-ordinating Centre for NHS Service Delivery and Organisation R & D (NCCSDO).
Greenlaw, C. & Brown-Welty, S. (2009). A Comparison of Web-Based and Paper-Based Survey Methods: Testing Assumptions of Survey Mode and Response Cost, *Evaluation Review*, 33(5), 464-480.
Gress, S., Delnoij, D. & Groenewegen, P. (2006). *Managing primary care behaviour through payment systems and financial incentives.* In: Saltman R, Rico A, Boerma WGW, editors. Primary care in the driver's seat? Organizational reform in European primary care. Buckingham (UK): Open University Press. p. 184-200.
Grol, R. and Wensing, M., (2004). What drives change? Barriers and incentives for achieving evidence-based practice. *Medical Journalists' Association*. 180, 7-60.
Grove, A.L., Meredith, J.O., Macintyre, M., Angelis, J. & Neailey, K. (2010a) Challenges faced by a UK health visiting service during lean implementation. *Leadersh Health Service*. 23, 204–218.
Grove, A.L., Meredith, J.O., Macintyre, M., Angelis, J. & Neailey, K. (2010b) Lean implementation in primary care health visiting services in National Health Service UK. *Quality and Safety in*

Health Care. 19(5)
Groves, R. M., Fowler Jr, F. J., Couper, M. P., Lepkowski, J. M., Singer, E. & Tourangeau, R. (2011) *Survey methodology*. John Wiley & Sons.
Guba, I. and Nerkar, A. (1994). *Competing Paradigms in Qualitative Research*. In N.K.Denzin & Y.S. Lincoln (Eds), Handbook of Qualitative Research: Sage Publications, Newbury Park, CA
Guest, G., MacQueen, K. M. & Namey, E. E. (2012) *Applied thematic analysis*. Thousand Oaks, CA: Sage.
Guha, S., Kettinger, W. J.Teng, J. T. C., (1993). Business process reengineering: Building a comprehensive methodology, *Information Systems Management*, 10, 13-23.
Gupta, S., Woodside, A., Dubelaar, C. & Bradmore, D. (2009). Diffusing knowledge-based core competencies for leveraging innovation strategies: modelling out-sourcing to knowledge process organizations (KPOs) in pharmaceutical networks. *Industrial Marketing Management*. 38, 219–227.
Hair Jr, J. F., Wolfinbarger, M., Money, A. H., Samouel, P. & Page, M. J. (2011) *Essentials of business research methods.* USA, NY: Routledge.
Hakansson, H., Ford, I.D., Gadde, L.E., Snehota, I. & Waluszewski, A. (2009) *Business in Networks.* Chichester: Wiley
Hall, R. (2013). *Patient Flow: Reducing Delay in Healthcare Delivery*, Second Edition. Springer.
Hamel, G., & Prahalad, C. (1994). *Competing for the future*. Boston, Mass.: Harvard Business School Press.
Harper, D. & Thompson, A. (2012). *In Qualitative Research Methods in Mental Health and Psychotherapy: A Guide for Students and Practitioners*. Chichester: Wiley-Blackwell, pp. 209-223.
Harrington, H. J. (1991). *Business process improvement: the breakthrough strategy for total quality, productivity, and competitiveness*, McGraw-Hill, New York.
Harrington, T.S. & Srai, J.S. (2012). Defining product-service network configurations and location roles: a current and future state analysis framework for international engineering operations. *International Journal of Product Development*. 17(3/4), 228–253.
Harris R. & Trainor M., (1995). Innovations and R&D in Northern Ireland manufacturing: a Schumpeterian approach. *Regional Studies*, 29 (7), 593-604
Harrison, T., Lee, H., & Neale, J. (2003). *The practice of supply chain management*. Boston: Kluwer Academic Pub.
Hayes, R.H. and Wheelwright, S. (1984). *Restoring our competitive advantage*. New York: Wiley
Heatley M. & Kruske S. (2011) *Defining collaboration in Australian maternity care*. Women Birth 24, 53–57.
Helfat C.E., Raubitscek R.S., (2000), Product sequencing: co-evolution of knowledge, capabilities and products, *Strategic Management Journal*, 21, 961-979
Helfrich, C.D., Weiner, B.J., McKinney, M.M. and Minasian, L., (2007). Determinants of implementation effectiveness: adapting a framework for complex interventions. *Medical Care Research and Review*. 64, 279-303.
Hendricks, K.B. & Singhal, V.R. (2005) An empirical analysis of the effects of supply chain disruption on long-run stock price performance and equity risk of the firm. *Production and Operations Management.* 14(1), 35-52.
Heracleous, L. & Wirtz, J. (2010). Singapore Airlines' balancing act. *Harvard Business Review,* July-August: 145-149.
Herzlinger, R.E. (2006). *Why Innovation in Health Care Is So Hard*. Harvard Business Review.
Heskett, J.L., Jones, T.O., Loveman, G.W., Sasser, W.E. & Schlesinger, L.A. (2008). Putting the Service-Profit Chain to Work. *Harvard Business Review*, July-August 2008, pp. 118-128
Hester, R.E. and Harrison, R.M. (2015). *Pharmaceuticals in the Environment*. Issues in

environmental science and technology. 41.
Hill, A. & Hill, T. (2012). *Operations management*, Palgrave Macmillan (3rd ed.). New York, NY.
Hill, C., Jones, G. R. & Schilling, M. (2014). *Strategic management: theory: an integrated approach. Mason*, OH: South-Western, Cengage Learning
Hines, P. & Rich, N. (1997). The seven value stream mapping tools. *International Journal of Operations & Production Management*, 17(1), 46-64.
Hitt, M., Carnes, C., & Xu, K. (2016a). A current view of resource based theory in operations management: A response to Bromiley and Rau. *Journal Of Operations Management*, 41, 107-109.
Hitt, M., Xu, K., & Carnes, C. (2016b). Resource based theory in operations management research. *Journal Of Operations Management*, 41, 77-94.
Holden R.J. (2011) Lean Thinking in emergency departments: a critical review. Annals of emergency medicine. 57 (3), 265-278.
Holloway, I., &Wheeler, S. (2013). *Qualitative research in nursing and healthcare*. Third edition. Chichester, West Sussex, U.K.: Wiley-Blackwell.
Houlihan, J.B. (1987) International supply chain management. *International Journal of Physical Distribution and Logistics Management.* 17(2), 51-66
Houweling, S.T., Kleefstra, N., Van Hateren, K.J.J., Kooy, A. & Groenier, K.H. (2009). Diabetes specialist nurse as main care provider for patients with type 2 diabetes. *Netherlands Journal of Medicine*. 67, 279–284.
Hovgaard, A. & Hansen, E. (2004). Innovativeness in the forest products industry. *Forest Products Journal*. 54(1), 26-33.
Howe, K. R. (1988). Against the quantitative-qualitative incompatibility thesis or dogmas die hard. *Educational Researcher*. 17: 10–16.
Hunt, S.D. & D.F. Davis. (2008). Grounding Supply Chain Management in Resource-Advantage Theory. *Journal of Supply Chain Management*, 44 (1) 10-21.
Hwang, Y. & Rho, J. (2014). Strategic value of RFID for inter-firm supply chain networks: An empirical study from a resource and social capital perspective. *Information Development*, 32(3), 509-526. http://dx.doi.org/10.1177/0266666914556910
Ifanti, A., Argyriou, A., Kalofonou, F., & Kalofonos, H. (2013). Financial crisis and austerity measures in Greece: Their impact on health promotion policies and public health care. *Health Policy*, 113(1-2), 8-12. http://dx.doi.org/10.1016/j.healthpol.2013.05.017
IMS Health (MIDAS), (2013). *Global retail pharmaceutical market at ex-factory prices*. Retrieved from: http://www.efpia.eu/uploads/Figures_2014_Final.pdf
Institute of Medicine, (2007). *Hospital-Based Emergency Care: At the Breaking Point*. Washington, DC: National Academies Press.
Ireland, R. & Crum, C. (2005). *Supply chain collaboration*, Boca Raton, Fla., J. Ross.
Ittelson, W. (1973). *Environment and Cognition*. New York: Seminar Press
Jaakkola, E. & Renko, M. (2007), Critical innovation characteristics influencing the acceptability of a new pharmaceutical product market, *Journal of Marketing Management*, 23(3/4), 327-46.
Jaana, M., Tamim, H., Paré, G., & Teitelbaum, M. (2011). Key IT management issues in hospitals: Results from a Delphi study in Canada. *International Journal of Medical Informatics*, 80(12), 828–840.
Jamali, D., Hallal, M. & Abdallah, H. (2010). Corporate governance and corporate social responsibility: evidence from the healthcare sector. *Corporate Governance*. 10(5), 590-602.
Jarrett, P.G. (1998). Logistics in the health care industry. *International Journal of & Physical Distribution and Logistics Management*. 28(9/10), 741-72.
Jimmerson, C., Weber, D. & Sobek, D. (2004), Reducing waste and errors: piloting lean principles at Intermountain Healthcare, *Joint Commission Journal on Quality and Safety*. 31(5), 249-57.

Johannessen, J.A., Olsen, B. & Lumpkin, G.T. (2001). Innovation as newness: what is new, how new, and new to whom? *European Journal of Innovation Management*. 4(1), 20-31.
Johnsen, T.E. (2011) Supply network delegation and intervention strategies during suppier involvement in new product development. *International Journal of Operations & Production Management.* 31(6), 688-708
Johnson, G., Whittington, R. & Scholes, K. (2010). *Exploring strategy* (9th ed.). Pearson
Johnson, P. & Clark, M. (2006) *Mapping the terrain: an overview of business and management research methodologies*, in P. Johnson and M. Clark. (eds) Business and Management Research Methodologies. London: Sage.
Johnson, R. & Onwuegbuzie, A. (2004). Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher*, 33(7), 14-26. http://dx.doi.org/10.3102/0013189x033007014
Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), 112-133.
Johnston, R. & Clark, G. (2008). *Service operations management, improving service delivery* (3rd ed.). Harlow: Financial Times - Prentice Hall.
Jones D.T., Hines P. & Rich N. (1997). Lean logistics. International Journal of Physical *Distribution & Logistics*, 27(3/4), 153-173.
Jones, E., Henry, M., Cochran, D., & Frailey, T. (2010). RFID Pharmaceutical Tracking: From Manufacturer Through In Vivo Drug Delivery. *Journal Of Medical Devices*, 4(1), 015001.
Jonsson, P. (2008). *Logistics and Supply Chain Management*. McGraw Hill.
Joosten, T., Bongers, I. & Janssen, R. (2009) Application of lean thinking to health care: issues and observations. *Int J Qual Health Care*. 21,341–347.
Junior, M.L. & Filho, M.G. (2010). Variations of the kanban system: Literature review and classification‖, *International Journal Production Economics*, 125, 13–21.
Kabir, M.I. (2013). Reverse Logistics in Pharmaceutical Industry. *International Journal of Supply Chain Management.* 2(1), 96-100.
Kang Sherman Heng, H. & Loosemore, M. (2013). Structural holes in hospital organisations. *Engineering, Construction And Architectural Management*, 20(5), 474-487. http://dx.doi.org/10.1108/ecam-05-2011-0045
Kannampallil, T., Schauer, G., Cohen, T., & Patel, V. (2011). Considering complexity in healthcare systems. *Journal Of Biomedical Informatics*, 44(6), 943-947. http://dx.doi.org/10.1016/j.jbi.2011.06.006
Kaplan, R.S. & Norton, D.P. (2008). *Mastering the management system*. Harvard Business Review, 86(1), 62.
Karagiannopoulos, G.D., Georgopoulos, N. & Nikolopoulos, K. (2005) Fathoming Porter's five forces model in the internet era, *info*, 7(6) 66 - 76
Karim, A. & Arif-Uz-Zaman, K. (2013). A methodology for effective implementation of lean strategies and its performance evaluation in manufacturing organizations. *Business Process Management Journal*. 19(1), 169 - 196
Kastanioti, C., Kontodimopoulos, N., Stasinopoulos, D., Kapetaneas, N., & Polyzos, N. (2013). Public procurement of health technologies in Greece in an era of economic crisis. *Health Policy*, 109(1), 7-13. http://dx.doi.org/10.1016/j.healthpol.2012.03.015
Kauremaa, J., Smaros, J. & Holmstrom, J. (2009). Patterns of vendor-managed inventory: findings from a multiple-case study. *International Journal of Operations & Production Management*. 29(11), 1109-39.
Kay, E., & Blinkhorn, A. (1996). A qualitative investigation of factors governing dentists' treatment philosophies. *British Dental Journal*, 180(5), 171-176.
Kearney, A.T. (2009). *Excellence in Logistics*. Chicago: Ed.AT Kearney.

Kelemen, M. & Rumens, N. (2008). *An Introduction to Critical Management Research*. London: Sage

Khan, O. & Burnes, B. (2007). Risk and supply chain management: creating a research agenda. *The International Journal of Logistics Management*. 18(2), 197-216.

Khanna, I. (2012). Drug discovery in pharmaceutical industry: productivity challenges and trends. *Drug Discovery Today*. 17(19–20), 1088-1102

Kiely, D. (2004). The state of pharmaceutical industry supply planning and demand forecasting. *The Journal of Business Forecasting Methods & Systems*. 23(3), 20-2.

Kim, D. (2005) *An integrated supply chain management system: a case study in healthcare sector*. Lecture Notes in Computer Science. 3590, 218-27.

Kim, D., Kumar, V., & Kumar, U. (2012). Relationship between quality management practices and innovation. *Journal Of Operations Management*, 30(4), 295-315.

Kimberly, J. and Cook, J.M., (2008). Organizational measurement and the implementation of innovations in mental health services. *Administration and Policy in Mental Health and Mental Health Services Research*. 25, 11-20.

Kimpel, J.F. (2013). Critical success factors for data warehousing: A classing answer to a modern question. *Issues in Information Systems*. 14(1), 376-384.

King, B. & Minium, E. (2003) *Statistical Reasoning in Psychology and Education*. John Wiley & Sons.

Kirkwood, J. & Campbell-Hunt, C. (2007) Using multiple paradigm research methodologies to gain new insights into entrepreneurial motivations, *Journal of Enterprising Culture*, 15(3), 219-241.

Kisperska-Moron, D. & Swierczek, A. (2009), The agile capabilities of polish companies in the supply chain: an empirical study, *International Journal of Production Economics*, 118(1), 217-224.

Klein, B., Crawford, R.G. and Alchian, A. (1978). Vertical integration, appropriate rents, and the competitive contracting process. *Journal of Law and Economics*. 21, 297-326

Klein, M., Dabbs, D., Shuai, Y., Brufsky, A., Jankowitz, R., Puhalla, S., & Bhargava, R. (2013). Prediction of the Oncotype DX recurrence score: use of pathology-generated equations derived by linear regression analysis. *Modern Pathology*, 26(5), 658-664 http://dx.doi.org/10.1038/modpathol.2013.36

Knemeyer, A.M., Zinn, W., Eroglu, C. (2009). Proactive planning for catastrophic events in supply chains. *Journal of Operations Management*. 27(2), 141–153.

Kniberg, H. (2009). *Kanban vs. scrum - how to make the most of both*, Retrieved from: http://www.crisp.se/henrik.kniberg/Kanban-vs-Scrum.pdf

Kollberg, B., Dahlgaard, J., & Brehmer, P. (2006). Measuring lean initiatives in health care services: issues and findings. *International Journal of Productivity and Performance Management,* 56(1), 7-24.

Kong, P., & Daud, Y. (2013). Effectiveness of Enterprise Resource Planning System in Supporting the Lean Manufacturing. *Applied Mechanics and Materials*, 315, 899-904.

Kongar, E., Haznedaroglu, E., Abdelghany, O. & Bahtiyar, M. (2014). A novel IT infrastructure for reverse logistics operations of end-of-life pharmaceutical products. *Information Technology And Management*, 16(1), 51-65.

Koskela, L. & Ballard, G. (2012). Is production outside management?. *Building Research & Information*, 40(6), 724-737.

Kostagiolas, P., Kaitelidou, D., Hatzopoulou, M., (2008), *Improving the quality of health services*, Papasotiriou, Athens

Kostopoulos, K. Spanos, Y. E. & Prastacos, G. P. (2002). *The Resource-Based View of the Firm and Innovation: Identification of Critical Linkages*, The 2nd European Academy of Management Conference, Stockholm

Kringos, D., Boerma, W., van der Zee, J., & Groenewegen, P. (2013). Europe's Strong Primary Care Systems Are Linked To Better Population Health But Also To Higher Health Spending. *Health Affairs*, 32(4), 686-694. http://dx.doi.org/10.1377/hlthaff.2012.1242

Kroezen, M., van Dijk, L., Groenewegen, P.P. & Francke, A.L., (2011). Nurse prescribing of medicines in Western European and Anglo-Saxon countries: a systematic review of the literature. *BMC Health Services Research*. 11 (1) 127

Kumar S., Dieveney E. & Dieveney A. (2009) Reverse logistic process control measures for the pharmaceutical industry supply chain. *International Journal of Productivity and Performance Management*, 58(2), 188-204

Kuo, C.H. & Chen, H.G. (2008) *The Critical Issues about Deploying RFID in Healthcare Industry by Service Perspective*. Proceedings of the 41st Annual Hawaii International Conference on System Sciences (HICSS 2008). Hawaii, IEEE Computer Society Washington, DC, USA

Kvale, S. & Brinkmann, S. (2008), *Interviews: Learning the Craft of Qualitative Research Interviewing*, 2nd ed., Sage, Thousand Oaks, CA.

Kwon, H., & Trail, G. (2005). The feasibility of single-item measures in sport loyalty research. *Sport Management Review*, 8(1), 69–89.

L. Sanders Jones, J., & Linderman, K. (2014). Process management, innovation and efficiency performance. *Business Process Management Journal*, 20(2), 335-358.

LaGanga, L.R. (2011) Lean service operations: Reflections and new directions for capacity expansion in outpatient clinics. *Journal of Operations Management*. 29(5), 422-433

Lai, F., Li, D., Wang, Q. & Zhao, X., (2008). The information technology capability of third-party logistics providers: a resource-based view and empirical evidence from China. *Journal of Supply Chain Management*. 44, 22-38.

Laínez, J., Schaefer, E., & Reklaitis, G. (2012). Challenges and opportunities in enterprise-wide optimization in the pharmaceutical industry. Computers & Chemical Engineering, 47, 19-28.

Lamming, R.C. (2000) Japanese supply chain relationships in recession. *Long Range Planning*. 33(6), 757-78

Lance, C. E., Dawson, B., Birkelbach, D. & Hoffman, B. J. (2010) Method effects, measurement error, and substantive conclusions, *Organizational Research Methods*, 13(3), pp. 435-455.

Lao, S. I., Choy, K. L., Ho, G. T. S., Tsim, Y. C., Poon, T. C., & Cheng, C. K. (2012). A real-time food safety management system for receiving operations in distribution centres. *Expert Systems with Applications*, 39, 2532–2548.

Lau, K.W. & Wang, Y. (2009) Reverse logistics in the electronic industry of China: a case study. *Supply Chain Management: An International Journal*. 14(6), 447-465.

Leadbeater, C. (2003). Overdue: How to create a modern public library service, London: Demos, Retrieved from: http://www.demos.co.uk/catalogue/default.aspx?id=262

Lebreton, B. & Tuma, A. (2006) A quantitative approach to assessing the profitability of car and truck tire remanufacturing. *International Journal of Production Economics*. 104(2), 639-652.

Lechner, C., & Gudmundsson, S. (2012). Entrepreneurial orientation, firm strategy and small firm performance. *International Small Business Journal*, 32(1), 36-60.

Lee C., Lee K. & Pennings J.M. (2001). Internal capabilities, external networks, and performance: A study on technology-based ventures. *Strategic Management Journal*, 22, 615-640

Lee, C. K. M., Ho, W., Ho, G. T. S., & Lau, H. C. W. (2011). Design and development of logistics workflow systems for demand management with RFID. *Expert Systems with Applications*, 38, 5428–5437.

Leech, N., & Onwuegbuzie, A. (2009). A typology of mixed methods research designs. *Quality & Quantity*, 43(2): 265-275.

Leeman, J., Baernholdt, M. & Sandelowski, M. (2007) Developing a theory-based taxonomy of methods for implementing change in practice. *Journal of Advanced Nursing*. 58(2), 191–200.

Leonard-Barton, D. (1995). *Wellsprings of knowledge: Building and sustaining the sources of innovation*. Boston: Harvard Business School Press

Leslie DL, Rosenheck RA (2002) From conventional to atypical antipsychotics and back: dynamic processes in the diffusion of new medications. *The American Journal of Psychiatry* 159(9):1534–1540

Levenson, R., Dewar, S. & Shepherd, S. (2008). *Understanding Doctors, The Royal College of Physicians and the King's Fund*, London, Retrieved from: www.kingsfund.org.uk/document.rm?id=7617.

Levis, A. & Papageorgiou, L.G. (2004). A hierarchical solution approach for multi-site capacity planning under uncertainty in the pharmaceutical industry. *Computers and Chemical Engineering*. 28, 707–725.

Lewis, M., Brandon-Jones, A., Slack, N. & Howard, M., (2010). Competing through operations and supply: the role of classic and extended resource-based advantage. *International Journal of Operations & Production Management*. 30, 1032-1058.

Liddell, A., Adshead, S. & Burgess, E. (2008) *Technology in the NHS: transforming the patient's experience of care*. Kings Fund, London.

Lillrank, P. (1995). The transfer of management innovations from Japan. *Organization Studies*, 16(6), 971-989.

Lin, C.J., Chen, F.F. & Chen, Y.M. (2013). Knowledge kanban system for virtual research and development, *Robotics and Computer-Integrated Manufacturing*, 29, 119-134.

Lindsey, G. (2015). The Lean prescription, powerful medicine for our ailing healthcare system. *Healthcare*, 3(2), 119-120.

Lionis, C., Symvoulakis, E & Markaki, A., Vardavas, C., Papadakaki, M. Daniilidou, N. Souliotis, K. & Kyriopoulos, I. (2009) Integrated primary health care in Greece, a missing issue in the current health policy agenda: a systematic review. *International Journal of Integrated Care*; 9, 1568-4156

Liu N. & D'Aunno T. (2011) The productivity and cost-efficiency of models for involving nurse practitioners in primary care: a perspective from queuing analysis. *Health Services Research* 47, 594–613.

Liyanage S., Greenfield P.F. & Don R., (1999). Towards a fourth generation of R&D management model-research networks in knowledge management. *International Journal of Technology Management*, 18, 372-393

Lluch, M. (2011). Healthcare professionals' organisational barriers to health information technologies-A literature review. *International Journal Of Medical Informatics*, 80(12), 849-862. http://dx.doi.org/10.1016/j.ijmedinf.2011.09.005

Lodge, A. & Bamford, D. (2008) Using Lean techniques in radiology waiting time improvement: a case study. *Public money and management*. 28(1), 49-52.

Lorenz, E. (1993). The essence of chaos. Seattle: University of Washington Press

Lummus, R.R., Vokurka, R.J. & Rodeghiero, B. (2006) Improving quality through value stream mapping: a case study of a physicians clinic. *Total Quality Management & Business Excellence.* 17(8), 1063–1975.

Lynn G.S., Skov R.B. & Abel K.D., (1999), Practices that support team learning and their impact on speed to market and new product success, *Journal of Product Innovation Management,* 16, 439-454

Macinko, J., Starfield, B. & Shi, L. (2003). The contribution of primary care systems to health outcomes within Organization for Economic Cooperation and Development (OECD) countries, 1970-1998. *Health Services Research Journal*. 38(3), 831-65.

Maddox, C., Halsall, D., Hall, J., & Tully, M. (2016). Factors influencing nurse and pharmacist willingness to take or not take responsibility for non-medical prescribing. *Research In Social*

And Administrative Pharmacy, 12(1), 41-55. http://dx.doi.org/10.1016/j.sapharm.2015.04.001
Magal, S., & Word, J. (2011). *Integrated Business Processes with ERP Systems*. Hoboken NJ: Wiley
Maher, L., Plsek, P. & Bevan, H. (2008) *Making a bigger difference: a guide for NHS front-line staff and leaders on assessing and stimulating service innovation*. NHS Institute for Innovation and Improvement.
Maiga, A. & Jacobs, F. (2004). The association between benchmarking and organisational performance: An empirical investigation. *Managerial Finance*, 30(8), 13-33.
Malterud, K. (2001). Qualitative research: standards, challenges, and guidelines. *The lancet*, 358(9280), 483-488.
Mancusi, M.L. & Vezzulli, A. (2010). *R&D, Innovation, and Liquidity Constraints, KITeS* Working Papers. Bocconi University.
Maneesriwongul, W. & Dixon, J. K. (2004) Instrument translation process: A methods revie', *Journal of Advanced Nursing*, 48(2), 175-186.
Manning, M., Purrington, K., Penner, L., Duric, N., & Albrecht, T. (2016). Between-race differences in the effects of breast density information and information about new imaging technology on breast-health decision-making. *Patient Education And Counseling*. http://dx.doi.org/10.1016/j.pec.2016.01.010
Marler, J. & Fisher, S. (2013). An evidence-based review of e-HRM and strategic human resource management. *Human Resource Management Review*, 23(1), 18-36. http://dx.doi.org/10.1016/j.hrmr.2012.06.002
Martin, S., Smith, P. C. Gravelle, H. & Rice, N. (2011). *Evidence: Do quality improvements in primary care reduce secondary care costs? The Health Foundation Inspiring Improvement.*
Martínez-Jurado, P., & Moyano-Fuentes, J. (2014). Lean Management, Supply Chain Management and Sustainability: A Literature Review. *Journal Of Cleaner Production*, 85, 134-150.
Martín-Peña, M.L. & Díaz-Garrido, E. (2008). Typologies and taxonomies of operations strategy: A literature review. *Management Research News*, 31(3), 200-218.
Marwa, S. & Zairi, M. (2008). A pragmatic approach to conducting a successful benchmarking expedition case of Dubai Holding Group (DHG). *The TQM Journal*, 20(1), 59-67.
Mason, J. (2002). *Researching Your Own Practice: The Discipline of Noticing*. Routledge Falmer
Matthews, B. & Ross, L. (2010) *Research Methods: A practical guide for the social sciences*. UK, Essex: Pearson Education Ltd.
Mattsson, S.A. (2002). *Logistics and Supply Chain Management*, Lund, Studentlitteratur.
Maxcy, S. J. (2003). *Pragmatic threads in mixed methods research in the social sciences: the search for multiple modes of inquiry and the end of the philosophy of formalism.* In A. Tashakkori & C. Teddlie (Eds) Handbook of Mixed Methods in Social and Behavioral Research. Thousand Oaks, CA.: Sage.
Maylor, H. and Blackmon, K. (2005) *Researching business and management: a roadmap for success*. Palgrave Macmillan.
McCracken, G. (1988). *The Long Interview* (Sage University Paper Series on Qualitative Research Methods, No. 13). Newbury Park, Calif.: Sage
McFarlane, D., Sarma, S., Chirn, J., Wong, C., & Ashton, K. (2003). Auto ID systems and intelligent manufacturing control. *Engineering Applications Of Artificial Intelligence*, 16(4), 365-376.
McMackin, R.A. & Pittel, E. (2005). *A Public Health Approach to Address the Mental Health Needs of Juvenile Offenders*, Emerald Group Publishing Limited, pp. 3–25.
Meade, B., Buckley, D. & Boland, M. (2009). What factors affect the use of electronic patient records by Irish GPs? *International Journal of Medical Informatics*. 78 (8), 551–558.
Mehrsai, A., Karimi, H., Thoben, K., & Scholz-Reiter, B. (2013). Using Metaheuristic and Fuzzy System for the Optimization of Material Pull in a Push-Pull Flow Logistics Network. *Mathematical Problems In Engineering*, 1-19

Melnyk, S.A., Davis, E.W., Spekman, R.E. and Sandor, J. (2010). Outcome-driven supply chains. *Sloan Management Review*, 51(2), 33-38.
Melville, N., Kraemer, K. & Gurbaxani, V. (2004). Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value. *MIS Quarterly*, 28(2), 283-322.
Menor, L.J. & Roth, A.V., (2008). New service development competence and performance: an empirical investigation in retail banking. *Production and Operations Management*. 17, 267-284.
Michel, A., Todnem By, R., & Burnes, B. (2013). The limitations of dispositional resistance in relation to organizational change. *Management Decision*, 51(4), 761-780. http://dx.doi.org/10.1108/00251741311326554
Miller, J. G., Graham, M. B. W., Freeland, J. R., Hottenstein, M., Maister, D. H.,Meredith, J., & Schmenner, R. W. (1981). Productions/Operations Management, and Agenda for the 1980s. *Decision Sciences*, 12(4) 547-571.
Minichiello, V., Aroni, R., Timewell, E., & Alexander, L. (1990). *In-depth Interviewing: Researching people.* Hong Kong: Longman Cheshire Pty Limited.
Mintzberg, H. (1998). *Strategic thinking as seeing. In B. Garratt (Eds), Developing strategic thought: Reinventing the art of direction*. London: McGraw-Hill
Mitchell V.L. & Zmud R.W. (1999). The effects of coupling IT and work process strategies in redesign projects. *Organization Science*, 10, 424-438
Modernisation Agency. (2004) Complexity of sustaining healthcare improvements: What have we learned so far? *NHS Research into Practice Report*, 13.
Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research*, 1(1), 48-76.
Morgan, G. & Smircich, L. (1980). The case for Qualitative Research. *The academy of Management Review*, 5(4): 491-500.
Morrow, E., Robert, G., & Maben, J. (2014). Exploring the nature and impact of leadership on the local implementation of The Productive Ward Releasing Time to Care™. *Journal Of Health Organization And Management*, 28(2), 154-176. http://dx.doi.org/10.1108/jhom-01-2013-0001
Morton, R. (2006) Reverse spells 'headache relief'. *Logistics Today*. 47(9), 35-6.
Muijs, D. (2010). *Doing quantitative research in education with SPSS*. London: Sage
Murphy, J.P. (1990). *Pragmatism: From Peirce to Davidson*. Boulder, CO: Westview Press.
Mustaffa, N.H. & Potter, A., (2009). Healthcare supply chain management in Malaysia: a case study. *Supply Chain Management: An International Journal*. 14 (3), 234–243.
Myers, D. (2008). *Construction economics a new approach* (2nd ed.). London: Taylor & Francis.
Nahmias, S. & Olsen, T.L. (2015). *Production and Operations Analysis* (Seventh Edition). Waveland Press, Inc.
Nandi, S. & Banwet, D. (2000). Benchmarking for world class manufacturing – concept, framework and applications. P*roductivity*, 41(2), 189-200.
Narayana, S., Kumar Pati, R., & Vrat, P. (2014). Managerial research on the pharmaceutical supply chain – A critical review and some insights for future directions. *Journal Of Purchasing And Supply Management*, 20(1), 18-40. http://dx.doi.org/10.1016/j.pursup.2013.09.001
National Organisation for Medicines. (2016). *The Organisation's aim and objectives*. Retrieved from: https://www.eof.gr/web/guest/information
Naufal, A., Jaffar, A., Yusoff, N. & Hayati, N., (2012). Development of Kanban System at Local Manufacturing Company in Malaysia - Case Study, *Procedia Engineering*, 41(1). 721 – 1726.
Ndubisi, N.O., Jantan, M., Hing, L.C. &Ayub, M.S. (2005) Supplier selection and management strategies and manufacturing flexibility. *Journal of Enterprise Information Management.* 18(3), 330-49.

New Hampshire Department of Environmental Services, (2009) *How to address unwanted medicine disposal in New Hampshire*. Available at: http://des.nh.gov/organization/commissioner/pip/publications/wmd/documents/unused_medicine.pdf (accessed 28 May 2009).

Newman, W. L. (2014). *Social research methods: qualitative and quantitative approaches*. Essex, UK: Pearson.

NHS Confederation (2002), *Creating High Performance – Why is It So Hard?*, No. 4, Leading Edge Series, NHS Confederation, London.

NHS England. (2013). *Improving Health and Patient Care through Community Pharmacy-Evidence Resource Pack*. Retrieved from: https://www.england.nhs.uk/wp-content/uploads/2013/12/comm-pharm-res-pack.pdf

Nicholson, L., Vakharia, A.J. & Erenguc, S.S. (2004). Outsourcing inventory management decisions in healthcare: models and application. *European Journal of Operational Research*, 154(1), 271-90.

Niglas, K. (2010). *The multidimensional model of research methodology: An integrated set of continua,* in A. Tashakkori and C. Teddlie (eds) The Sage Handbook Of Mixed Methods In Social and Behavioral Research. Thousand Oaks, CA: Sage Publications, pp. 215-36.

Nikitas, A., Avineri, E., & Parkhurst, G. (2011). Older people's attitudes to road charging: are they distinctive and what are the implications for policy?. *Transportation planning and technology*, 34(1), 87-108.

Nulty, D. (2008). The adequacy of response rates to online and paper surveys: what can be done?. *Assessment & Evaluation In Higher Education*, 33(3), 301-314. http://dx.doi.org/10.1080/02602930701293231

Nunes. V., Neilson. J., O'Flynn. N., Calvert. N., Kuntze. S., Smithson. H., Benson. J., Blair. J., Bowser. A., Clyne. W., Crome. P., Haddad. P., Hemingway. S., Horne. R., Johnson. S., Kelly. S, Packham. B., Patel. M. & Steel, J. (2009). *Clinical Guidelines and Evidence Review for Medicines Adherence: Involving patients in decisions about prescribed medicines and supporting adherence*. London: National Collaborating Centre for Primary Care and Royal College of General Practitioners.

Nunnaly, J. C& Bernstein, I. H. (1994) *Psychometric theory*. 3rd edn. New York: McGrawn-Hill.

O'Reilly, M., & Parker, N. (2012). Unsatisfactory saturation: A critical exploration of the notion of saturated sample sizes in qualitative research. *Qualitative Research Journal*, 1-8. doi:10.1177/1468794112446106

Odier, N. (2010) The US health-care system: A proposal for reform. *Journal of Medical Marketing*. 10, 279 – 304.

OECD Health Data (2013), *The European federation of pharmaceutical Industries and Associations (EFPlA) calculations* (non-weighted average for 23 Eu & EFTA countries). Retrieved from: http://www.efpia.eu/uploads/Figures_2014_Final.pdf

OECD Health Data. (2010). *Eco-Santé OCDE 2010 Version*: October 2010. Accessed 29 October 2010.

OECD Health Statistics. (2014a). *How does the United Kingdom compare?*. Retrieved from: http://www.oecd.org/unitedkingdom/Briefing-Note-UNITED-KINGDOM-2014.pdf

OECD Health Statistics. (2014b). *How does Greece compare?*. Retrieved from: http://www.oecd.org/els/health-systems/Briefing-Note-GREECE-2014.pdf

OECD Health Statistics. (2015a). *Country Note: How does health spending in the United Kingdom compare?* Retrieved from: http://www.oecd.org/health/health-systems/Country-Note-UNITED%20KINGDOM-OECD-Health-Statistics-2015.pdf

OECD Health Statistics. (2015b). *Country Note: How does health spending in Greece compare?* Retrieved from: http://www.oecd.org/health/health-systems/Country-Note-GREECE-OECD-

Health-Statistics-2015.pdf
OECD Health Statistics. (2015c). *Focus on Health Spending*. Retrieved from: https://www.oecd.org/health/health-systems/Focus-Health-Spending-2015.pdf
Ohno, T. (1988). *The Toyota production system: Beyond large-scale production*. Portland, OR: Productivity Press.
Oke, A., Burke, G. & Myers, A. (2007). Innovation types and performance in growing UK SMEs. *International Journal of Operations & Production Management*. 27(7), 735-53.
Omachonu, V.K. & Einspruch,N.G. (2010). Innovation in Healthcare Delivery Systems: A Conceptual Framework. *The Innovation Journal: The Public Sector Innovation Journal*, 15(1).
Ouma, A., Njeru, A., & Dennis, J. (2015). Effect of KAIZEN on Managing Cost Levels in the Pharmaceutical Industry in Kenya. *International Journal of Academic Research in Business and Social Sciences*, 5(9).
Page, T. (2014). Notions of innovation in healthcare services and products. *International Journal of Innovation and Sustainable Development.* 8(3), 217-231.
Pålsson, H., & Kovács, G. (2014). Reducing transportation emissions. *International Journal Of Physical Distribution & Logistics Management*, 44(4), 283-304.
Papalexi, M., Bamford, D. & Dehe, B. (2015). A case study of Kanban implementation within the Pharmaceutical Supply Chain. *International Journal of Logistics Research and Applications*. 1-17, ISSN 1367-5567.
Papalexi, M., Breen, L., Bamford, D. & Tipi, N. (2014). *A preliminary examination of the deployment of lean and reverse logistics within the pharmaceutical supply chain (PSC) UK.* In: LRN Annual Conference and PhD Workshop 2014, 3-5th September 2014, University of Huddersfield
Papanikolaou, V., & Zygiaris, S. (2012). Service quality perceptions in primary health care centers in Greece. *Health Expectations*, 17(2), 197-207.
Pappa, E. & Niakas, D. (2006). Assessment of health care needs and utilization in a mixed public-private system: the case of the Athens area. *BMC Health Services Research*. 6, 146.
Pati, R.K., Vrat, P. & Kumar, P. (2008) A goal programming model for paper recycling system. *OMEGA: International Journal of Management Science*. 36(3), 405-417.
Paulraj, A., (2011). Understanding the relationships between internal resources and capabilities, sustainable supply management and organizational sustainability. *Journal of Supply Chain Management*, 47, 19-37.
Paunov, C. (2012). The global crisis and firms' investments in innovation. *Research Policy*, 41(1), 24-35. http://dx.doi.org/10.1016/j.respol.2011.07.007
Pazirandeh, A. (2011). Sourcing in global health supply chains for developing countries: literature review and a decision making framework. *International Journal of Physical Distribution and Logistics Management*. 41(4), 364–384.
Penrose, E.T., (1959), *The thery of the growth of the firm*, New York: Wiley
Peppard, J. & Ward, J. (2004). Beyond strategic information systems: towards an IS capability. *Strategic Information Systems*. 13, 167- 94.
Perez-Araos, A., Barber, K.D., Munive-Hernandez, J.E. & Eldridge, S. (2007). Designing a knowledge management tool to support knowledge sharing networks. *Journal of Manufacturing Technology Management*, 18(2), 153-168.
Persona, A., Battini, D., & Rafele, C. (2008). Hospital efficiency management: the just-in-time and Kanban technique. *International Journal Of Healthcare Technology And Management*, 9(4), 373.
Perunović, Z., Christoffersen, M., & Mefford, R. (2012). Deployment of vendor capabilities and competences throughout the outsourcing process. *International Journal Of Operations & Production Management*, 32(3), 351-374. http://dx.doi.org/10.1108/01443571211212619

Pettersen, J. (2009). Defining Lean production: Some conceptual and practical issues. *The TQM Journal*, 21(2), 127-142.
Petty, N., Thomson, O., & Stew, G. (2012). Ready for a paradigm shift? Part 2: Introducing qualitative research methodologies and methods. *Manual Therapy*, 17(5), 378-384. http://dx.doi.org/10.1016/j.math.2012.03.004
Pfeffer, J. & Sutton, R.I. (2013). *The knowing-doing gap: How smart companies turn knowledge into action*. Harvard Business School Press, Boston, Massachusetts.
Pierson, F.C. (1959). *The education of American businessmen*. New York, NY: Wiley.
Plano Clark, V.L. & Creswell, J.W. (2008). *The mixed methods reader*. London: Sage.
Plsek, P. & Greenhalgh, T. (2001). Complexity science: The challenge of complexity in health care. *British Medical Journal*, 323(7313), 625-628. http://dx.doi.org/10.1136/bmj.323.7313.625
Poba-Nzaou, P., Uwizeyemungu, S., Raymond, L. & Paré, G. (2012). Motivations underlying the adoption of ERP systems in healthcare organizations: Insights from online stories. *Information Systems Frontiers*, 16(4), 591-605.
Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y. & Podsakoff, N. P. (2003) Common Method Biases in Behavioral Research: A Critical Review of the Literature and Recommended Remedies, *Journal of Applied Psychology*, 88(5), 879-903.
Pomerantz, J.M. (2004) *Recycling expensive medication: Why not?* Retrieved from: http://www.ncbi.nlm.nih.gov
Porter, M. E. (1980). *Competitive strategy*, The Free Press.
Porter, M.E. & Teisberg, E.O. (2006). *Redefining health care: Creating value-based competition on results*. Harvard Business School Press, Boston, Mass, pp. xvii, 506.
Powell, Davies G., Williams, A.M., Larsen, K., Perkins, D., Roland, M. & Harris, M.F. (2008). Coordinating primary health care: an analysis of the outcomes of a systematic review. *Medical Journal of Australia*, 188(8), S65–S68. Retrieved from: www.mja.com.au/public/issues/188_08_210408/pow11099_fm.html (accessed on 13 March 2013).
Prahinski, C. & Kocabasog˘lu, C. (2006) Empirical research opportunities in reverse supply chains. *Omega*. 34(6), 519-32.
Priem, R. & Swink, M. (2012). A Demand-side Perspective on Supply Chain Management. *Journal Of Supply Chain Management*, 48(2), 7-13. http://dx.doi.org/10.1111/j.1745-493x.2012.03264.x
Proudlove, N., Moxham, C. & Boaden, R. (2008) Lessons for Lean in Healthcare from Using Six Sigma in the NHS. *Public Money & Management*. 28(1), 27-34.
Provan, K.G. & Kenis P. (2008). Modes of network governance: Structure, management, and effectiveness. *Journal of Public Administration Research and Theory*, 18 (2), 229–252
Qrunfleh, S. & Tarafdar, M. (2014). Supply chain information systems strategy: Impacts on supply chain performance and firm performance. *International Journal Of Production Economics*, 147, 340-350. http://dx.doi.org/10.1016/j.ijpe.2012.09.018
Qrunfleh, S., & Tarafdar, M. (2013). Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement. *Supply Chain Management: An International Journal*, 18(6), 571-582.
Quinn, J.B., (2000), 'Outsourcing innovation: the new engine of growth', *Sloan Management Review*, 41, 13-28
Raab, S.S., Andrew-JaJa, C., Condel, J. & Dabbs, D. (2006) Improving Papanicolaou test quality and reducing medical errors by using Toyota production system methods. *American Journal of Obstetrics and Gynecology*. 194, 57–64.
Radnor, Z. & Barnes, D. (2007). Historical analysis of performance measurement and management in operations management. *International Journal of Productivity and Performance*

Management, 56(5), 384-396.
Radnor, Z. & Osborne, S. (2013). Lean: A failed theory for public services?. *Public Management Review*, 15(2), 265-287. http://dx.doi.org/10.1080/14719037.2012.748820
Radnor, Z. and Boaden, R. (2008). Editorial: Lean in the public services: panacea or paradox? *Public Money and Management*. 28(1), 3-6.
Radnor, Z., Walley, P., Stephens, A. & Bucci, G (2006) *Evaluation of the lean approach to business management and its use in the public sector* (summary report). Research Findings No.20, Scottish Executive, Office of Chief Researcher, Edinburgh.
Radnor, Z.J., Holweg, M. & Waring J. (2012). Lean in healthcare: the unfilled promise? *Social science & medicine*. 74(3), 364–371.
Raghupathi, W., & Raghupathi, V. (2014). Big data analytics in healthcare: promise and potential. *Health Information Science and Systems*, 2(1), 3.
Rai, A., Patnayakuni, R. & Seth, N. (2006). Firm performance impacts of digitally enabled supply chain integration capabilities. *MIS Quarterly* 30 (2), 225–246.
Ramsay, J. (2001). The Resource-Based Perspective, Rents, and Purchasing's Contribution to Sustainable Competitive Advantage. *Journal of Supply Chain Management*. 37 (3) 38-47
Richardson, E. & Pollock, A. M. (2010). Community pharmacy: moving from dispensing to diagnosis and treatment. *British Medical Journal*. 340, 1066-1068.
Richardson, H. A., Simmering, M. J. & Sturman, M. C. (2009) A tale of three perspectives: Examining post hoc statistical techniques for detection and correction of common method variance, *Organizational Research Methods*, 12(4), 762-800.
Riege, A. (2003). Validity and reliability tests in case study research: a literature review with "hands-on" applications for each research phase. *Qualitative Market Research: An International Journal*, 6(2), 75-86. http://dx.doi.org/10.1108/13522750310470055
Riezebos, J., Klingenberg, W., & Hicks, C. (2009). Lean Production and information technology: Connection or contradiction?. *Computers In Industry*, 60(4), 237-247. http://dx.doi.org/10.1016/j.compind.2009.01.004
Rivard-Royer, H., Landry, S. & Beaulieu, M. (2002). Hybrid stockless: a case study: lessons for health-care supply chain integration. *International Journal of Operations & Production Management*. 22(4), 412-24.
Roark, D.C. (2005). Managing the healthcare supply chain. *Nursing Management*, 36-40.
Robins, F. (2006) The challenge of TBL: a responsibility to whom? *Busi. Soc. Rev*. 111, 1–14.
Rogers, E.M., (2003). *Diffusion of Innovations*. NY Free Press.
Roland, M., McDonald, R., Sibbald, B., Boyd, A., Fotaki, M., Gravelle, H. & Smith, L. (2006). *Outpatient services and primary care. A scoping review of research into strategies for improving outpatient effectiveness and efficiency*. Report for the NHS Service Delivery and Organisation R&D Programme. London
Rosano, A., Lauria, L., Viola, G., Burgio, A., De Belvis, A.G., Ricciardi, W. (2011). Hospitalization for ambulatory care sensitive conditions and the role of primary care. *Italian Journal of Public Health*. 8(1), 77-88.
Rossetti, C., Handfield, R., & Dooley, K. (2011). Forces, trends, and decisions in pharmaceutical supply chain management. *International Journal Of Physical Distribution & Logistics Management*, 41(6), 601-622. http://dx.doi.org/10.1108/09600031111147835
Rostamy-Malkhalifeh, M., & Mollaeian, E. (2012). Evaluating performance supply chain by a new non-radial network DEA model with fuzzy data. *Data Envelopment Analysis And Decision Science*, p.1-9.
Roth, A. & Menor, L. (2003). Insights into service Operations Management: A research agenda.

Production and Operations Management, 12(2), 145-164. http://dx.doi.org/10.1111/j.1937-5956.2003.tb00498.x
Roulston, K. (2010), *Reflective Interviewing: A Guide to Theory and Practice*, Sage, London.
Rowley, J. (2012). Conducting research interviews. *Management Research Review*, 35(3/4), 260-271.
Rowley, J., Baregheh, A. & Sambrook, S. (2011). Towards an innovation-type mapping tool. *Management Decision*, 49(1), 73 – 86.
Rowley, J., Jones, R., Hanna, S. & Vasileiou, M. (2012), Using card-based games to enhance the value of semi-structured interviews, *International Journal of Market Research*, 54 (1).
Rudberg, M & West, M. (2008) Global Operations Strategy: Coordinating Manufacturing Networks. OMEGA: *the Intl. J. of Management Science*, 36, 91-106
Rumelt, R. (2003). *What in the World is Competitive Advantage?*. The Anderson School at UCLA
Rupnow, P. (2007) *Using reverse logistics standards to improve your operations. Reverse Logistics Association News Letter*. 34, Retrieved from: daily@rltinc.com
Rushton, A., Croucher, P., & Baker, P. (2014). *The handbook of logistics and distribution management.* London: KoganPage.
Ryals, L.J. & Humphries, A.S. (2010). Efficiency versus value maximisation in comanufacturing relationships, *The International Journal of Logistics Management*, 21(2), 309 - 330
Ryan, R.J., Scapens, R.W. & Theobald, M. (2002). *Research methods and methodology in accounting and finance* (2nd ed.). London: Thomson Learning.
Rye & Kimberly, (2007). The adoption of innovations by provider organisations in health care. *Medical Care Research and Review*. 64(3), 235-278.
Rytter, N.G., Boer, H. & Koch, C. (2007). Conceptualizing operations strategy processes. *International Journal of Operations & Production Management*, 27(10), 1093-1114.
Saldaña, J. (2013). *The coding manual for qualitative researchers*. Los Angeles [i.e. Thousand Oaks, Calif]: SAGE Publications.
Sale, J.E.M., Lohfeld, L.H. & Brazil, K. (2002). Revisiting the Quantitative-Qualitative Debate: Implications for Mixed-Methods Research. Quality & Quantity. 36, 43-53.
Saloner, G., Shepard, A. & Podolny, J. (2001). *Strategic Management*. John Wiley & Sons, New York.
Samuel, C., Gonapa, K., Chaudhary, P., & Mishra, A. (2010). Supply chain dynamics in healthcare services. *International Journal Of Health Care Quality Assurance*, 23(7), 631-642.
Sanchez-Rodrigues, V., Potter, A. & Naim, M.M. (2010). Evaluating the causes of uncertainty in logistics operations. *The International Journal of Logistics Management*, 21(1), 45 - 64
Sandø, A.D., Aanes, S.G., Slordal, L. & Spigset, O. (2010). Routines for first prescription or oral contraceptives. *Tidsskr Nor Laegeforen* 130, 2344–2348.
Sang M. L., DonHee L. & Schniederjans M. J., (2011), Supply chain innovation and organizational performance in the healthcare industry, *International Journal of Operations & Production Management*, 31(11) 1193 – 1214.
Sarac, A., Absi, N., & Dauzère-Pérès, S. (2010). A literature review on the impact of RFID technologies on supply chain management. *International Journal of Production Economics*, 128, 77–95.
Sartori G (2010) *Reverse logistics role in securing the pharmaceutical supply chain*. Retrieved from: http://www.rlmagazine.com/edition16p18.php
Saunders, M., Lewis, P. & Thornhill, A. (2009) *Research methods for business students*. 5th edn. Harlow: Prentice Hall.
Saunders, M., Lewis, P. & Thornhill, A. (2012). *Research Methods For Business Students*. Harlow, England: Pearson, 2012. Print.
Saunders, M., Lewis, P. & Thornhill, A. (2015) *Research methods for business students*. 7th edn.

Harlow: Prentice Hall.
Savage, C.J., Roberts, K.J., & Wang, X.Z. (2006) A holistic analysis of pharmaceutical manufacturing and distribution: are conventional supply chain techniques appropriate? *Pharmaceutical Engineering*. 26(4), 10-18.
Savary, L. & Crawford-Mason, C. (2006) *The Nun and the Bureaucrat: How they Found an Unlikely Cure for America's Sick Hospitals*. CC-M Productions, Washington, DC.
Savignac, F. (2008). Impact of financial constraints on innovation: what can be learned from a direct measure? *Economics of Innovation and New Technology*, 17 (6) 553–569.
Scavo, F. (2011). *The enterprise system spectator: ERP market on the rebound*, Retrieved from: http://fscavo.blogspot.com/2004/05/erp-market-onrebound.html
Schadewaldt V., McInnes E., Hiller J.E. & Gardner A. (2013) Views and experiences of nurse practitioners and medical practitioners with collaborative practice in primary health care – an integrative review. *BMC Family Practice* 14, 132.
Schadewaldt, V., McInnes, E. Hiller, J.E. & Gardner, A. (2014). Investigating characteristics of collaboration between nurse practitioners and medical practitioners in primary health care: a mixed methods multiple case study protocol. *Journal of Advanced Nursing* 70(5), 1184–1193
Scheller, E.S. & Smeltzer, L.R. (2006). *Strategic Management of the Health Care Supply Chain*, 1st ed., Wiley, San Francisco, CA.
Schneider, A., Hommel, G. & Blettner, M. (2010). Linear regression analysis, part 14 of a series on evaluation of scientific publications. *Deutsches Ärzteblatt International Journal*. 107(44), 776–82. DOI: 10.3238/arztebl.2010.0776
Schwandt, T. A. (2001) *The Sage dictionary of qualitative inquiry*. Thousand Oaks, CA: Sage.
Sciarrotta, T. (2003) How Philips reduced returns. *Supply Chain Management Review*. 7(6), 32-8.
Scottish Government (2010) *The Healthcare Quality Strategy for NHS Scotland*, Edinburgh: The Scottish Government.
Sehgal, V. (2010). *Postponement as Supply Chain Strategy. Supply Chain Musings.* Retrieved from:http://www.supplychainmusings.com/2010/10/postponement-as-supply-chain-strategy.html
Seifert, D. (2003). *Collaborative planning, forecasting, and replenishment: how to create a supply chain advantage*, New York, AMACOM.
Sen, M., Chaudhury, A., Singh, R., John, J. & Ramachandran, R. (2013). Multi-scale flow sheet simulation of an integrated continuous purification–downstream pharmaceutical manufacturing process. *International Journal of Pharmaceutics*. 445, 29-38
Senturia, T., Flees, L., & Maceda, M. (2008). *Leading change management requires sticking to the PLOT*. London: Bain.
Seuring, S., & Gold, S. (2012). Conducting content-analysis based literature reviews in supply chain management. *Supply Chain Management: An International Journal*, 17(5), 544-555.
Shah, N. (2004). Pharmaceutical supply chains: key issues and strategies for optimisation. *Computers & Chemical Engineering*. 28(6/7), 929-41.
Shah, R., Goldstein, S., & Ward, P. (2002). Aligning supply chain management characteristics and interorganizational information system types: an exploratory study. *IEEE Transactions On Engineering Management*, 49(3), 282-292. http://dx.doi.org/10.1109/tem.2002.803382
Shao, X.-F., & Ji, J.-H., (2008). Evaluation of postponement strategies in mass customization with service guarantees. *International Journal of Production Research* 46 (11), 153–171.
Shapiro, J. F. (2001). *Modeling the supply chain,* Pacific Grove, Calif., Duxbury/Thomson Learning.
Sheng, Q. Z., Zeadally, S., Mitrokotsa, A., & Maamar, Z. (2011). RFID technology, systems, and applications. *Journal of Network and Computer Applications*, 34, 797–798.
Shewhart, W.A. (1939). *Statistical method from the viewpoint of quality control*. Dover Publications:

New York
Shih, S., Rivers, P. & Sonya Hsu, H. (2009), Strategic information technology alliances for effective health-care supply chain management, *Health Care Management Research*, 22 (3):140-50.
Shingo, S. (1986). *Zero quality control: Source inspection and the Poka-Yoke system*. Cambridge, MA: Productivity Press.
Shortliffe, E.H. (2005). Strategic action in health information technology: why the obvious has taken so long, *Health Affairs*, 24 (5), 1222–1233.
Siegel, D. S. (2009) Green management matters only if it yields more green: an economic/strategic perspective. *Academy of Management Perspectives*. 5–16.
Silverman, D. (2010), *Doing Qualitative Research: A Practical Handbook*, 3rd ed., Sage, London.
Silverman, D. (2011) *Interpreting Qualitative Data*. London, UK: Sage.
Simchi-Levi, D., Kaminsky, P. & Simchi-Levi, E. (2008). *Designing and Managing the Supply Chain: Concepts, Strategies and Case Studies*. McGraw-Hill, New York, NY.
Simon, J., Rundall, T., & Shortell, S. (2007). Adoption of Order Entry with Decision Support for Chronic Care by Physician Organizations. *Journal Of The American Medical Informatics Association*, 14(4), 432-439. http://dx.doi.org/10.1197/jamia.m2271
Simons H. (2009) Case Study Research in Practice. SAGE, Los Angeles CA; London UK.
Singh, C. D., Singh, R., Mand, J. S. and Singh, S. (2013). Application of Lean and JIT principles in Supply Chain Management. *International Journal of Management Research and Business Strategy*. 2(1), 2319-345.
Singh, R. & Wood-Harper, T. (2011). *The socio-technical balanced scorecard for assessing a public university.* In E. Alkhalifa (Eds), E-Strategies for Resource Management Systems: Planning and Implementation (pp.47-60). Hershey, PA.: IGI, Global.
Singhal, J. & Singhal, K. (2007). Holt, Modigliani, Muth, and Simon‟s work and its role in the renaissance and evolution of operations management. *Journal of Operations Management*, 25, 300-309.
Sirmon, D. G., Hitt, M. A., Ireland, R. D., & Gilbert, B. A. (2011). Resource orchestration to create competitive advantage: Breadth, depth, and life cycle effects. *Journal of Management*, 37 (5), 1390–1412.
Sjoberg, D., Johnsen, A., & Solberg, J. (2012). Quantifying the Effect of Using Kanban versus Scrum: A Case Study. *IEEE Softw*. 29(5), 47-53. http://dx.doi.org/10.1109/ms.2012.110
Skinner, L.R., Bryant, P.T. & Richey, R.G. (2008) Examining the impact of reverse logistics disposition strategies. *International Journal of Physical Distribution and Logistics Management*. 38(7), 518–539.
Slack, N. & Lewis, M. (2011). *Operations Strategy* (3rd edition). Harlow: Financial Times Prentice Hall.
Slack, N., Chambers, S. & Johnston, R. (2010). *Operations management* (6th ed.). Harlow: FT Prentice Hall.
Slack, N., Chambers, S., Johnston, R. & Betts, A. (2006). O*perations and process management*. London: FT Prentice-Hall.
Sliwa, M. & Wilcox, M. (2008). Philosophical thought and the origins of quality management: Uncovering conceptual underpinnings of W.A. Shewhart's ideas on quality. *Culture and Organization*, 14(1), 97-106.
Smeds, R. (2001). Implementation of business process innovations: an agenda for research and action, *International Journal of Technology Management*, 22, 1-12.
Smith, L. 2006. West marine: a CPFR success story. *Supply chain management review*, 10 (2),29-36
Smits, M., Wagner, C., Spreeuwenberg, P., van der Wal, G., & Groenewegen, P. (2009). Measuring patient safety culture: an assessment of the clustering of responses at unit level and hospital level. *Quality And Safety In Health Care*, 18(4), 292-296.

Solberg, C., Rossetto, T., & Joffe, H. (2010). The social psychology of seismic hazard adjustment: re-evaluating the international literature. *Natural Hazards & Earth Systems Sciences*, 10, 1663-1677.
Souliotis, K. & Lionis, C. (2005) Creating an integrated health care system in Greece: a primary care perspective. *Journal of Medical Systems*. 29(2):187–96.
South, S. (1998). *Managing returned freight*. Inbound Logistics, 18(12), 48.
Spear, S.J. (2005), Fixing health care from the inside‖, *Harvard Business Review*, 83, 78-91.
Spector, P. (1992) Summated rating scale construction. Thousand Oaks, CA: Sage.
Spender, J.C. (2014). *Business Strategy: Managing Uncertainty, Opportunity, and Enterprise*. Oxford University Press
Sprague, L. (2007). Evolution of the field of operations management. *Journal of Operations Management*, 25, 219-238.
Statista. (2016a). *Global spending on medicines from 2010 to 2020* (in billion U.S. dollars). Retrieved from:http://www.statista.com/statistics/280572/medicine-spending-worldwide/
Statista. (2016b). *Change in revenue on the global pharmaceutical market from 2010 to 2014, by region*. Retrieved from: http://www.statista.com/statistics/266482/world-pharmaceutical-market-change-in-revenue-by-region/
Stavrulaki, E. & Davis, M. (2010). Aligning products with supply chain processes and strategy. *The International Journal of Logistics Management*, 21(1), 127 -151
SteelFisher, G.K. (2005). *International innovations in health care: quality improvements in the United Kingdom.* The Commonwealth Fund.
Stirman S.W., Kimberly J., Cook N., Calloway A., Castro F. & Charns M. (2012). The sustainability of new programs and innovations: a review of the empirical literature and recommendations for future research. *Implementation Science* 7, 19.
Swafford, P.M., Ghosh, S., & Murthy, N., (2006). The antecedents of supply chain agility of a firm: scale development and model testing. *Journal of Operations Management* 24 (2), 170–188.
Tabachnick, B.G. & Fidell, L.S. (2007). *Using multivariate statistics*. Boston, MA: Pearson/Allyn & Bacon.
Talluri, S. & Sarkis, J. (2001). A computational geometry approach for benchmarking. *International Journal of Operations & Production Management*, 21(1/2), 210-222.
Tashakkori, A. & Creswell, J. W. (2007a). The new era of mixed methods. *Journal of Mixed Methods Research*, 1(1), 3-7.
Tashakkori, A. & Creswell, J. W. (2007b). Exploring the nature of research questions in mixed methods research. *Journal of Mixed Methods Research*, 1(3), 207-11.
Tashakkori, A. & Teddlie, C. (1998) *Mixed Methodology: Combining Qualitative and Quantitative Approaches.* Thousand Oaks, CA: Sage.
Taylor, F.W. (1911). *The principles of scientific management*. New York, NY: Harper.
Teddlie, C. & Tashakkori, A. (2009). *Foundations of Mixed Methods Research*. Los Angeles: Sage.

Teece, D. J., (1980). The diffusion of an administrative innovation, *Management Science*, 26, 464.
Teece, D., Pisano, G. & Shuen, A. (1997) Dynamic capabilities and Strategic management. *Strategic Management Journal*. 18(7), 509-33
Theodorou, M., Tsiantou, V., Pavlakis, A., Maniadakis, N., Fragoulakis, V., Pavi, E., & Kyriopoulos, J. (2009). Factors influencing prescribing behaviour of physicians in Greece and Cyprus: results from a questionnaire based survey. *BMC Health Services Research*, 9(1), 150. http://dx.doi.org/10.1186/1472-6963-9-150
Thomas, P. & While, A. (2007) Should nurses be leaders of integrated health care? *Journal of Nursing Management.* 15(6), 643–8.

Tidd, J. & Bessant, J. (2009) *Managing Innovation: Integrating Technological, Market and Organizational Change,* 4th edition. Chichester: John Wiley

Tidd, J., Bessant, J. & Pavitt, K. (2005). *Managing innovation: integrating technological, market and organizational change,* John Wiley & Sons, Chichester

Timmons, S., Coffey, F., & Vezyridis, P. (2014). Implementing lean methods in the Emergency Department. *Journal Of Health Organization And Management*, 28(2), 214-228. http://dx.doi.org/10.1108/jhom-10-2012-0203

Tiwari, A.K., Mohnen, P., Palm, F.C., van der Loeff, S.S., (2007). *Financial Constraints and R&D Investment: Evidence from CIS.* UNU-MERIT Working Paper, United Nations University.

Tomkins, C. & Groves, R. (1983). The everyday accountant and researching his reality. *Accounting, Organizations and Society*, 8(4), 361-374.

Toussaint, J. (2009) Writing The New Playbook For U.S Health Care: Lessons From Wisconsin. *Health Affairs*. 28(5), 1343-1350.

Tran, N., Hu, J., Li, J., & Ong, S. (2014). Suitability of artificial sweeteners as indicators of raw wastewater contamination in surface water and groundwater. *Water Research*, 48, 443-456.

Transparency Market Research. (2014). *Medical Waste Management Market: Global Industry Analysis, Size, Share, Growth, Trends and Forecast, 2013 – 2019*. Retrieved from:http://www.researchandmarkets.com/reports/2851715/medical-waste-management-market-global-industry#relb0

Trochim, W. M. & Donnelly, J. P. (2008) *The research methods knowledge base*. Mason, OH: Cengage Learning.

Tsiknakis, M., & Kouroubali, A. (2009). Organizational factors affecting successful adoption of innovative eHealth services: A case study employing the FITT framework. *International Journal of Medical Informatics*, 78(1), 39–52.

Tuckett, A. G. (2005). Applying thematic analysis theory to practice: A researcher's experience. *Contemporary Nurse*, 19(1-2), 75-87.

Tushman, M.L. & Anderson, P. (2004). *Managing strategic innovation and change* (2nd ed.). Oxford: Oxford University Press.

Ulhassan, W., Westerlund, H., Thor, J., Sandahl, C., & von Thiele Schwarz, U. (2014). Does Lean implementation interact with group functioning?. *Journal Of Health Organization And Management*, 28(2), 196-213. http://dx.doi.org/10.1108/jhom-03-2013-0065

Usunier, J.-C. (1998) *International and Cross-Cultural Management Research* UK, London: Sage.

Uthayakumar, R. & Priyan, S. (2013). Pharmaceutical supply chain and inventory management strategies: Optimization for a pharmaceutical company and a hospital. *Operations Research For Health Care*, 2(3), 52-64. http://dx.doi.org/10.1016/j.orhc.2013.08.001

Vaismoradi, M., Jones, J., Turunen, H., & Snelgrove, S. (2016). Theme development in qualitative content analysis and thematic analysis. *Journal of Nursing Education and Practice*, 6(5).

Van Lent, W., Goedbloed, N. & Van Harten, W. (2009) Improving the efficiency of a chemotherapy unit: applying a business approach to oncology. *European Journal of Cancer*. 45, 800–806.

Van Ruth, L., Francke, A.L. & Mistiaen, P. (2008). Effects of nurse prescribing of medication: a systematic review. *The Internet Journal Of Healthcare Administration*. 5 (2), http://dx.doi.org/10.5580/11e.

Velamuri, V., Neyer, A.K. & Moeslein, K.M. (2008). *What influences the design of hybrid products? Lessons learned from the preventive health-care industry*. Paper presented at EURAM, Ljubljana, May.

Velayutham, S., Aldridge, J., & Fraser, B. (2012). Gender differences in student motivation and self-regulation in science learning: A multi-group structural equition modelling analysis. *International Journal of Science and Mathematics Education*, 10(6), 1347-1368.

http://dx.doi.org/10.1007/s10763-012-9339-y
Veral, E. & Rosen, H. (2001). Can a focus on costs increase costs? *Hospital materiel management quarterly*. 22, 28–35.
Vermeulen, M., Stukel, T., Guttmann, A., Rowe, B., Zwarenstein, M., & Golden, B. (2014). Evaluation of an Emergency Department Lean Process Improvement Program to Reduce Length of Stay. *Annals Of Emergency Medicine*, 64(5), 427-438.
Vermeulen, W. (2003). Benchmarking as an enabler of business excellence in the South African financial sector. *Benchmarking: An International Journal*, 10(1), 65-72.
Vigtil, A. (2007). Information exchange in vendor managed inventory. *International Journal of Physical Distribution & Logistics Management.* 27(2), 131-47.
Vilko J. P.P. & Hallikas, J.M. (2012). Risk assessment in multimodal supply chains. *International Journal of Production Economics*.140, 586–595.
Visich, J., Li, S., Khumawala, B., & Reyes, P. (2009). Empirical evidence of RFID impacts on supply chain performance. *International Journal Of Operations & Production Management*, 29(12), 1290-1315.
Voss, C. A. (1984). Production/Operations Management - a Key Discipline and Area for Research. *Omega*, 12(3) 309-319.
Voss, C.A. (1995). Operations management from Taylor to Toyota – and beyond?. *British Journal of Management*, 6(December, Special Issue), S17-S29.
Voss, C.A., Ahlstrom, P. & Blackmon, K. (1997). Benchmarking and operational performance: Some empirical results. *International Journal of Operations & Production Management*, 17(10), 1046-1058.
Voura, C., Schroedl, N., Gruber, M.M., Strohmeier, D., Eitzinger, B., Bauer, W., Brenn, G., Khinast, J.G. & Zimmer, A., (2011). Printable medicines: a microdosing device for producing personalised medicines. Pharm. *Technol. Eur*. 23, 32–36.
Vozikis, A., Stavropoulou, L. & Patrinos, G.P. (2015). Community Pharmacists' Strategies in Greece: An Assessment of the Policy Environment and the Mapping of Key Players. *Scientific Research Publishing* Inc. Retrieved from: http://file.scirp.org/pdf/Health_2015111810280221.pdf
Walker, J. L. (2012). The use of saturation in qualitative research. *Canadian Journal of Cardiovascular Nursing*, 22(2), 37-46. Retrieved from http://www.cccn.ca
Walker, J., & Carayon, P. (2009). From Tasks To Processes: The Case For Changing Health Information Technology To Improve Health Care. *Health Affairs*, 28(2), 467-477. http://dx.doi.org/10.1377/hlthaff.28.2.467
Wamba, S., Anand, A., & Carter, L. (2013). RFID Applications, Issues, Methods and Theory: A Review of the AIS Basket of TOP journals. *Procedia Technology*, 9, 421-430.
Wang, Z., Zhang, X., Huang, Y., & Wang, H. (2015). Comprehensive evaluation of pharmaceuticals and personal care products (PPCPs) in typical highly urbanized regions across China. *Environmental Pollution*, 204, 223-232.
Warnock, D. (2000). Understanding strategy. *Strategy & Leadership*, 28(5), 25.
Waters, C. (2009). *Supply chain management*. Basingstoke [England]: Palgrave Macmillan.
Waters, D. (2007). *Trends in the supply chain, in Global logistics* (5th edition), Kogan Page, London.
Wears, R.L. (2005). Computer technology and clinical work still waiting for godot, JAMA: *The Journal of the American Medical Association*. 293 (10), 1261–1263.
Weaver, K. & Olson, J.K. (2006). Understanding Paradigms Used For Nursing Research. *Journal of Advanced Nursing* 53.4: 459-469.
Weber, B. (2016). *Infrastructure as an Asset Class: Investment Strategy, Sustainability*, Proj. John Wiley & Sons.
Weingart, S.N., Mattsson, T., Zhu J., (2012). Improving electronic oral chemotherapy prescription:

Can we build a safer system? *Journal Of Oncology Pharmacy Practice*. 8(6): 168–173.
Werbach, A. (2013). *Strategy for Sustainability: A Business Manifesto*. Boston, Mass.: Harvard Business Press.
Westrick, S., & Mount, J. (2009). Impact of perceived innovation characteristics on adoption of pharmacy-based in-house immunization services. *International Journal of Pharmacy Practice*, 17(1): 39-46.
Wheelwright, S., C. (1984). Manufacturing Strategy: Defining the Missing Link, *Strategic Management Journal*, 5, 77-91.
White, A. & Mohdzain, M. (2009), An innovative model of supply chain management: a single case study in the electronic sector, *International Journal of Information Technology and Management*, 8(1), 69-84.
Whitson, D. (1997). Applying just in time systems in health care. *IIE Solutions*. 29(6), 33-7.
Wietholter, J., Sitterson, S., & Allison, S. (2009). Effects of computerized prescriber order entry on pharmacy order-processing time. *American Journal Of Health-System Pharmacy*, 66(15), 1394-1398. http://dx.doi.org/10.2146/ajhp080303
Williams, I. & Bryan, S., (2007). Cost-effectiveness analysis and formulary decision making in England: findings from research. *Social Science and Medicine*. 65, 2116–2129.
Williams, I. & Dickinson, H., (2008). Knowledge for adoption: a review of the literature on knowledge-based facilitators of technology adoption in health care. *Health Services Management Centre*, University of Birmingham.
Williams, I. (2011) Organizational readiness for innovation in health care: some lessons from the recent literature. *Health Services Management Research*. 1–6.
Williamson, O.E. (1975) *Markets and Hierarchies*. New York: Free Press
Williamson, R., Meacham, L., Cherven, B., Hassen-Schilling, L., Edwards, P., & Palgon, M. Espinoza S. & Mertens A. (2014). Predictors of successful use of a web-based healthcare document storage and sharing system for pediatric cancer survivors: Cancer SurvivorLinkTM. *Journal Of Cancer Survivorship*, 8(3), 355-363. http://dx.doi.org/10.1007/s11764-014-0346-6
Wilson, T. & Holt, T. (2001). Complexity and clinical care. *British Medical Journal*, 323, 685-688.
Winsome, S.J. & Johnson, P. (2000). The Pros and Cons of Data Analysis Software for Qualitative Research. *Journal of Nursing Scholarship*. 32(4), 393-397.
Wisner, J., Tan, K.C. & Leong, G. (2015). *Principles of supply chain management: a balanced approach.* Cengage Learning
Wittink, M. N., Barg, F. K. & Gallo, J.J. (2006). Unwritten Rules of Talking to Doctors About Depression: Integrating Qualitative and Quantitative Methods. *Ann Fam Med* 4:302-309
Womack, J.P. & Jones, D.T. (1997). Apply Lean thinking to a value stream to create Lean enterprise. *Management Theory*, 11-14.
Wong, W. & Wong, K. (2008). A review on benchmarking of supply chain performance measures. *Benchmarking: An International Journal*, 15(1), 25-51.
Wood, D. (2014). A Prescription for Lean Healthcare. *Healthcare Quality*, 17(2), 24-28.
Woosley, J. (2009). *Improving healthcare supply chains and decision making in the management of pharmaceuticals*, Unpublished Doctoral Dissertation, Louisiana State University, Baton Rouge, LA.
World Bank. (2015). *World Development Indicators database*. Retrieved from: http://databank.worldbank.org/data/download/GDP.pdf
World Health Organisation, (2004) *WHO review of NICE in the United Kingdom*. WHO Drug Information. 17(4).
Wu, L. & Chiu, M.L. (2015). Organizational applications of IT innovation and firm's competitive performance: A resource-based view and the innovation diffusion approach. *Journal of Engineering and Technology Management*. 35, 25–44

Xie, Y. & Breen, L. (2012) Greening community pharmaceutical supply chain in UK: a cross boundary approach. *Supply Chain Management: An International Journal*. 7(1), 40–53.

Xie, Y. & Breen, L. (2014). Who cares wins? A comparative analysis of household waste medicines and batteries reverse logistics systems. *Supply Chain Management: An International Journal.* 19(4), 455–474.

Xtalks (2007) *Exploring the first stage implementation results of Pfizer's RFID pilot program*. Xtalks, Retrieved from: www.xtalks.com/rfidpharma0701.ashx

Yamamoto, Y., & Bellgran, M. (2013). Four Types of Manufacturing Process Innovation and their Managerial Concerns. *Procedia CIRP*, 7, 479-484.

Yang, B. & Yang, Y., (2010). Postponement in supply chain risk management: a complexity perspective. *International Journal of Production Research* 48 (7), 1–12.

Yoo, J.W., Lemak, D. & Choi, Y. (2006). Principles of management and competitive strategies: Using Fayol to implement Porter. *Journal of Management History*, 12(4), 352-368.

Young, G., Nyaga, G., & Zepeda, E. (2016). Hospital employment of physicians and supply chain performance. *Health Care Management Review*, 41(3), 244-255. http://dx.doi.org/10.1097/hmr.0000000000000074

Young, T. & McClean, S. (2009) Some challenges facing lean thinking in healthcare. *International Journal of Quality in Health Care*. 5, 309-10.

Yu, X., Li, C., Shi, Y. Yu, M. (2010). Pharmaceutical supply chain in China: current issues and implications for health system reform. *Health Policy*. 97(1), 8–15.

Zhang, S., Bamford, D., Moxham, C. & Dehe, B. (2012). Strategy deployment systems within the UK healthcare sector: A case study. *International Journal of Productivity and Performance Management*, 61, 863-888.

Zhou, L., Naim, M.M. & Wang, Y. (2007) Soft systems analysis of reverse logistics battery recycling in China. *International Journal of Logistics: Research and Applications*. 10(1), 57-70.

Zhu, Q., Sarkis, J. & Lai, K. (2012). Green supply chain management innovation diffusion and its relationship to organizational improvement: an ecological modernization perspective. *Journal of Engineering and Technology Management*. 29 (1), 168–185.

Zikmund, W., Babin, B., Carr, J. & Griffin, M. (2012) *Business research methods*. USA: Cengage Learning.

Zornitsky, J.J. (1995). Making Effective HRM a Hard Business Issue. *Compensation Benefits Management*. 2(1), 16-24.

Appendices

Appendix 1: Survey instrument

Deployment of innovation within the PSC

Page 1: Welcome

I would like to invite you to take part in the study named above. Your response will contribute to a PhD project on deployment of innovative programmes within the Pharmaceutical Supply Chain.

Purpose of the survey: The purpose of this survey is to collect information about innovative programmes within the Pharmaceutical Supply Chain in the UK. There has been pressure on the NHS, and generally on healthcare organisations, to keep a tight rein on their drugs spending. The annual drugs bill in the UK is approximately £10 billion, which equates to about 10% of NHS expenditure, having risen 3.5% a year between 2007 and 2011 (McKee, 2012). Therefore, pharmacies tend to concentrate on innovative programmes to reduce waste and costs, while improving quality of services (Odier, 2010). Hence, the aim of the study is to explore the impact of innovation upon productivity and performance over the last five years.

Please respond to all questions (unless otherwise instructed) as this will allow comparisons to be made between respondents.

To encourage your participation in the survey a prize is being offered which is a 8.3" Tablet: Tesco hudl 2. The winner will be selected via a random computerised draw selection process which will be carried out the next working day after the relevant close date.

Definition of Innovation: Innovation, for the purpose of this survey, is defined as new or significantly improved products, services or processes used to produce or supply any products or services that the organisation delivers. The innovation (new or improved) must be new to the organisation, but it does not need to be new to the healthcare sector. Information Required: Section 1 - Innovation Activities; Section 2 - Context for Innovation; Section 3 - General Information.

I would be very interested to hear your experiences. Please help by filling in the relevant box; it should only take 10-15 minutes of your time. Your answers will be kept anonymous and strictly confidential. If you would like any further information or details of the study, please contact: Marina Papalexi via email: M.papalexi@hud.ac.uk

Thank you for your participation and support!

Note that responses are not saved until you have clicked on the CONTINUE button at the bottom of each page. You cannot return to review or amend a previous page.

Mckee, S., (2012), 'NHS spend on new drugs set to shrink', PharmaTimes online magazine. Retrieved from http://www.pharmatimes.com/article/12-07- 03/NHS_spend_on_new_drugs_set_to_shrink.aspx
Odier, N., (2010), The US health-care system: A proposal for reform. *Journal of Medical Marketing*, 10, 279 – 304.

Page 2: Section 1 - Innovation Activities

The following questions are related to changes in organisation strategy and practices over the last five years; investments in current and future innovation and the introduction of new or improved products, services and processes.

This part of the survey uses a table of questions, view as separate questions instead?

1. To what extent the pharmacy has invested in any of the following, for the purposes of current or future innovation:

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Acquisition of advanced machinery, equipment and software for innovation:	○	○	○	○	○
Computer hardware	○	○	○	○	○
Computer software	○	○	○	○	○

This part of the survey uses a table of questions, view as separate questions instead?

2. For each of the main innovation related investments in question 2, please ESTIMATE the amount of expenditure. Where precise figures cannot be provided please give your best estimates

	£(annually)					
	0-5.000	**5.000-10.000**	**10.000-15.000**	**15.000-20.000**	**More than 20.000**	**I do not know**

Acquisition of advanced machinery, equipment and software for innovation						
Training for innovative activities						

This part of the survey uses a table of questions, view as separate questions instead?

3. To what extent the pharmacy has introduced

	Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**
New or significantly improved products					
New or significantly improved services/processes for delivering products					

This part of the survey uses a table of questions, view as separate questions instead?

4. Please ESTIMATE the percentage of the organisation's total turnover from products and services/process that were:

	0%-10%	**10%-20%**	**20%-30%**	**30%-40%**	**40%-50%**	**50%-60%**	**60%-70%**	**More than 70%**	**I do not know**
New to your market									
Significantly improved									
Total turnover									

Page 3: Section 2 - Context for Innovation

This part of the survey uses a table of questions, view as separate questions instead?

5. To what extent the following factors were important in your decision to innovate in products, services or processes

	Not Important at All	Somewhat Important	Neutral	Important	Very Important
Improved flexibility of production or service provision					
Reduced time to respond to customer or supplier needs					
Improved staff communication					
Enhanced staff or patient satisfaction					

This part of the survey uses a table of questions, view as separate questions instead?

6. To what extent information from each of the following sources was important to your organisation's innovation activities

	Not Important at All	Somewhat Important	Neutral	Important	Very Important
Your organisation					
Suppliers of equipment, materials,					

services or software	
Patients or end users	
Government or public research institutes	

This part of the survey uses a table of questions, view as separate questions instead?

7. To what extent your organisations co-operated on any innovation activities with any of the following

	Strongly Disagree	Disagree	No Opinion	Agree	Strongly Agree
Other healthcare organisations					
Suppliers of equipment, materials, services or software					
Patients or end users					

This part of the survey uses a table of questions, view as separate questions instead?

8. To what extent the following factors were important in constraining innovation activities

	Not Important at All	Somewhat Important	Neutral	Important	Very Important
Excessive perceived economic risks					

Direct innovation costs too high					
Availability of finance					

Page 4: Section 3 - General Information regarding yourself

Finally, please answer the following questions related to yourself. This will allow the assessment of your organisation's environment. We would like to remind you that the survey is anonymous and the following data will only be used for conducting the investigation.

9. Please indicate your current residence

- Greece
- The UK

10. What is your job title?

11. What is your work experience with the organisation?

- 0-5 years
- 6-10 years
- 11-15 years
- 16-20 years
- More than 20 years

12. What is your highest level of educational qualification?

- High school
- College diploma
- Professional qualification
- Undergraduate degree

Postgraduate Master's degree

PhD

13. In the box below, please write any additional comments that you would like to make

Please submit your contact information below to enter to win the prize

14. E-mail address

More info

Page 5: Final Page

Thank you for completing this survey.

Results will be available for you. If you are interested, please contact me Email:

M.papalexi@hud.ac.uk

Appendix 2: SPSS output - reliability tests

Access to information

Case Processing Summary

		N	%
Cases	Valid	127	97.7
	Excluded[a]	3	2.3
	Total	130	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.620	4

Item Statistics

	Mean	Std. Deviation	N
INFO_ORG	4.03	.917	127
INFO_SUPP	3.71	1.085	127
INFO_PATIENTS	3.62	1.098	127
INFO_UNI	2.95	1.265	127

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
INFO_ORG	10.28	6.252	.419	.545
INFO_SUPP	10.61	6.002	.345	.589
INFO_PATIENTS	10.69	6.072	.321	.606
INFO_UNI	11.36	4.519	.538	.430

Scale Statistics

Mean	Variance	Std. Deviation	N of Items

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
14.31	9.011	3.002	4

External/internal Collaboration

Case Processing Summary

		N	%
Cases	Valid	128	98.5
	Excluded[a]	2	1.5
	Total	130	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.727	3

Item Statistics

	Mean	Std. Deviation	N
COLL_OTHORG	3.64	.986	128
COLL_SUPP	3.77	.909	128
COLL_PATIENTS	3.34	1.152	128

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
COLL_OTHORG	7.10	3.084	.581	.603
COLL_SUPP	6.98	3.503	.510	.687
COLL_PATIENTS	7.41	2.605	.574	.619

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
10.74	6.067	2.463	3

Innovation level regarding the use of technology

Case Processing Summary

		N	%
Cases	Valid	130	100.0
	Excluded[a]	0	.0
	Total	130	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.742	2

Item Statistics

	Mean	Std. Deviation	N
INNOVLEVEL_HARD	3.98	.927	130
INNOVLEVEL_SOFT	4.05	.979	130

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
INNOVLEVEL_HARD	4.05	.959	.590	.[a]
INNOVLEVEL_SOFT	3.98	.860	.590	.[a]

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
8.02	2.891	1.700	2

Innovation level regarding the introduction of new/improved products/services

Case Processing Summary

		N	%
Cases	Valid	126	96.9
	Excluded[a]	4	3.1
	Total	130	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.666	2

Item Statistics

	Mean	Std. Deviation	N
INNOV_PRODUCTS	3.44	1.008	126
INNOV_SERVICES	3.60	.922	126

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
INNOV_PRODUCTS	3.60	.851	.501	.[a]
INNOV_SERVICES	3.44	1.016	.501	.[a]

a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
7.03	2.799	1.673	2

Appendix 3: SPSS output –frequencies for sample characteristics

Total Sample

Years of work experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	35	26.9	26.9	26.9
	2	37	28.5	28.5	55.4
	3	16	12.3	12.3	67.7
	4	19	14.6	14.6	82.3
	5	23	17.7	17.7	100.0
	Total	130	100.0	100.0	

Educational Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	6	4.6	4.6	4.6
	3	17	13.1	13.1	17.7
	4	90	69.2	69.2	86.9
	5	15	11.5	11.5	98.5
	6	2	1.5	1.5	100.0
	Total	130	100.0	100.0	

1. Greece

Years of work experience[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	15	30.6	30.6	30.6
	2	12	24.5	24.5	55.1
	3	11	22.4	22.4	77.6
	4	9	18.4	18.4	95.9

	5	2	4.1	4.1	100.0
	Total	49	100.0	100.0	

a. Residence = 1

Educational Level[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2	3	6.1	6.1	6.1
	3	15	30.6	30.6	36.7
	4	14	28.6	28.6	65.3
	5	15	30.6	30.6	95.9
	6	2	4.1	4.1	100.0
	Total	49	100.0	100.0	

a. Residence = 1

2. UK

Years of work experience[a]

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	20	24.7	24.7	24.7
	2	25	30.9	30.9	55.6
	3	5	6.2	6.2	61.7
	4	10	12.3	12.3	74.1
	5	21	25.9	25.9	100.0
	Total	81	100.0	100.0	

a. Residence = 2

Educational Level[a]

	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	2	3	3.7	3.7	3.7
	3	2	2.5	2.5	6.2
	4	76	93.8	93.8	100.0
	Total	81	100.0	100.0	

a. Residence = 2

Appendix 4: SPSS output – means, standard deviations and correlations in the total sample

Descriptive Statistics

	Mean	Std. Deviation	N
Residence	1.62	.486	130
PFINNOV_TIME	4.02	1.049	130
PFINNOV_COMMUNICATIN	3.51	1.098	129
PFINNOV_SATISFACTION	3.88	1.012	130
NFINNOV_ECONRISK	3.87	1.030	130
NFINNOV_HC	4.03	.930	128
NFINNOV_AVAILFIN	3.96	.991	128
INFO	3.5885	.74901	130
COLL	3.5795	.81708	130
INNOV_LEVEL	4.0115	.85014	130
INNOV_PRODSERV	3.5154	.82814	130

Correlations

		Residence	PFINNOV_TIME	PFINNOV_COMMUNICATIN	PFINNOV_SATISFACTION	NFINNOV_ECONRISK	NFINNOV_HC	NFINNOV_AVAILFIN	INFO	COLL	INNOV_LEVEL	INNOV_PRODSERV
Residence	Pearson Correlation	1	.270**	-.014	.236**	-.223*	-.251**	-.292**	.076	-.142	.086	-.062
	Sig. (2-tailed)		.002	.879	.007	.011	.004	.001	.388	.108	.333	.480
	N	130	130	129	130	130	128	128	130	130	130	130
PFINNOV_TIME	Pearson Correlation	.270**	1	.383**	.550**	.095	.040	.023	.383**	.182*	.269**	.147
	Sig. (2-tailed)	.002		.000	.000	.281	.651	.794	.000	.038	.002	.095
	N	130	130	129	130	130	128	128	130	130	130	130
PFINNOV_COMMUNICATIN	Pearson Correlation	-.014	.383**	1	.618**	.029	-.012	.044	.445**	.290**	.107	.268**
	Sig. (2-tailed)	.879	.000		.000	.745	.890	.623	.000	.001	.229	.002
	N	129	129	129	129	129	127	127	129	129	129	129
PFINNOV_SATISFACTION	Pearson Correlation	.236**	.550**	.618**	1	.037	-.071	.018	.523**	.275**	.159	.192*
	Sig. (2-tailed)	.007	.000	.000		.680	.428	.838	.000	.002	.070	.029
	N	130	130	129	130	130	128	128	130	130	130	130
NFINNOV_ECONRISK	Pearson Correlation	-.223*	.095	.029	.037	1	.759**	.610**	-.059	.112	.015	-.198*
	Sig. (2-tailed)	.011	.281	.745	.680		.000	.000	.502	.203	.865	.024
	N	130	130	129	130	130	128	128	130	130	130	130
NFINNOV_HC	Pearson Correlation	-.251**	.040	-.012	-.071	.759**	1	.716**	-.167	.069	-.050	-.151
	Sig. (2-tailed)	.004	.651	.890	.428	.000		.000	.060	.438	.574	.090
	N	128	128	127	128	128	128	127	128	128	128	128

NFINNOV_AVAILFIN	Pearson Correlation	-.292**	.023	.044	.018	.610**	.716**	1	-.087	-.050	-.083	-.110
	Sig. (2-tailed)	.001	.794	.623	.838	.000	.000		.330	.578	.353	.217
	N	128	128	127	128	128	127	128	128	128	128	128
INFO	Pearson Correlation	.076	.383**	.445**	.523**	-.059	-.167	-.087	1	.284**	.234**	.299**
	Sig. (2-tailed)	.388	.000	.000	.000	.502	.060	.330		.001	.007	.001
	N	130	130	129	130	130	128	128	130	130	130	130
COLL	Pearson Correlation	-.142	.182*	.290**	.275**	.112	.069	-.050	.284**	1	.297**	.283**
	Sig. (2-tailed)	.108	.038	.001	.002	.203	.438	.578	.001		.001	.001
	N	130	130	129	130	130	128	128	130	130	130	130
INNOV_LEVEL	Pearson Correlation	.086	.269**	.107	.159	.015	-.050	-.083	.234**	.297**	1	.437**
	Sig. (2-tailed)	.333	.002	.229	.070	.865	.574	.353	.007	.001		.000
	N	130	130	129	130	130	128	128	130	130	130	130
INNOV_PRODSERV	Pearson Correlation	-.062	.147	.268**	.192*	-.198*	-.151	-.110	.299**	.283**	.437**	1
	Sig. (2-tailed)	.480	.095	.002	.029	.024	.090	.217	.001	.001	.000	
	N	130	130	129	130	130	128	128	130	130	130	130

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Appendix 5: SPSS output - regression for the innovation level (technology) in the total sample

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	COLL, NFINNOV_AVAILFIN, PFINNOV_TIME, INFO, Residence, PFINNOV_COMMUNICATIN, NFINNOV_ECONRISK, PFINNOV_SATISFACTION, NFINNOV_HC[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: INNOV_LEVEL

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.424[a]	.180	.116	.80633

a. Predictors: (Constant), COLL, NFINNOV_AVAILFIN, PFINNOV_TIME, INFO, Residence, PFINNOV_COMMUNICATIN, NFINNOV_ECONRISK, PFINNOV_SATISFACTION, NFINNOV_HC

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.509	9	1.834	2.821	.005[a]
	Residual	75.420	116	.650		
	Total	91.929	125			

a. Predictors: (Constant), COLL, NFINNOV_AVAILFIN, PFINNOV_TIME, INFO, Residence, PFINNOV_COMMUNICATIN, NFINNOV_ECONRISK, PFINNOV_SATISFACTION, NFINNOV_HC

b. Dependent Variable: INNOV_LEVEL

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.035	.682		2.985	.003
	Residence	.143	.173	.082	.827	.410
	PFINNOV_TIME	.196	.087	.240	2.262	.026
	PFINNOV_COMMUNICATIN	-.074	.088	-.096	-.847	.399
	PFINNOV_SATISFACTION	-.064	.108	-.076	-.587	.558
	NFINNOV_ECONRISK	.057	.109	.069	.526	.600
	NFINNOV_HC	-.129	.143	-.139	-.898	.371
	NFINNOV_AVAILFIN	.039	.114	.045	.340	.735
	INFO	.160	.120	.140	1.334	.185
	COLL	.296	.098	.284	3.004	.003

a. Dependent Variable: INNOV_LEVEL

Appendix 6: SPSS output - regression for the innovation level (new/improved products/services) in the total sample

Variables Entered/Removed[b]

Model	Variables Entered	Variables Removed	Method
1	COLL, NFINNOV_AVAILFIN, PFINNOV_TIME, INFO, Residence, PFINNOV_COMMUNICATIN, NFINNOV_ECONRISK, PFINNOV_SATISFACTION, NFINNOV_HC[a]	.	Enter

a. All requested variables entered.

b. Dependent Variable: INNOV_PRODSERV

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.460[a]	.212	.151	.75806

a. Predictors: (Constant), COLL, NFINNOV_AVAILFIN, PFINNOV_TIME, INFO, Residence, PFINNOV_COMMUNICATIN, NFINNOV_ECONRISK, PFINNOV_SATISFACTION, NFINNOV_HC

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.930	9	1.992	3.467	.001[a]
	Residual	66.659	116	.575		
	Total	84.589	125			

a. Predictors: (Constant), COLL, NFINNOV_AVAILFIN, PFINNOV_TIME, INFO, Residence, PFINNOV_COMMUNICATIN, NFINNOV_ECONRISK, PFINNOV_SATISFACTION, NFINNOV_HC

b. Dependent Variable: INNOV_PRODSERV

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.308	.641		3.601	.000
	Residence	-.118	.163	-.070	-.725	.470
	PFINNOV_TIME	.037	.081	.048	.459	.647
	PFINNOV_COMMUNICATIN	.084	.082	.113	1.015	.312
	PFINNOV_SATISFACTION	-.025	.102	-.031	-.242	.809
	NFINNOV_ECONRISK	-.205	.103	-.258	-1.998	.048
	NFINNOV_HC	.036	.135	.040	.265	.792
	NFINNOV_AVAILFIN	.022	.108	.027	.206	.837
	INFO	.236	.112	.215	2.098	.038
	COLL	.221	.093	.221	2.386	.019

a. Dependent Variable: INNOV_PRODSERV

Appendix 7: SPSS output means, standard deviations and correlations in the multi-group analysis

1. Greece

Descriptive Statistics[a]

	Mean	Std. Deviation	N
PFINNOV_TIME	3.65	1.091	49
PFINNOV_COMMUNICATIN	3.53	1.101	49
PFINNOV_SATISFACTION	3.57	1.080	49
NFINNOV_ECONRISK	4.16	.874	49
NFINNOV_HC	4.33	.774	49
NFINNOV_AVAILFIN	4.33	.875	49
INFO	3.5153	.69110	49
COLL	3.7279	.64433	49
INNOV_LEVEL	3.9184	.77960	49
INNOV_PRODSERV	3.5816	.58047	49

a. Residence = 1

Correlations[a]

		PFINNOV_TIME	PFINNOV_COMMUNICATIN	PFINNOV_SATISFACTION	NFINNOV_ECONRISK	NFINNOV_HC	NFINNOV_AVAILFIN	INFO	COLL	INNOV_LEVEL	INNOV_PRODSERV
PFINNOV_TIME	Pearson Correlation	1	.538**	.525**	.192	.310*	.361*	.484**	.011	.101	.046
	Sig. (2-tailed)		.000	.000	.187	.030	.011	.000	.940	.491	.755
	N	49	49	49	49	49	49	49	49	49	49
PFINNOV_COMMUNICATIN	Pearson Correlation	.538**	1	.808**	-.049	.037	.076	.537**	.012	-.094	.159
	Sig. (2-tailed)	.000		.000	.740	.801	.604	.000	.935	.520	.275
	N	49	49	49	49	49	49	49	49	49	49
PFINNOV_SATISFACTION	Pearson Correlation	.525**	.808**	1	-.211	-.128	.041	.553**	.208	-.080	.173
	Sig. (2-tailed)	.000	.000		.145	.380	.780	.000	.151	.587	.234
	N	49	49	49	49	49	49	49	49	49	49
NFINNOV_ECONRISK	Pearson Correlation	.192	-.049	-.211	1	.812**	.528**	-.039	.019	.356*	-.191
	Sig. (2-tailed)	.187	.740	.145		.000	.000	.792	.898	.012	.189
	N	49	49	49	49	49	49	49	49	49	49
NFINNOV_HC	Pearson Correlation	.310*	.037	-.128	.812**	1	.669**	-.029	-.027	.356*	-.246
	Sig. (2-tailed)	.030	.801	.380	.000		.000	.843	.854	.012	.088
	N	49	49	49	49	49	49	49	49	49	49
NFINNOV_AVAILFIN	Pearson Correlation	.361*	.076	.041	.528**	.669**	1	.129	-.246	.315*	-.156
	Sig. (2-tailed)	.011	.604	.780	.000	.000		.376	.089	.028	.284
	N	49	49	49	49	49	49	49	49	49	49

INFO	Pearson Correlation	.484**	.537**	.553**	-.039	-.029	.129	1	.193	.036	.419**
	Sig. (2-tailed)	.000	.000	.000	.792	.843	.376		.184	.805	.003
	N	49	49	49	49	49	49	49	49	49	49
COLL	Pearson Correlation	.011	.012	.208	.019	-.027	-.246	.193	1	.141	.153
	Sig. (2-tailed)	.940	.935	.151	.898	.854	.089	.184		.332	.292
	N	49	49	49	49	49	49	49	49	49	49
INNOV_LEVEL	Pearson Correlation	.101	-.094	-.080	.356*	.356*	.315*	.036	.141	1	.199
	Sig. (2-tailed)	.491	.520	.587	.012	.012	.028	.805	.332		.170
	N	49	49	49	49	49	49	49	49	49	49
INNOV_PRODSERV	Pearson Correlation	.046	.159	.173	-.191	-.246	-.156	.419**	.153	.199	1
	Sig. (2-tailed)	.755	.275	.234	.189	.088	.284	.003	.292	.170	
	N	49	49	49	49	49	49	49	49	49	49

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. Residence = 1

2. UK

Descriptive Statistics[a]

	Mean	Std. Deviation	N
PFINNOV_TIME	4.23	.965	81
PFINNOV_COMMUNICATIN	3.50	1.102	80
PFINNOV_SATISFACTION	4.06	.927	81
NFINNOV_ECONRISK	3.69	1.080	81
NFINNOV_HC	3.85	.975	79
NFINNOV_AVAILFIN	3.73	.996	79
INFO	3.6327	.78282	81
COLL	3.4897	.89766	81
INNOV_LEVEL	4.0679	.89006	81
INNOV_PRODSERV	3.4753	.94836	81

a. Residence = 2

Correlations[a]

		PFINNOV_TIME	PFINNOV_COMMUNICATIN	PFINNOV_SATISFACTION	NFINNOV_ECONRISK	NFINNOV_HC	NFINNOV_AVAILFIN	INFO	COLL	INNOV_LEVEL	INNOV_PRODSERV
PFINNOV_TIME	Pearson Correlation	1	.309**	.515**	.154	.008	-.039	.318**	.347**	.352**	.232*
	Sig. (2-tailed)		.005	.000	.169	.945	.730	.004	.002	.001	.037
	N	81	80	81	81	79	79	81	81	81	81
PFINNOV_COMMUNICATIN	Pearson Correlation	.309**	1	.521**	.064	-.040	.024	.401**	.417**	.217	.316**
	Sig. (2-tailed)	.005		.000	.575	.727	.838	.000	.000	.053	.004
	N	80	80	80	80	78	78	80	80	80	80
PFINNOV_SATISFACTION	Pearson Correlation	.515**	.521**	1	.269*	.051	.125	.508**	.389**	.283*	.244*
	Sig. (2-tailed)	.000	.000		.015	.656	.272	.000	.000	.011	.028
	N	81	80	81	81	79	79	81	81	81	81
NFINNOV_ECONRISK	Pearson Correlation	.154	.064	.269*	1	.717**	.607**	-.046	.106	-.101	-.227*
	Sig. (2-tailed)	.169	.575	.015		.000	.000	.685	.345	.367	.041
	N	81	80	81	81	79	79	81	81	81	81
NFINNOV_HC	Pearson Correlation	.008	-.040	.051	.717**	1	.704**	-.211	.055	-.191	-.146
	Sig. (2-tailed)	.945	.727	.656	.000		.000	.062	.631	.091	.198
	N	79	78	79	79	79	78	79	79	79	79
NFINNOV_AVAILFIN	Pearson Correlation	-.039	.024	.125	.607**	.704**	1	-.166	-.041	-.235*	-.122
	Sig. (2-tailed)	.730	.838	.272	.000	.000		.145	.718	.037	.286
	N	79	78	79	79	78	79	79	79	79	79

INFO	Pearson Correlation	.318**	.401**	.508**	-.046	-.211	-.166	1	.340**	.319**	.273*
	Sig. (2-tailed)	.004	.000	.000	.685	.062	.145		.002	.004	.014
	N	81	80	81	81	79	79	81	81	81	81
COLL	Pearson Correlation	.347**	.417**	.389**	.106	.055	-.041	.340**	1	.380**	.310**
	Sig. (2-tailed)	.002	.000	.000	.345	.631	.718	.002		.000	.005
	N	81	80	81	81	79	79	81	81	81	81
INNOV_LEVEL	Pearson Correlation	.352**	.217	.283*	-.101	-.191	-.235*	.319**	.380**	1	.531**
	Sig. (2-tailed)	.001	.053	.011	.367	.091	.037	.004	.000		.000
	N	81	80	81	81	79	79	81	81	81	81
INNOV_PRODSERV	Pearson Correlation	.232*	.316**	.244*	-.227*	-.146	-.122	.273*	.310**	.531**	1
	Sig. (2-tailed)	.037	.004	.028	.041	.198	.286	.014	.005	.000	
	N	81	80	81	81	79	79	81	81	81	81

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

a. Residence = 2

Appendix 8: SPSS output - multigroup analysis for the innovation level (technology)

1. Greece

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	COLL, PFINNOV_TIME, NFINNOV_ECONRISK, INFO, PFINNOV_COMMUNICATIN, NFINNOV_AVAILFIN, NFINNOV_HC, PFINNOV_SATISFACTION[a]	.	Enter

a. All requested variables entered.

b. Residence = 1

c. Dependent Variable: INNOV_LEVEL

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.446[a]	.199	.039	.76420

a. Predictors: (Constant), COLL, PFINNOV_TIME, NFINNOV_ECONRISK, INFO, PFINNOV_COMMUNICATIN, NFINNOV_AVAILFIN, NFINNOV_HC, PFINNOV_SATISFACTION

b. Residence = 1

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.814	8	.727	1.244	.299[a]
	Residual	23.360	40	.584		
	Total	29.173	48			

a. Predictors: (Constant), COLL, PFINNOV_TIME, NFINNOV_ECONRISK, INFO, PFINNOV_COMMUNICATIN, NFINNOV_AVAILFIN, NFINNOV_HC, PFINNOV_SATISFACTION

b. Residence = 1

c. Dependent Variable: INNOV_LEVEL

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.389	1.075		1.293	.203
	PFINNOV_TIME	.012	.141	.017	.086	.932
	PFINNOV_COMMUNICATIN	-.098	.197	-.138	-.498	.622
	PFINNOV_SATISFACTION	-.006	.215	-.009	-.029	.977
	NFINNOV_ECONRISK	.139	.223	.156	.624	.536
	NFINNOV_HC	.090	.298	.089	.302	.764
	NFINNOV_AVAILFIN	.193	.197	.217	.980	.333
	INFO	.058	.211	.051	.275	.784
	COLL	.227	.208	.188	1.089	.283

a. Residence = 1

b. Dependent Variable: INNOV_LEVEL

2. UK

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	COLL, NFINNOV_HC, PFINNOV_TIME, INFO, PFINNOV_COMMUNICATIN, PFINNOV_SATISFACTION, NFINNOV_ECONRISK, NFINNOV_AVAILFIN[a]	.	Enter

a. All requested variables entered.

b. Residence = 2

c. Dependent Variable: INNOV_LEVEL

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.544[a]	.295	.213	.80062

a. Predictors: (Constant), COLL, NFINNOV_HC, PFINNOV_TIME, INFO, PFINNOV_COMMUNICATIN, PFINNOV_SATISFACTION, NFINNOV_ECONRISK, NFINNOV_AVAILFIN

b. Residence = 2

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.276	8	2.284	3.564	.002[a]
	Residual	43.588	68	.641		
	Total	61.864	76			

a. Predictors: (Constant), COLL, NFINNOV_HC, PFINNOV_TIME, INFO, PFINNOV_COMMUNICATIN, PFINNOV_SATISFACTION, NFINNOV_ECONRISK, NFINNOV_AVAILFIN

b. Residence = 2

c. Dependent Variable: INNOV_LEVEL

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.404	.711		3.384	.001
	PFINNOV_TIME	.223	.116	.239	1.925	.058
	PFINNOV_COMMUNICATIN	-.067	.103	-.084	-.653	.516
	PFINNOV_SATISFACTION	.096	.145	.100	.666	.508
	NFINNOV_ECONRISK	-.055	.131	-.066	-.421	.675
	NFINNOV_HC	-.139	.164	-.150	-.847	.400
	NFINNOV_AVAILFIN	-.021	.146	-.023	-.143	.886
	INFO	.128	.146	.112	.875	.385
	COLL	.273	.119	.276	2.295	.025

a. Residence = 2

b. Dependent Variable: INNOV_LEVEL

Appendix 9: SPSS output – multi-group analysis for the innovation level (new/improved products/services)

1. Greece

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	COLL, PFINNOV_TIME, NFINNOV_ECONRISK, INFO, PFINNOV_COMMUNICATIN, NFINNOV_AVAILFIN, NFINNOV_HC, PFINNOV_SATISFACTION[a]	.	Enter

a. All requested variables entered.

b. Residence = 1

c. Dependent Variable: INNOV_PRODSERV

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.502[a]	.252	.103	.54978

a. Predictors: (Constant), COLL, PFINNOV_TIME, NFINNOV_ECONRISK, INFO, PFINNOV_COMMUNICATIN, NFINNOV_AVAILFIN, NFINNOV_HC, PFINNOV_SATISFACTION

b. Residence = 1

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.083	8	.510	1.689	.131[a]
	Residual	12.090	40	.302		
	Total	16.173	48			

a. Predictors: (Constant), COLL, PFINNOV_TIME, NFINNOV_ECONRISK, INFO, PFINNOV_COMMUNICATIN, NFINNOV_AVAILFIN, NFINNOV_HC, PFINNOV_SATISFACTION

b. Residence = 1

c. Dependent Variable: INNOV_PRODSERV

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.964	.773		3.834	.000
	PFINNOV_TIME	-.036	.101	-.068	-.357	.723
	PFINNOV_COMMUNICATIN	.041	.141	.079	.293	.771
	PFINNOV_SATISFACTION	-.089	.154	-.166	-.577	.567
	NFINNOV_ECONRISK	-.007	.160	-.010	-.042	.967
	NFINNOV_HC	-.153	.215	-.204	-.711	.481
	NFINNOV_AVAILFIN	-.021	.142	-.032	-.148	.883
	INFO	.406	.152	.483	2.678	.011
	COLL	.073	.150	.082	.490	.627

a. Residence = 1

b. Dependent Variable: INNOV_PRODSERV

2. UK

Variables Entered/Removed[b,c]

Model	Variables Entered	Variables Removed	Method
1	COLL, NFINNOV_HC, PFINNOV_TIME, INFO, PFINNOV_COMMUNICATIN, PFINNOV_SATISFACTION, NFINNOV_ECONRISK, NFINNOV_AVAILFIN[a]	.	Enter

a. All requested variables entered.

b. Residence = 2

c. Dependent Variable: INNOV_PRODSERV

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.503[a]	.253	.165	.86589

a. Predictors: (Constant), COLL, NFINNOV_HC, PFINNOV_TIME, INFO, PFINNOV_COMMUNICATIN, PFINNOV_SATISFACTION, NFINNOV_ECONRISK, NFINNOV_AVAILFIN

b. Residence = 2

ANOVA[b,c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.263	8	2.158	2.878	.008[a]
	Residual	50.984	68	.750		
	Total	68.247	76			

a. Predictors: (Constant), COLL, NFINNOV_HC, PFINNOV_TIME, INFO, PFINNOV_COMMUNICATIN, PFINNOV_SATISFACTION, NFINNOV_ECONRISK, NFINNOV_AVAILFIN

b. Residence = 2

c. Dependent Variable: INNOV_PRODSERV

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.644	.768		2.139	.036
	PFINNOV_TIME	.100	.125	.102	.801	.426
	PFINNOV_COMMUNICATIN	.109	.112	.128	.972	.334
	PFINNOV_SATISFACTION	.100	.157	.099	.638	.526
	NFINNOV_ECONRISK	-.333	.142	-.381	-2.344	.022
	NFINNOV_HC	.120	.178	.123	.673	.503
	NFINNOV_AVAILFIN	.047	.158	.049	.296	.768
	INFO	.150	.158	.125	.948	.347
	COLL	.202	.129	.194	1.568	.122

a. Residence = 2

Coefficients[a,b]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.644	.768		2.139	.036
	PFINNOV_TIME	.100	.125	.102	.801	.426
	PFINNOV_COMMUNICATIN	.109	.112	.128	.972	.334
	PFINNOV_SATISFACTION	.100	.157	.099	.638	.526
	NFINNOV_ECONRISK	-.333	.142	-.381	-2.344	.022
	NFINNOV_HC	.120	.178	.123	.673	.503
	NFINNOV_AVAILFIN	.047	.158	.049	.296	.768
	INFO	.150	.158	.125	.948	.347
	COLL	.202	.129	.194	1.568	.122

a. Residence = 2

b. Dependent Variable: INNOV_PRODSERV