Perceived Challenges in Improving Electronic Communication between General Practitioners and Hospital Laboratories in Ireland and Potential Impact of MedLIS

Dissertation submitted in partial fulfillment of the requirements for the degree of Master of Business Administration (Information Systems) at Dublin Business School

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MBA (Information Systems) August 2016
Declaration

I, Rajesh Tukdeo, declare that this research is my original work and that it has never been presented to any institution or university for the award of Degree or Diploma. In addition, I have referenced correctly all literature and sources used in this work and this work is fully compliant with the Dublin Business School’s academic honesty policy.

Signed:      Rajesh Tukdeo

Date:        22nd August 2016
Acknowledgements

Firstly, a special thanks to my Supervisor Mr. John Lamont for all his encouragement, support and advice throughout the learning process of this dissertation. His guidance was invaluable for the completion of this dissertation.

The completion of this undertaking could not have been possible without the participation and helping hands from many individuals. Their contributions are sincerely appreciated and acknowledged –

Dr. Jasbir Singh Puri from Our Lady of Lourdes Hospital, Drogheda, Dr. Vikrant Kale from Beaumont Hospital, Dublin, Dr. Nick Buggle and Dr. Siobhan McCabe from Sheltonville Surgery, Arklow, Dr. Jim Holden from Harold's Cross Medical Center, Dublin, Dr. Hemant Kumar from Derrinturn Health Center, Carbury, Dr. Sanjay Date from Dr. Date Surgery, Tramore, Dr. Conor O'Shea from Wheaton Hall Medical Practice, Drogheda, Ms. Marie Lalor from Healthlink, Dr. Miriam Griffin from HSE, Mr. Michael Nerney from HSE, Mr. John Crumlish and Mr. William Robertson from Mater Misericordiae University Hospital, Dublin, Dr. Pat Twomey from St. Vincent's University Hospital, Dublin, Ms. Deirdre Deverell, Ms. Frances Gibbons and Ms. Patricia Fitzsimons from Temple St. Children University Hospital, Dublin and Mr. Brian O'Mahony from GPIT.

I would like to thank the DBS library staff – Mr. Trevor Haugh, Ms. Debora Zorzi and Ms. Jane Buggle, Deputy Librarian for their help during this dissertation.

Lastly, special thanks to my wife Shilpa and daughter Sharvari, for their unending sacrifice, support, and patience that made this work possible.
Abstract

General practitioners (GP) are the first contact points for a patient for primary health care while the clinical laboratories assist them in detecting diseases effectively. So it is essential that the communication between them should be as efficient as possible with minimum turn-around time in terms of sending orders and receiving test results, to improve care quality. In Ireland, GPs receive test results electronically from hospital laboratories via a messaging service Healthlink, provided by Health Service Executive (HSE). But majority of them still order diagnostic tests for patients using manual paper-based system which is inefficient and time consuming for both of them. To overcome these problems, HSE has planned to introduce a new nationwide laboratory information system, MedLIS by replacing existing laboratory information systems in 43 HSE hospitals throughout Ireland.

The purpose of this research was to explore the existing challenges for GPs and hospital laboratories in Ireland in sending test orders and receiving results and potential impact of MedLIS on these processes. The researcher adopted qualitative approach by interviewing Irish GPs and hospital laboratory professionals to understand their experiences and perceptions about MedLIS and drew conclusions based on the findings.

This research highlights several obstacles in achieving an efficient data exchange between hospital laboratories and their associated GPs. It also indicates that MedLIS is going to play a vital role in taking care of these issues and streamlining communication between GPs and hospital laboratories. Further research in this area can be carried out with larger sample size compared to the sample size used in this research that would be beneficial for healthcare in Ireland.
# Contents

Chapter 1. Introduction ........................................................................................................... 7
  1.1. Industry Context .......................................................................................................... 7
  1.2. Healthcare Informatics ................................................................................................. 9
  1.3. Laboratory Information System (LIS) ........................................................................ 11
  1.4. EHR-LIS Integration ................................................................................................... 12
  1.5. Scenario in Ireland ..................................................................................................... 13
  1.6. Research Question ..................................................................................................... 14

Chapter 2. Literature Review ............................................................................................... 16
  2.1. Literature Introduction ............................................................................................... 16
  2.2. Comparing Healthcare Systems across the Globe ....................................................... 17
  2.3. Role of ICT in Healthcare .......................................................................................... 18
  2.4. Information Management in Clinical Laboratories .................................................... 20
  2.5. Health services in Ireland ........................................................................................ 23
  2.6. Issues in Irish Healthcare Industry .......................................................................... 33
  2.7. Moving Towards Solution – MedLIS .......................................................................... 38
  2.8. LIS in US Healthcare Industry ................................................................................... 44
  2.9. Literature Conclusion ................................................................................................. 47

Chapter 3. Research Methodology ...................................................................................... 49
  3.1. Research Philosophy ................................................................................................... 51
  3.2. Research Approach ..................................................................................................... 53
  3.3. Research Strategy ........................................................................................................ 54
  3.4. Time Horizons ............................................................................................................ 57
  3.5. Sampling - Selecting Respondents ............................................................................. 58
  3.6. Data Collection Instruments ....................................................................................... 60
  3.7. Data Analysis Procedures .......................................................................................... 61
  3.8. Ethics ........................................................................................................................ 62
  3.9. Limitations ................................................................................................................ 65

Chapter 4. Research Findings and Analysis ........................................................................ 67
  4.1. Research Objective I ................................................................................................... 70
  4.2. Research Objective II ................................................................................................. 77
  4.3. Discussion ................................................................................................................ 82

Chapter 5. Conclusion and Recommendation .................................................................. 84

Chapter 6. Self-Reflection .................................................................................................. 89
  6.1. Introduction ................................................................................................................ 89
  6.2. Kolb’s Learning Style ................................................................................................. 89
  6.3. Master of Business Administration .......................................................................... 91
  6.4. Learning Experience ................................................................................................ 92
  6.5. Skills Developed ........................................................................................................ 93
  6.6. Dissertation ............................................................................................................... 95
  6.7. Moving Ahead ........................................................................................................... 95

Bibliography ......................................................................................................................... 96

Appendices ............................................................................................................................ 103
  Appendix A: Research Invitation Email to participants ................................................... 103
  Appendix B: Semi-structured Interview Questions to General Practitioners .................. 104
  Appendix C: Semi-structured Interview Questions to Laboratory-based Professionals ...... 105
Table of Figures and Charts

Figure 1: Percentage of GDP spent on healthcare ................................................................. 8
Figure 2: Global healthcare drivers – population aging .......................................................... 9
Figure 3: Patient centric e-health solutions and services ...................................................... 10
Figure 4: Total expenditure on healthcare as % of GDP in 2014 ........................................... 17
Figure 5: Organizational chart of pathology department in a hospital .................................. 20
Figure 6: Modules in an ideal laboratory information system .............................................. 23
Figure 7: Practicing doctors per 1000 people in Ireland, 2013 ........................................... 25
Figure 8: General practitioner weekly activities ................................................................. 25
Figure 9: Use of computers by GPs in primary care ............................................................. 26
Figure 10: eHealth Ireland ICT achievements in 2015 .......................................................... 27
Figure 11: HSE hospitals in Ireland with their laboratory status ........................................... 28
Figure 12: Steps in ordering patient tests using HealthlinkOnline portal ................................. 30
Figure 13: Steps in retrieving patient test results using HealthlinkOnline portal .................... 32
Figure 14: High waiting time (red) and Non-wait territory (green) - EHCI 2015 scores ............ 34
Figure 15: Expenditure on different health programs – 2005 to 2014 ....................................... 35
Figure 16: Population growth comparison between Ireland & EU ........................................... 35
Figure 17: Challenges in realizing the vision in Irish healthcare ............................................ 37
Figure 18: Change in density of GPs per 1000 People in Ireland from 2010 to 2015 .................. 37
Figure 19: MedLIS architecture ............................................................................................. 40
Figure 20: MedLIS implementation phases and timeline ......................................................... 41
Figure 21: IHI (Individual Health Identifier) system layout ................................................... 43
Figure 22: Percentage of physicians with laboratory order and laboratory results capability ...... 44
Figure 23: Comparing % of hospitals implementing CPOE and laboratory results in 2012 and 2013 ... 45
Figure 24: Laboratory order and results workflow between EHR and LIS ............................... 46
Figure 25: Point-to-Point Interface between EMR and LIS .................................................. 46
Figure 26: Quest Diagnostics Care360 solution for physicians ................................................ 47
Figure 27: Research process .................................................................................................. 50
Figure 28: Research onion ..................................................................................................... 50
Figure 29: Research choices ................................................................................................. 55
Figure 30: Sampling techniques ............................................................................................ 58
Figure 31: Types of questionnaire .......................................................................................... 60
Figure 32: Kolb Learning Cycle ............................................................................................. 91

Chart 1: Research interview techniques ................................................................................ 68
Chart 2: Research interviewee profiles ................................................................................... 68
Chart 3: GPs - practicing experience in Ireland ...................................................................... 71
Chart 4: Average number of tests ordered by GPs daily ......................................................... 72
Chart 5: GPs capable of ordering tests electronically ............................................................. 72
Chart 6: Laboratory professionals work experience in Ireland ............................................... 73
Chart 7: Hospital laboratories capable of accepting orders electronically .............................. 74
Chart 8: Hospital laboratories capable of sending test results electronically .......................... 75
Chart 9: Average number of tests received from GPs daily .................................................... 75
Chart 10: Percentage of GPs positive about MedLIS for their practice .................................... 78
Chapter 1. Introduction

General practitioners are the first choice of any person to seek medical advice for ill-health. If more specific investigation is required, they may refer patients to visit specialists, hospital consultants or clinical laboratories for diagnostic investigation. According to review carried out by EC Harris LLP and published by Medical Laboratory Scientists Association (MLSA, 2009, p.1), almost 70% of all primary or secondary care patients need some kind of diagnostic analysis to diagnose or monitor the treatments. So ability of the clinical laboratories in delivering effective and efficient service is going to determine success of HSE in transforming laboratory services in Ireland.

In Ireland, most of the hospitals have their own laboratory information systems which they operate independently in standalone mode. There is also a common messaging hub Healthlink for them to dispatch laboratory results to requesting general practitioners easily. But this framework has several drawbacks i.e. it doesn’t support connectivity between different laboratories and it results in patients’ diagnostic data getting repeated, even creating discrepancies. This creates problems in maintaining patients’ information, keeping it up-to-date and accurate and making it accessible 24 x 7. It has certainly made communication from laboratories to GPs easier but not vice versa due to lack of electronic test ordering.

1.1. Industry Context

In the 21st century, healthcare has become a vital part of every country’s economy because it deals with well-being of the society. Most of the developed nations spend a significant amount of their GDP on healthcare services. Well organized health care sector plays an important role in improving quality of life for the citizens. Similarly, any unattended issues in the health care industry may cause undue effect on the economy. Typically, healthcare services framework is focused around the patient and it includes physicians/nurses, pharmacies, laboratories and
insurance companies as core entities. Each of them provides unique service to patient. (Gaynor, 2011) This industry consists of workforce working towards prevention, detection and treatment of patients' medical conditions. These treatments are usually provided through either public or private mode of services. (Michigan State University, n.d.)

![Figure 1: Percentage of GDP spent on healthcare (Source: OECD, 2015)](image)

According to Deloitte report on 2015 global healthcare (Deloitte, 2015), worldwide healthcare costs have increased due to aging population, chronic diseases and infrastructure improvements. Health expenditure is expected to rise by 5.2% annually during 2014-2018. Majority of the world’s regions are facing an acid test to contain the rapidly increasing cost of healthcare. In North America, healthcare expenditure is expected to rise yearly at an average of 4.9% during 2014-2018. US healthcare spending is already the highest in the world but it is still likely to grow and reach 17.9% of GDP by 2018. In Western European region, the continued need to reduce debt and fiscal deficits is expected to maintain public health care spending to just 2.4 percent annually during 2014-2018. Countries affected by Euro-zone crisis, like Greece, Portugal and Spain may move towards reforms to merge private and public health services into one. Northern European countries (e.g. UK, Germany, Sweden etc) can see a more robust recovery in health care expenditure by 2018.
1.2. **Healthcare Informatics**

Healthcare informatics is using information technology in healthcare services to facilitate these entities to communicate with each other. Van Bemmel and Musen (van Bemmel & Musen 1997 cited in Brady 2010, p.321) define it as “the science that studies the use and processing of data, information, and knowledge applied to medicine, health care and public health”. Its main aim is to improve quality & bring efficiency in services rendered to patients. Core activity of hospital-based IT systems is to collect and process both administrative and clinical data. Their aim is to give access to information to healthcare providers so as to make patient care more cost-effective and to improve the effectiveness of care. Initially use of IT systems in healthcare was focused merely on administrative tasks, like aiding billing function. As the IT advanced, systems were marketed for other niche markets, for example, laboratories, pharmacies, diagnostics, imaging and intensive care etc. Now a day, IT trends within healthcare have focused towards integration of these scattered systems in order to streamline data flow among different users. (Blackwell, 2008, p.212) In integrated information systems, health data about patient is exchanged electronically between doctors, laboratories, pharmacies & insurance companies by means of internet. Improved infrastructure in terms of hardware & software enabled more
integration between outside systems for health information exchange (HIE) and helped physicians to make better & real-time clinical decisions.

Main aim of HIE is to facilitate diverse organizations like clinics, hospitals, laboratories, pharmacies etc. to share patient healthcare data electronically based on national data exchange standard. It is often used to improve coordination of care, achieve cost reduction, reduce medical errors, enhance patient safety and avoid duplication of services. (Adler-Milstein et al., 2011 cited in Bhansali and Gupta, 2014) Sometimes, patient safety becomes matter of concern when all necessary clinical details of the patient are not available at the point of care. HIEs could help in such scenarios. For example, it can reduce the number of adverse drug events by finding existing allergies of the patient and improving the accuracy of the allergy list (Kaelber and Bates, 2007 cited in Bhansali and Gupta, 2014). It can also improve patient health safety through drug-disease information processing by making all patient diagnoses available at that time. (Bhansali and Gupta, 2014) Within healthcare industry, pathological laboratories have a special place since the diagnostic tests only account for 60-70 percent of healthcare information used in clinical decision-making process.

![Figure 3: Patient centric e-health solutions and services (Source: Pattichis, 2015)](image-url)
1.3. **Laboratory Information System (LIS)**

Usually healthcare systems handle two types of data – administrative and clinical.

Administrative data consists of billing, costs, staff and other resources information, schedules etc. while clinical data contains patient information, diagnostic test results, vital signs etc.

Clinical data can be collected by using monitoring instruments like ECG monitor or within a laboratory in the form of blood, tissue, urine etc. Recent trend has been to integrate clinical and administrative data, not just within one entity but across different healthcare organizations.

One way to achieve data integration is Laboratory Information System (LIS) which deals with organizing laboratory workflow. (Blackwell, 2008, p.216)

LIS is defined as computerized information management system to support laboratory functions such as receiving orders from doctors and sending results to them. Due to developments in the medical field, laboratory’s complexities have increased many folds. Main objective of LIS is to improve healthcare quality by reducing technical and human error. So it has a substantial responsibility towards patients, service providers and the facility (hospital as well clinic) to offer better services. (Harrison & McDowell, 2008) Medical errors have been one of the main sources of declined primary care and it’s responsible for around 180,000 deaths in US hospitals alone annually. One-third of the laboratory tests having abnormal conditions detected haven’t been given due attention by the service providers which otherwise would have helped to prevent at least quarter of these deaths. (Weiner et al., 2006) So many US hospitals and laboratories have adopted implementation of laboratory services automation. E.g. Mather Memorial Hospital in New York, has successfully achieved significant reduction in laboratory related errors, higher efficiency & productivity with automation. It also achieved the main motive behind the automation – shorten turn-around time for those routine tasks that deal with high volume of samples. (Harrison & McDowell, 2008) Instead of keeping LIS stand-alone, it is beneficial to
integrate it with external applications to improve healthcare service quality. The clinical laboratory plays an important role in timely movement of test results to and from patient care staff. (Harrison & McDowell, 2008, p.683) Modern clinical laboratories are administrators of patient health information, in the form of diagnostic results, which may be numbers, text, or other images. These details together with interpretative data assist health care providers in delivering optimal patient care. (Sepulveda and Young, 2013, p.1129)

1.4. EHR-LIS Integration

According Health Information and Quality Authority report (HIQA, 2013), healthcare sector being information-intensive, generates huge volumes of data every day. Based on estimates, around 30% of the total health budget may be spent directly or indirectly to collect, handle and store the information. Therefore, it is essential to manage this information in the most effective way possible to ensure a high quality and safe service. Irish healthcare domain is heterogeneous in terms of ICT infrastructure. So integration among diverse systems is not easy. Therefore, it is critical that these different systems should effectively communicate and interoperate health information. In absence of a robust interoperable system, patients as well as service providers need to provide same information repetitively. To communicate between two different systems, there has to be an interoperability protocol based on international standards. ISO-IEC defines interoperability as “Interoperability is the ability of two or more systems or components to exchange information and to use the information that has been exchanged”. (ISO/IEC, 2005 cited in HIQA, 2013) Interoperability helps healthcare providers to improve the quality and safety of the care through better coordination across the various points of care. They can also benefit from efficiency gains due to reduction in duplicate data entry, e.g. capturing of the same demographic information at multiple locations.
In modern era, most of the doctors use EHR (Electronic Health Records) to manage their practice. Adoption of EHR is growing since doctors can leverage power of IT to improve delivery of patient care & treatment with better clinical decisions. (Jensen & Aanestad, 2006) Similarly, market for LIS is expected to rise from US$ 3.4 billion in 2014 to US$ 5.1 billion by 2020 at an annual rate of 6.7%. (PRNewswire, 2015) So there has been growing need of integrating EHR and LIS to generate competitive advantage in healthcare sector in which US has taken clear lead as compared to others since this integration is driven by incentives offered by the Department of Health under ARRA (American Recovery and Reinvestment Act of 2009). (Henricks et al., 2015) Data exchange between the EHR and LIS takes place via electronic interfaces, most commonly based on the HL7 protocol. Most common data that goes from EHR to LIS is patient admission, discharge, and transfer details, consisting of patient demographic data. This minimizes errors in the entry of patient information. In reverse direction, test results are sent from the LIS to the EHR. (Sinard et al., 2015)

1.5. Scenario in Ireland

In Ireland, laboratory information infrastructure is in fragmented condition. As of now, there are 43 hospital laboratories providing diagnostic laboratory medicine nationwide and all have their own independent LIS and these LIS operate in standalone mode. At present, there is almost no laboratory-to-laboratory connectivity between them. So in 2015, HSE announced a major investment plan to replace Ireland’s current hospital laboratory systems with a new integrated laboratory information system with help of Cerner, the multinational health care technology company. This project is known as MedLIS (National Medical Laboratory Information System) and its deployment model has been planned on one central instance of the software and database. Its purpose is to deliver laboratory services to healthcare providers like hospital staff, nursing staff, GPs, consultants etc. (eHealth Ireland, 2015a)
1.6. **Research Question**

Based on the above discussion, researcher is going to probe possible reasons behind contrasting differences between US & Irish healthcare systems with reference to communication between doctors and pathology laboratories. Researcher is going to look at the upcoming national laboratory system MedLIS that will be implemented soon in major hospitals in Ireland starting with St. James hospital and regional hospitals in Tullamore and Portlaoise. Then he is also going to focus on possible implementation obstacles from integration perspective using research methods.

Here are the primary questions addressed in this research -

- *What are the challenges as perceived by the general practitioners and Laboratory-based Professionals in Ireland with reference to electronic communication?*
- *What is the impact of National Medical Laboratory Information System (MedLIS) on general practitioners and hospital laboratories?*

Rationale behind this research is to study challenges in health information exchange automation with reference to laboratory information systems like Healthlink and MedLIS in Irish healthcare industry as compared to automation in US healthcare. This research is important from the business angle and assures that the findings will highlight impact of MedLIS on general practitioners and convince them about importance of LIS integration to achieve cost benefits and efficiency in healthcare services. This research also has the capability to generate substantial business in technical and functional areas of healthcare because both general practitioners and laboratories need to invest money to upgrade their IT framework as well as processes.
Information exchange between EHR and LIS

<table>
<thead>
<tr>
<th>Automated system in US</th>
<th>Semi-automated system in Ireland</th>
</tr>
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</table>

- **Doctor handover specimen & test order to Patient**
- **HealthLink**
- **Patient submits specimen & order to pathologist**
- **Lab performs tests & uploads results on HealthLink**
- **Doctor download Test Results from HealthLink**
- **Lab sends Diagnostic Test directly to Lab**
- **Doctor sends Test Results directly to Doctor**

HealthLink

Lab performs tests & uploads results on HealthLink

Doctor download Test Results from HealthLink

Doctor handover specimen & test order to Patient

Patient submits specimen & order to pathologist

Lab sends Diagnostic Test directly to Lab

Doctor sends Test Results directly to Doctor

Lab sends Test Results directly to Doctor

Doctor sends Diagnostic Test directly to Lab
Chapter 2. Literature Review

A literature has been defined as record of the research conducted by other people. (Maylor and Blackmon, 2005, p. 98) It consists of collection of details about research question, relevant data about the research and its findings. It can be in the form of academic books, journals, articles or professional papers. In most of the research studies, researcher had to rely on recent studies in the relevant field, industry specific reports or company data. Literature review section plays a vital role of examining these literatures for their relevance as a base for proposed study. The literature review can reveal some points on the need to gauge drawbacks within secondary data sources. Tasks in this process go beyond traditional tasks like verifying conclusions of past studies, examining the correctness of secondary sources used, the credibility of these sources etc. (Blumberg, Cooper and Schindler, 2014, p.68) According to Cameron and Price (2009, pp.176-179), literature review is a review conducted by researcher by focusing on strengths & weaknesses in the literature and analyzing it from the perspectives of different authors, linking back to research topic. Any academic work used during the literature review, must be acknowledged, by putting the reader’s understanding in own words and referencing to avoid plagiarism.

2.1. Literature Introduction

The relevant literature for this research has been collected to gather secondary data to support the research question. Since the research is based on healthcare & IT, first theme has been focused on using IT in healthcare, especially laboratory information system (LIS). Second literature theme highlights overall issues in healthcare industry in Ireland which is the research target market. Finally, third theme reviews literature specific to laboratory systems in US and MedLIS in Ireland since research is also expected to compare these systems with the existing systems in Ireland.
2.2. **Comparing Healthcare Systems across the Globe**

Health is the basic right of a human being. According to Sara Baldwin (2011, p.1), it is a common belief that healthcare in most of the advanced nations in modern world is developed and adequate for the people due to their development in all areas, not just healthcare. In contrast, poverty of least developed is reflected in their underdeveloped healthcare system. In short, prosperity of a country is synonymous with its healthcare infrastructure. But this is not the case as no country has perfect healthcare system to cater to its population. So countries across the world should aim towards continuous improvement in their existing healthcare setup.

In global economy, healthcare plays a vital role in economic policies of majority of the nations since it consumes a large chunk of public funds. There two core targets in the health sector today - first is to improve efficiency and effectiveness and second is to contain costs to patient while improving the quality. (Brady, 2010, pp. 319-336)

![Health expenditure, total (% of GDP)](source)

Figure 4: Total expenditure on healthcare as % of GDP in 2014 (Source: The World Bank, 2015a)

After analyzing the above graph, it is evident US spent highest percent (17%) of GDP on healthcare in the world in 2014. Second highest expenditure was by Germany (11.3%), followed
by Canada and Japan with almost similar portion of GDP. Ireland spent around 7.8% of GDP on healthcare. American healthcare system is very complex in nature due to the mixture of public and private care. US government runs several programs for the needy populations. Medicaid scheme is for the poverty-stricken people while Medicare is used by the elderly and low-income disabled populations. The Children’s Health Insurance Program covers poor children who do not meet Medicaid qualifications. Physicians’ offices, walk-in clinics usually provide primary care. Secondary and tertiary care is accessible at hospitals and surgery centers. Problem with this system is that it is still expensive and it doesn’t provide uniform service access to citizens due to overcrowding in emergency departments. UK has its own health service, known as National Health Service (NHS). This is the public healthcare system that covers most of the legal UK citizens. Employees are frequently offered private insurance by their employers and trade unions to include the coverage provided by the NHS. Patients need to pay co-payments for medicines, dental services, and optician services; Primary level healthcare in UK is provided by general practitioners but patients can be referred to specialists for further care if required. Main problems with NHS are the long waiting hours and shortage of healthcare workers and equipment. (Baldwin, 2011, p.1)

2.3. Role of ICT in Healthcare

Even though IT has been an integral part of healthcare sector in many developed countries for many decades, there was considerable initial resistance to use computers in healthcare practices by doctors. But industry had recognized the potential of ICT to make significant impact on healthcare delivery by making it more efficient and safer. According to Whetton (Whetton 2005 cited in Brady 2010, p.320), traditional health systems needed paradigm shift due to the new challenges like new medical problems, more stress on consumer-centric services, continuity of care across all services etc.
US initiated the concept of using IT in healthcare during 1960s with the help of federal agencies Medicaid and Medicare since they were the key players in influencing IT adoption in healthcare. During those days, hospitals used to share accounting systems on expensive mainframes. Reduction in the size of computers was one of the significant factors for large hospitals to include them as part of their infrastructure upgrades in 1970s. But these systems were mostly standalone in nature. So automation was limited in terms of various departments like laboratories and pharmacies. 1980s saw emergence of personal computers and they were getting more & more accepted by health service providers to manage not only their financial but also clinical data. During the same period, technical progress in networking provided them the opportunity to have limited success in combining both systems. In 1990s, internet revolution changed ICT (Information & Communication Technologies) in healthcare sector completely. Hospitals moved towards more robust integration among scattered systems. Reduction in hardware & storage prices encouraged individual service providers also to think about moving towards digitization. It also saw growth EHRs (Electronic Medical Records) as a solution to manage increasing complexity in healthcare data. First decade of the 21st century saw shift in the industry towards new driving forces like managed care based on outcomes, clinical decision support systems (CDS), Cloud computing, data warehousing & analytics etc. (Grandia, 2014) But the potential to use IT for strategic advantage of healthcare institutions picked up in 1990s. Many researchers thought that the healthcare industry could ride the IT bandwagon to gain competitive advantage by improving IT infrastructure. They suggested that hospitals could benefit from integration of its different information systems like billing, payroll, patient information system, administration, transaction processing system etc. However, there can be potential resistance to this integration since it transforms organizational work-flow by reducing physician’s role in controlling overall system and different departments with their own MIS.
(Management Information Systems) will be more independent in terms of decision making. (Michelman and Kyu Kim, 1990) According to Rodger and Pendharkar (1996), hospital administrators have acknowledged IT as a tool to improve patient care quality and not just to gain competitive advantage. It has led to study perceptions of end-users about adoption IT in healthcare. They observed that end-users are managing the information using IT from quality perspective since middle managers need more qualitative data at department levels.

2.4. Information Management in Clinical Laboratories

Pathology has been an essential part of healthcare for a long time in terms of monitoring and managing chronic conditions. It acts more than conducting regular back-office activities by involving in patient care in clinics, infection control agencies etc. Healthcare professionals rely on pathology to diagnose illnesses, to perform screening for complex diseases like cancer and to oversee the spread of a disease among patients. (NHS, 2014) Clinical laboratories have become a vital healthcare component since diagnostic tests performed at these laboratories make up for almost 60-70% of the total information used by healthcare professionals in making clinical decisions. (Fowler et al. 2005 cited in Harrison & McDowell, 2008, p.679)

![Organizational chart of pathology department in a hospital](Source: Bon Secours Hospitals, n.d., p.1)
The clinical laboratories act as the nerve centre of diagnostic medicine since they provide critical information in various stages of diagnosis like monitoring, screening and prevention which enables healthcare professionals in effective decision-making and customizing the treatment for the individual patient. Medical diagnoses and treatments rely on the correct and prompt availability of laboratory test results. In earlier days, laboratory stakeholders were main beneficiary of the progress caused by laboratory automation instead of patients. But in recent time, the primary care trend is moving towards personal attention which requires conducting more complex and providing service with timeliness. (Plebani, 2015)

Like any other function of the hospital management system, LIS has a vital role in providing quick & accurate diagnostic test results to requesting authority and it also has responsibility towards internal & external stakeholders. Within internal environment, any compromise with accuracy of results can impact quality of service and patient outcomes. From external perspective, it can result in reduced repayment of claims against the clinical tests by insurance companies. So it is evident that healthcare institute’s financial performance is closely linked with quality of its diagnostic processes. The biggest challenge with LIS is its ability to communicate effectively with other IT systems within the organization as well as the outside entities and to achieve this; the organization must be equipped with up-to-date hardware & software capabilities. The healthcare organizations that haven’t kept pace with rapidly changing technology and subsequent upgrades to IT, have failed due to increased complexities in diagnostic testing domain. (Harrison & McDowell, 2008)

According to Garcia (2014), during initial period, LIS emerged as a tool to manage billing for tests conducted in the laboratories. But over the time, new features were added in LIS to handle more complex functions with the help of different interfaces. This has resulted in a new
terminology called laboratory informatics which relates to applying IT in clinical laboratories to improve their functioning. Most common interfaces of a LIS are –

- **ADT interface** – With help of ADT interface, LIS can quickly retrieve up-to-date patient information like admission, discharge and transfer of the patients which eliminates feeding duplicate patient demographics in LIS.
- **Ordering interface** – Physicians can order diagnostic tests using EHR and these orders are transferred electronically to requested laboratory. In the laboratory, LIS receives the orders and an acknowledgement is sent back to EHR.
- **Results interface** – LIS sends results back to EHR electronically. These results can be either preliminary or final. Laboratories can attach additional comments to test results that can help physicians to interpret them effectively.
- **Instrument interface** – This interface deals with test equipments in the laboratories and the LIS system so that the data originated from them can be read directly by LIS, thus avoiding manual efforts.
- **Billing interface** – Billing interface is essential since it connects LIS with hospital’s accounting system to take care of financial transactions related to charges against the tests performed.
But acceptance of health informatics by healthcare professionals in different countries has had witnessed some problems. Some notable barriers in the adoption are tasks, policies, organizational structure etc. at national level. Before introduction of IT in healthcare, systems were more focused on the provider rather than patient. But due to health information technologies (HIT), clinical workflows have been more patient centered. Policies determine people and their accountability within a framework. HIT has brought changes to health policies in terms of IT literacy and training. To make HIT implementation successful, team work is essential among different groups within the organization where as present structure in healthcare industry is hierarchical. Healthcare professionals also have a skeptical opinion about the cost-effectiveness of IT system implementations.

2.5. Health services in Ireland

According to eHealth Ireland strategy report, health services sector is given prime importance in Ireland’s economy. It provides employment to around 125,000 people in various sub-sectors of healthcare like biotech, pharmacy, medical devices etc. Importance of this sector is highlighted by the fact that most of the premier global ICT, pharmacy and biotech companies have their
setup in Ireland. Total workforce employed in healthcare sector across Europe is close to 15 million which contributes to approx. 11% of GDP. (eHealth Ireland, n.d.b, p.44) But in comparison with most European countries, Ireland follows a different model of health service since it doesn't have consolidated service; instead it is made up of fragmented systems like public, private and voluntary providers. These providers provide different types of healthcare which are often disconnected. The service staffs have been divided in different categories like salaried employees in hospitals, independent general practitioners, voluntary hospital staff, private healthcare employees etc. Due to disconnected systems, there isn't a single way for patients to access care and reimbursement of care provided. (Burke, 2009, p.14) Even though health service comprises of many distinct elements like general practitioners, consultants, surgeons, nurses, pharmacists, clinics, hospitals, private and hospital laboratories etc., research is focusing on two key elements from the dissertation point of view – general practitioners and laboratory.

**General Practitioners in Ireland**

McCluskey (2006, p.142) has defined a general practitioner as “a medical graduate with specific training to give personal, primary and continuing care to individuals, families and a practice population, irrespective of age, sex and illness”. General practitioners play a vital role in maintaining community health of a nation by providing a broad range of services to their patients from birth and childhood, towards older age and end of life care. According to HSE (HSE, n.d.), there are around 2,500 GPs working in Ireland in different categories like single practice, group practice, primary care centers etc. From 2005 till 2015, the number of GPs in Ireland has risen by 20%. Around 64% GPs attend 15 or more patients in one clinical session even though the time spent on each patient is flexible. In a clinical session, the GP is supposed to supervise minimum 10 min. appointment with each patient in addition to monitor trainee
GPs at the end. This suggests that one clinical session may take around three hours. (Health Education England, 2012)

![Figure 7: Practicing doctors per 1000 people in Ireland, 2013 (Source: Department of Health, 2015, p.61)](image)

Workload on GPs has gone up since many of them work for seven or more clinical sessions per week coupled with paperwork for 1 to 3 sessions. Activities during paperwork like reviewing investigations and clinical letters, preparing referral letters for patients, preparing reports etc. may be directly or indirectly related to clinical care but still they are essential.

![Figure 8: General practitioner weekly activities (Source: Trinity College Dublin, 2016)](image)
In an ICT adoption study that was conducted in 31 countries across Europe, it has been found that use of computers by GPs vary from country to country. Main tasks performed by GPs using computers are – to maintain patients’ records, to prescribe drugs, to store tests results, to create patients’ appointments, to search medical information etc. Compared to many other countries, GPs in Ireland have shown good inclination towards ICT adoption in their practice. (De Rosis and Seghieri, 2015)

Figure 9: Use of computers by GPs in primary care (Source: De Rosis and Seghieri, 2015, p.9)

They have invested in IT improvements which have resulted in more than 90% of GPs using practice management software in their practices. Out of these, around 95% practices are using one of the four accredited GP systems like Helix, Socrates, CompleteGP and Helix Practice Manager. GPs regularly used message broker system called ‘Healthlink’ to communicate with hospital laboratories. Some of the critical tasks handled by these GP systems are – to manage patient demographics, create patient electronic referrals, retrieve laboratory results using Healthlink, maintain medications, record immunizations etc. (eHealth Ireland, n.d.e)
Laboratory Services in Ireland

Dept. of health started ICT initiative in 1995 in the form of a referral project called ‘Healthlink’ which provides a web-based messaging service to transmit patient’s clinical data securely between hospitals, health agencies and GPs. It is capable of exchanging more than 10 million messages every year. Healthlink messaging is at the core of the National Electronic General Referral Project, the National Cancer Control Program referral initiatives and GP communication from the National Screening Service. Healthlink system can be used to communicate variety of messages in real time, e.g. laboratory reports, discharge details, patient waiting list updates etc. It uses HL7 messaging standard which is an internationally accepted protocol for healthcare information exchange. It can be integrated with different systems like GP practices, hospitals over a secured channel using secured socket layer (SSL).

In 2002 HISI conference, the team suggested a design to merge test results electronically with PMS (Practice Management System) of GP in Ireland. It allowed GPs to manage the results
better. In 2003, the project was upgraded with the introduction of messaging protocol ‘HL7’ to achieve seamless information exchange between different applications. (eHealth Ireland, n.d.a)

Figure 11: HSE hospitals in Ireland with their laboratory status (Source: MLSA, 2009, p.13)
Test Orders from GPs to Hospital Laboratories

Prior to 2006, GPs had no other option but to use paper forms to place diagnostic test orders to hospital laboratories. But the scenario changed when Healthlink launched a system to help them in ordering tests online. In this system, GP can select the tests to order, which generates a unique bar-code. This code is sent to the laboratory along with the specimens where the system retrieves the order details using the code again. (eHealth Ireland, n.d.f) Using this service, GPs can get rid of paper forms and achieve quick turn-around time while laboratories can maintain orders electronically and reject incomplete orders. Despite these benefits, this system is available only in selected laboratories like St. James and Mater hospital while it is still in pilot stage in Cavan General Hospital. (Healthlink, n.d.c)
Figure 12: Steps in ordering patient tests using HealthlinkOnline portal (Source: Healthlink, n.d.)
Test Results from Hospital Laboratories to GPs

Hospital laboratories perform requested diagnostic tests by using patient specimen and then upload the results on Healthlink servers using a secure network. Requesting GPs can login to HealthlinkOnline portal using username, password and 8 digit PIN and view patient test results easily. For additional security, users have to download a digital certificate. GPs can integrate this results module in their practice management system using web-service calls provided by Healthlink. (Healthlink, n.d.b)
Figure 13: Steps in retrieving patient test results using HealthlinkOnline portal (Source: Healthlink, n.d.a)
2.6. **Issues in Irish Healthcare Industry**

Even though healthcare had been a part of the Irish government planning since independence, it underwent the first major reform in 1970s. At this time, the government established a health board for each region under the Department of Health having a combination of medical professionals and people from the health ministry. Most of the system was de-centralized till early 2000. But in 2005, the government made second major reform by formulating HSE (Health Service Executive) and unified all health boards under it. In Ireland, GP (General Practitioner) serves as first contact between HSE and patients through primary care services. (Harvey, 2007)

Ideally healthcare system should have been patient-centric, flexible and affordable to every citizen. But these measures by the government had its limitations. Majority of the people in Ireland still have to pay at point of use as compared to other countries in the European Union. Instead, public health service is mismanaged and underfunded which is not able to cope with the growing population and demand for better services. This has caused increase in privately owned healthcare systems. But these services are managed like businesses, concentrating on profits. So they avoid taking responsibility of complex procedures and pass them back to public system. This has put a lot of burden on the infrastructure which includes hospitals, laboratories. It has also attributed to a long waiting time for patients. (Breslin, 2015) Irish health system had been in the limelight of the media due to several reasons like depleting service quality, negative public perception about Department of Health and Children, views about the Ministry of Health etc. Due to changes in diagnosis complexities, patients' hopes about healthcare coupled with government worries about the costs had created doubts in public mind about the overall quality of healthcare. In 1993, Department of Health and Children promoted the Waiting List Initiative (WLI) to cope with enduring problem of waiting lists of patients. Aim was to support hospitals to clear the backlog of patients waiting for a long time for their treatment. But despite government
measures, the solution failed to reduce waiting lists significantly. So peoples’ trust in healthcare system is still low. (Collins and Joyce, 2008)

Figure 14 : High waiting time (red) and Non-wait territory (green) - EHCI 2015 scores (Source: Björnberg, 2016, p. 39)

One more issue pointed out by Harvey (2007, p.13-14) is variations in healthcare services within the country. Even though the government has tried to convince people about huge investments in healthcare industry, people have criticized the system and its outcome due to two-tier system of public and private services. In Ireland, people who can afford health insurance are given preferential treatments for procedures while the medical card holders have to wait for a long time.
As seen in the above table, ICT expenditure in Ireland hasn’t been consistent from 2005 to 2014. It had gone down significantly in 2010 which has affected service quality. Average spending on healthcare ICT globally is around 2-3% of GDP which is similar to average EU spending on ICT solutions in healthcare. Compared to this, Ireland lags behind significantly with about 0.85%.

(eHealth Ireland, n.d.b, p.17)
This graph highlights another challenge to healthcare in Ireland, which is increasing with the ageing population within Europe. Other factors that impact cost of services in healthcare domain, are growth in chronic diseases, declined birth rate, uneven ratio between working and retired people etc. (eHealth Ireland, n.d.b, p.16) Ireland’s population is also aging fast compared to EU. According to the Department of Health, % rise in number of people above 65 in Ireland is much more than EU average.

To address these issues, HISI (Health Informatics Society of Ireland) presented many recommendations to HSE in 2009. These suggestions were mostly related to improving ICT to address problems faced by main stakeholders – patients, taxpayers & healthcare professionals. HISI categorized these recommendations based on certain areas of IT implementation in Ireland—

- Patient safety
- Coordination between different service providers
- Quality of care
- Better resource utilization

It also suggested improvement in the ICT infrastructure at various levels in the healthcare industry. E.g. EHR, CPOE (Computerized Practitioner Order Entry), CDS (Clinical Decision Support), Telemedicine, Business Intelligence etc. Most of these systems have a direct or indirect impact on communication with the pathology laboratories. Doctors can use EHR to place diagnostic test orders or view test results in their clinic. Integration of EHR with LIS can improve CDS as well as primary care quality. (HISI, 2009)
Dr. Fergus O’Ferrall has pointed out several reasons for the current state of healthcare services in Ireland. Firstly, inadequate financial support is causing the system to be inefficient. Out of total healthcare spending, almost 80% is used for chronic diseases. This is due to the percentage of the ageing population and social habits. Secondly, primary care is in an underdeveloped state due to the low ratio of available GPs compared to other countries which makes it difficult for them to provide cost-effective service to needy people. So he has suggested that Irish healthcare financing should be done using a single tier insurance system which can work based on patient need instead of patient income. This can bring substantial difference in the quality of healthcare services. (O’Ferrall, 2011)
In its report, the Medical Laboratory Scientists Association highlighted some notable issues during studies conducted at various hospital laboratories –

- Many hospitals had experienced challenges in their testing activities due to budget constraints, employment restrictions, staff working hours etc. Budget cuts could force limitations of processing GP requests
- There was shortage of skilled workforce and existing staff also needed training e.g. nursing staff with GPs should have good training to prevent errors
- Some hospital laboratories couldn’t manage efficient delivery due to space constraints
- Increase in workload from GPs and hospitals
- Due to absence of single patient identification number, end-to-end information flow was not competent and caused high rejections of samples
- Not much executive authority to laboratory manager to implement necessary changes
- An integrated IT system needed to track patients’ data between different departments but not enough investment budgeted
- Existing IT systems outdated and requests of tests from GPs still paper based

(MLSA, 2009, pp.86-100)

2.7. Moving Towards Solution – MedLIS

Ireland needs a system to deliver quick and accurate pathology investigations to stakeholders like GPs, consultants, hospital management etc. To overcome these challenges and address other clinical risks, HSE has proposed the solution, MedLIS, which is based on single database instead of collection of scattered LIS systems. Implementation of this project will require replacing existing LIS systems in all 43 HSE hospitals with MedLIS. (eHealth Ireland, 2015b)
MedLIS (National Medical Laboratory Information Systems)

According to Murray and Nerney, the managers associated with MedLIS project, the main strategic goal of MedLIS is “to ensure patients healthcare providers have rapid 24-hour access to complete and up-to-date accurate laboratory data across all sites”. If this project gets executed successfully, it will facilitate healthcare professionals to manage patient-centric diagnostic data at one place. It will also provide numerous benefits to patients as well as clinicians. It will reduce the turnaround time to receive test results significantly, help making better clinical decisions, and improve the primary care for patients. Being single instance system, it will substantively reduce duplicate tests and supply information in a standard format to all stakeholders. (Murray and Nerney, 2011)

Such an integrated system will enhance efficiency of entire system by providing easy secure exchange of patients’ diagnostic data like orders and results, between GPs, hospital consultants, nurses, wards, laboratories etc. One of the interesting features of MedLIS is its ability to alert physicians about abnormalities in the received results via a messaging hub. This feature will bring immense benefits to clinicians since they can visualize quickly if the selected patient results need their immediate attention. Even though, messages containing actual results can be visible from any registered computer irrespective of location, these can be customized by individual providers using rule engines based on user roles and privileges. This enhances message security since users can view only part of the message that they are authorized. As additional security, system can capture user credentials and current timestamp to keep audit of all message accesses and pages viewed. (Department of Health, 2014)
According to the Irish College of General Practitioners, a premier institution in promoting information technology in Irish healthcare with help of HSE, MedLIS system will bring betterment to both patients as well as GPs –

- Patient centric architecture to make patient records available anywhere in Ireland
- Diagnostic test results will be available to GPs irrespective of laboratory location
- Logic to warn physicians about any abnormal results
- It can get rid of paper based test ordering
- It can reduce unnecessary repeat test orders
- GPs can track the requested tests and received results (ICGP, 2016)

As described by Michael Nerney, MedLIS project Quality Manager; the MedLIS system is not only supporting laboratories but also going to make a difference to the clinicians. It provides them with an ordering module to streamline their processes by capturing relevant details during order submission. (Nerney, 2016)

Figure 19: MedLIS architecture (Source: Nerney, 2016)
MedLIS Timeline

In 2015, HSE floated a tender for the development of a nation-wide laboratory information system. (Ireland Tenders, 2015) The contract was awarded and signed with Cerner to develop and introduce this system in major hospitals throughout Ireland within four years timeframe. The actual project started in October 2015. The project is supposed to be implemented in five phases till 2019. (eHealth Ireland, n.d.d) The first phase is expected to start at the end of 2016 with three hospitals - St. James Hospital, regional hospital Tullamore and regional hospital Portlaoise. Then in subsequent phases, it will cover remaining HSE hospitals as shown below –

<table>
<thead>
<tr>
<th>Phase One</th>
<th>Hospital Sites To Go Live</th>
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<tbody>
<tr>
<td>St. James’s Hospital, Dublin</td>
<td></td>
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<tr>
<td>Regional Hospital, Tullamore</td>
<td></td>
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<tr>
<td>Regional Hospital, Portlaoise</td>
<td></td>
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<tr>
<td>Beaumont Hospital, Cavan General Hospital, Connolly Hospital, Mater Hospital, Regional Hospital Mullingar</td>
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<table>
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<tr>
<th>Phase Two</th>
<th>Hospital Sites To Go Live</th>
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<tbody>
<tr>
<td>Tallaght Hospital, Coombe Maternity Hospital, Naas Hospital, Our Lady of Lourdes Hospital, Drogheda, St Vincent’s University Hospital, Navan Hospital, National Maternity Hospital, Holles Street, Loughtnstown Hospital</td>
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<tr>
<th>Phase Three</th>
<th>Hospital Sites To Go Live</th>
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<tbody>
<tr>
<td>University College Hospital, Galway, Letterkenny General Hospital, Sligo General Hospital, Roscommon Hospital, Mayo General Hospital, Portumna Hospital, Limerick Regional Hospital, Ennis Hospital, St John’s Hospital, Nenagh Hospital</td>
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<thead>
<tr>
<th>Phase Four</th>
<th>Hospital Sites To Go Live</th>
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<tr>
<td>Cork University Hospital, Waterford Hospital, Kemy General Hospital, Mallow Hospital, South Tipperary General Hospital, Mercy Hospital, Cork, Bantry Hospital, South Infirmary Hospital, Cork, Wexford Hospital, St Luke’s Hospital, Kilkenny</td>
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<tr>
<th>Phase Five</th>
<th>Hospital Sites To Go Live</th>
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</thead>
<tbody>
<tr>
<td>Crumlin Children’s Hospital, Temple Street Children’s Hospital, Cappagh Hospital, St. Luke’s Hospital, Rotunda Maternity Hospital, St. Michael’s Hospital, Royal Victoria Eye &amp; Ear Hospital</td>
<td></td>
</tr>
</tbody>
</table>

Figure 20: MedLIS implementation phases and timeline (Source: eHealth Ireland, n.d.d)
EMPI (Enterprise Master Patient Index)

An effective healthcare means providing the right care to the right person using accurate patient data. So identifying a patient uniquely is very crucial in this scenario. To identify a patient correctly during medical care, most healthcare systems depend on manual processes, usually with the help of various personal identifiers like name, birth date, address etc. But there are drawbacks of this approach since it is not reliable and consistent when two systems have to deal with the same patient. (The Value of Precise Patient Identification, 2016)

As laboratories move towards patient-centric business, their challenges are also growing. Due to its nature, keeping track of patient demographics and other health related information has become a necessity so as to provide quality care to patients. Laboratories have to participate in data exchange with other systems like physician EHRs, hospital information systems, insurance companies etc. If the same patient’s data is going to flow between these systems, then a unique master number is necessary to determine the patient accurately to avoid any ambiguity. This concept is known as MPI (Master Patient Index) and when it is implemented throughout all the participating systems, it is called EMPI (Enterprise Master Patient Index). EMPI helps health service providers to track diagnostic information like ordered tests and test results associated with a patient easily. (Beasley, 2016)

IHI (Individual Health Identifier)

As seen earlier in different literatures, the system should be able to identify every person who is using healthcare services in Ireland. This is to ensure that care is provided to correct individuals and it is visible to the providers all the time. Lack of identifier makes it difficult for healthcare stakeholders to track patient records and it results in duplication of data. In the Irish healthcare environment, each provider uses its own patient identifier that is unique within that framework
only. Within hospitals also, various departments have their own way of identifying same patient by different numbers. A problem with this approach is that same patient information may get recorded differently in different systems leading to potential errors. It also makes patient tracking challenging at national level since one patient carries multiple identities. (Harney, 2012, pp.74-75) It can also cause fatal implications like patient receiving incorrect medications or vaccines due to similarity in data elements.

To take care of this issue, HSE had designed Health Identifiers Act in 2014 and came with idea of Individual Health Identifier (IHI). IHI is a unique number assigned by HSE to every individual in Ireland who consumes some kind of health services. This number not only determines patients accurately but also helps service providers to pinpoint the primary care providers like GPs, hospitals etc and their locations and it can’t be transferred to another. Within IHI system, some of the essential patient details are held like name, date and place of birth, gender, address, PPS (Personal Public Service) Number etc. (eHealth Ireland, 2016)

Figure 21: IHI (Individual Health Identifier) system layout (Source: Harney, 2012, p.81)
2.8. LIS in US Healthcare Industry

US has one of the largest laboratory markets in the world with annual 7 to 10 billion tests performed there alone in about 35,000 laboratories across the country. (Gabler, 2015) In a report prepared for US Assistant Secretary for Planning and Evaluation, Dullabh and Moiduddin (2009) stated that the government had identified the role of IT in making communication between laboratories and clinicians more effective in terms of cost & time long ago. CMS (Center for Medicare and Medicaid) has been active in setting up policies about health information exchange between doctors & laboratories. In order to improve the quality of patient care and reduce medical errors, it is essential that EHR and LIS should transmit data between each other bi-directionally to process orders & results. It has also reflected in the incentive program “Meaningful Use” under HITECH (Health Information Technology Economic and Clinical Health) act. It lists out the criteria for US physicians to qualify for incentive payment from the government and one of the criteria is that they must demonstrate the capability of receiving and displaying patient test results in their EHR. (Henricks, 2011) Due to this, many physicians and hospitals have implemented laboratory ordering and results modules within their systems.

Figure 22: Percentage of physicians with laboratory order and laboratory results capability (Source: HealthIT.gov, 2013b)
In USA, many doctors use CPOE (Computerized Provider Order Entry) to exchange data between their EHR systems and laboratories. They order diagnostic tests and receive results that can be embedded within the EHR. The main advantage of CPOE integration is improved clinical decisions for clinicians. (Dighe and Baron, 2011) Sometimes, this data exchange takes place directly between EHR (Electronic Health Record) and laboratories since some laboratories provide mechanism to integrate their ordering and results module with EHR using IT solutions. But there are cases, where an intermediate (third-party vendors) system is required to facilitate interaction. In such cases, laboratories or third-party companies makes legal agreement with the requesting doctors to allow integration of services. (HealthIT.gov, 2013a)
Figure 24: Laboratory order and results workflow between EHR and LIS (Source: HealthIT.gov, 2013, p. 3)

Some clinical laboratories have offered connectivity interfaces for physicians to achieve EHR-LIS automation. They offer point-to-point interface or laboratory interoperability module. By integrating these interfaces within their EHR, physicians can effortlessly interact with either a single or multiple laboratories to send orders and receive results. Point-to-point implementation is easier for a clinician in terms of technical costs since it involves communication with single laboratory only. But if the clinician wants to expand the connectivity to more laboratories, it becomes challenging since each implementation can be time-consuming and costly.

Figure 25: Point-to-Point Interface between EMR and LIS (Source: ViSolve., n.d.)
So some vendors offer a solution using laboratory interoperability module where a centralized hub handles routing of orders and results between multiple physicians and laboratories. One such organization is Quest Diagnostics which offers an automation solution “Care360” for physicians. By integrating its services, physician can easily manage laboratory orders and results.

Figure 26: Quest Diagnostics Care360 solution for physicians (Source: Questdiagnostics.com, n.d.)

2.9. Literature Conclusion

Irish healthcare systems have evolved over the last few decades and have been in fragmented state which makes data exchange between them difficult to achieve. If compared with the US in terms of percentage of GDP allocated to health services, Ireland’s provision is still inadequate. As evident it is from the different literature themes studies above, there is a definite room for improvement in the communication between GPs and hospital laboratories in Ireland. Apart from technical challenges, facility-centric nature of the laboratory information systems is a big obstacle in improving the connectivity with laboratories but this will change with the introduction of MedLIS. There is also lack of single patient identification system which is causing additional burden on healthcare systems due to information repetition. Diagnostic test ordering
process is still manual at many GP clinics. Support for electronic orders from GPs is also limited to three hospitals only which are insufficient as of now but this scenario will change within the span of around three and half years as MedLIS is designed to provide electronic ordering for all GPs. MedLIS will definitely boost healthcare sector to restore already crumbling services by improving efficiency.

USA has already been a leader in IT integration between GP and pathology laboratories. But there is a huge difference in their size of economy and spending on IT infrastructure. But HSE has taken good initiatives like eHealth Ireland concept which has a potential to create business opportunities not only in health services but also in IT industry since implementation of MedLIS and IHI will require expertise in both sectors. It will make patient care more cost-effective and reduce the number of medical errors due to incorrect laboratory test reporting.
Chapter 3. Research Methodology

A research is always an essential part of business and academic activities. It is a process of conducting investigations with the intention of improving knowledge. This knowledge improvement is associated with research question which is very specific and focuses on the research objectives. Some of the most common objectives are to explore more general issues with analysis, to construct new system, to explain new phenomenon or a combination of these objectives. Classification of research is based on different characteristics like – purpose (reason behind conducting research), process (steps in data collection and analysis), logic (specific or general) and outcome (expected solution). (Collis and Hussey, 2014, p. 2-3) Sekaran and Bougie (2010, p. 2) have also defined research as a mechanism to find solutions to a problem with the help of thorough study and analysis of the situational factors. By applying these definitions to business environment, they have summarized business research as “an organized, systematic, data-based, critical, objective, scientific enquiry or investigation into a specific problem, undertaken with the purpose of finding solutions to it”. There are three main characteristics of research –

- Collecting data systematically (Cowton, 1998)
- Data interpretation systematically
- Clear purpose: to find things out.

Therefore, research is something undertaken by people to find out things in a systematic way for increasing their knowledge. Systematic means there should be logical relationship and not based on beliefs. According to Saunders, Philip and Thornhill (2012, p. 4), research methodology is a systematic way of undertaking research with help of theoretical & philosophical assumptions in the field of research. It is an important approach that will influence nature of the research. It involves series of scientific steps to solve the problem as shown below –
Research Methodology indicates the path undertaken to conduct research. It contains processes and techniques to collect and analyze the data. These techniques include questionnaires, observations and interviews as well as both qualitative (numerical and objective) and quantitative (non numerical and subjective) techniques. Research is not merely reading books & articles, talking to a people or asking questions.

Figure 28: Research onion (Source: Saunders, Philip and Thornhill, 2012, p.128)
Mostly, beginning with one research question is the first step towards a research idea. It may lead to several more detailed questions or towards the definition of research objectives. For this, research idea needs to be refined to transform it into research question and then into research project. This is known as preliminary inquiry. Research questions can be divided into ones that are descriptive, evaluative and/or explanatory. Usually, questions starting with ‘What’, ‘When’, ‘Where’, ‘Who’ or ‘How’ lead the researcher to an answer that will be at least partly descriptive while the questions looking for explanations either commence with ‘Why’ or contain this word within the question. But there are many questions that start with ‘What’ or ‘How’ but they go beyond finding a descriptive answer.

The main purpose behind this research was to find the challenges in electronic communication between doctors and pathology laboratories in Ireland. Moreover, the research has also tried to find out the ways to overcome these challenges. Therefore, taking into account the intention of this research, following methodologies were used by the researcher - interpretive philosophy, with an inductive approach for the purpose of analyzing the interviewees’ opinions through semi structured interviews, using qualitative method of data collection.

3.1. Research Philosophy

Research philosophy is the outermost layer of the research onion. It is defined as combination of assumptions and beliefs necessary to develop knowledge. Even though, there are five major philosophies used in research, one shouldn’t consider that a particular philosophy is better than other. Selection should be based on practical circumstances that are most suitable for the research. (Saunders, Philip and Thornhill, 2012, p.127) Four main paradigms of research philosophy are pragmatism, realism, positivism and interpretivism. The realism philosophical approach is based on scientific enquiry. In this philosophy, researcher believes that what is
sensed, is reality and that objects exist independent of the human mind. From the viewpoint of epistemology, realism is very similar to positivism since it also assumes a scientific approach to the development of knowledge. There are two branches of realism - direct and critical. Direct realism says that environment is correctly depicted by humans through their senses while critical realism says that senses can sometimes be deceptive. Hence an accurate picture of the environment is not achieved. (Saunders, Philip and Thornhill, 2012, p. 136) In positivism paradigm, there is emphasis on the assumption that research should be conducted based on certain fixed laws and scientific principles that govern physical world and it is not affected by actions of individual participants thus making it objective in nature. Positivism assumes that it is not possible to separate out people from research environment. On the other hand, in interpretivism, it’s very much essential for the researchers to understand the difference between the humans in the role as social actors. It focuses on the conducting the research among the people rather than objects such as the trucks and computers. In this approach, researcher has to understand research environment from subjects’ point of view rather than bringing own ideas. From epistemological perspective, positivists think that researcher and subjects should be independent and only measurable phenomena can be treated as valid knowledge. But according to interpretivists, researcher can interact with subjects and develop knowledge based on their evidences. In methodological assumptions, positivists go for large sample size to formulate theories that can be measured while interpretivists go for small samples and formulate their theories after analyzing the situation. In case of axiological assumptions, results in interpretivism may be biased since facts can be drawn using interpretations but positivism results are unbiased since researcher is detached from the subjects. (Collis and Hussey, 2014, p. 43-50)
Appropriate philosophy for this research was Interpretivism since this mode gave more emphasis on interpretation by individuals in the society than bias-free & objective opinions. In this philosophy, there is an underlying assumption that reality is not independent of society and researcher can use approach ‘phenomenology’ by analyzing responses of the study subjects through various human characteristics like experiences, interpretations, thoughts, emotions etc. (Hair et al., 2011, p. 277) This research topic needed opinions of general practitioners and laboratory scientists about perceived challenges from their point of view. Objective philosophies like Realism & Positivism were not suitable here. Realism doesn’t consider interpretations of social actors as important for research. It may also be impacted due to bias of the researcher. Positivism philosophy is also not useful because it believes that the best way to describe reality is to use quantitative data & existing hypothesis and doesn’t depend on social actors. Pragmatism philosophy is useful when research is oriented towards finding solutions to the problem solving. (Saunders, Philip and Thornhill, 2012, pp. 134-137)

3.2. Research Approach

Next layer is research approach. There are two most common ways to approach the research. They are Inductive and Deductive. Deductive approach is more of a scientific research. It has various characteristics.

First characteristic of deductive approach is that there has to be clear relationship between different variables. Second characteristic suggests that the theories have to work in such a way that it should enable measuring the facts quantitatively. Finally, this approach indicates generalization by selecting sample size carefully. As compared to this, inductive approach deals with interaction of humans and behavior of subjects with the help of social science to gather evidence and form conclusions. So this approach can provide alternate solutions to overcome limitations of rigid methodology in deductive approach. (Saunders and Lewis, 2012, p.145-146)
Both approaches differ in terms of the sequence of steps that they follow. Deductive approach is suitable when the research is based on existing theory and used to evaluate that theory. In this approach, research strategy supported is quantitative with objective reasoning. Compared to this, inductive approach is used when researcher wants to build theory based on observations using qualitative research strategy and subjective reasoning. Using this approach, researcher can explore new phenomenon. (Bryman and Bell, 2015, pp. 23-27)

Since there was no hypothesis or existing theory to be tested for this research, researcher used inductive approach as a preferred mode. It was suitable since the philosophy to be used was interpretivism which is more subjective. Since general practitioners and chief medical scientists had their own different opinions about the research topic, conclusions had to be derived by identifying patterns using the data collected. This approach helped the researcher to highlight the problems faced by healthcare professionals in Ireland with respect to electronic information exchange involving pathology laboratories. (Saunders, Philip and Thornhill, 2012, pp. 143-146) In short, inductive approach helped the researcher to organize scattered raw data into a compact summary and facilitated the development of a theory based on the observations found. (Jebreen, 2012, p.9)

3.3. Research Strategy

Strategy and choice are vital components of research design. Research strategy is defined as the roadmap for the researcher to proceed towards an answer of the research question. It serves as bridge between research philosophy and data collection choice. Research onion has defined eight types of strategies and three choices – qualitative, quantitative & mixed method.
Experiment is preferred in research involving natural sciences. The main purpose of experiment is to observe and study the causal links between two variables, e.g. impact of change in one independent variable on another dependent variable. (Hakim 2000 cited in Saunders, Philip and Thornhill 2012, p.174) Another technique is - Case study strategy that is often used in exploratory and explanatory research. They are particularly good for researcher to get a detailed contextual understanding of the context of the research. Data collection techniques used in a case study may be varied and include a combination of interviews, observation and documentary analysis as well as questionnaires. The question arises as to whether a single case or a number of cases would be more suitable for the research because one case study strategy can also incorporate more than one case. (Saunders and Lewis, 2012, p.117) Grounded theory was developed by Corbin and Strauss. It has elements of both inductive and deductive approaches. Primarily, it belongs to the inductive approach since the researcher develops a theory using the data generated by a series of observations or interviews. (Saunders and Lewis, 2012, p.119) It is used to propose theoretical explanations of various social interactions and
processes in a wide range of contexts in business and management. (Saunders, Philip and Thornhill, 2012, pp. 185)

Quantitative research is a strategy to conduct research by collecting numerical data which are analyzed using mathematical theories & formulae in statistics. It deals with research methods capable of testing a theory by summarizing data into measurable variables and then analyzing it with statistics. (Yilmaz, 2013, p. 311) This type of research is usually conducted using tools like questionnaires to collect numerical data and the researcher has a good clarity about what to look for. (McCusker and Gunaydin, 2015, p. 538) Quantitative approach in business is used to measure consumer characteristics like behavior, opinions, attitudes etc. Prominent techniques of this approach are experiment and survey. Quantitative data consists of participant responses that are often coded or reduced to numbers for statistical analysis. This approach is suitable to test theories where the researcher stays away to avoid biasing of results. Due to this, the researcher can maintain distinction between facts and judgments. This approach requires large sample size and probability sampling. Large sample size can cause increase in the turn-around time. (Cooper and Schindler, 2008, p.164)

According to Kaya Yilmaz (2013, p. 3121), qualitative research means an approach using inductive & interpretive ways to study humans, cases, phenomena, situations and processes and analyze interpretation of people in descriptive terms which would be difficult to express in quantified numbers. Main aim of qualitative research is to understand relevant experiences & attitudes of the community in terms of words rather than numbers and proceed towards a solution by focusing on questions like ‘How’ instead of ‘How many’. (McCusker and Gunaydin, 2015, p. 539) Mixed methods research is a combination of qualitative and quantitative modes in research design. There are different ways of combining these two modes depending on when
and how to mix them. It can be fully integrated, partial or sequential. In this research, data is derived using subjective methods and the research is focused on opinions and viewpoints of the subjects.

So the researcher decided to adopt the qualitative strategy in this research where primary data was collected and analyzed qualitatively to find common patterns. (Saunders, Philip and Thornhill, 2012, pp. 160-178) Getting perception of general practitioners and laboratory scientists about the current state of communication with laboratories was vital for this research. To achieve this, interview was most suitable among available options. Archival research is not applicable since it relies on historical documentation. Case study is useful only when the researcher wants to concentrate deep into a single case. Experiment is used to verify or falsify a hypothesis which is not there in this research. On the other hand, interview allowed researcher to gather qualitative data from the subjects in standard format.

3.4. Time Horizons

Fifth layer of research onion is Time horizon. Research time horizon indicates the estimated completion timeframe for a research. It can be either cross-sectional or longitudinal. The important question is to be asked while planning research is ‘Does the researcher want his research to be snapshot taken at particular time’ or ‘does he want his research in series of snapshots over a given period’. Generally, it depends on the research question. The snapshot time is called cross-sectional and daily perspective called longitudinal. (Saunders and Lewis, 2012, p.155) In this research, it was cross-sectional since there were constraints on the available research time as compared to the long time frame of longitudinal. (Saunders and Lewis, 2012, p. 190)
3.5. Sampling - Selecting Respondents

Sample can be defined as subset of the population which acts as a representative of the larger population. Need for the sample arises from the fact that it is not practical to target the entire population for research study even if it may be possible.

In a broader sense, sampling can be carried out by using either ‘Probability’ or ‘Non-probability’ technique. Probability sampling is suitable when the entire target population is accessible for study. It allows the researcher to select random participants from available population but it can be time-consuming & expensive. Ways of conducting this sampling are Simple random, Stratified random, Systematic random and Cluster sampling. (Saunders, Philip and Thornhill, 2012, pp. 260-261) In simple random sampling technique, every sample person gets an equal chance of being part of the sample. Randomly generated numbers are to be used here to select population. Main drawback of simple random is that some small but important parts of a population may be missed due to randomness. To avoid this, the population is divided into homogeneous groups called strata, and then simple random sample within each group is taken. This is known as Stratified random sampling. There are two types of stratified random sampling - proportional and non-proportional stratified random sampling. Systematic random sampling
relies on the ordered listing within the population which the researcher is interested in. All random sampling methods lead to a practical problem where the population units are spread so widely, that the cost to contact them becomes very high. To deal with this issue, cluster sampling technique is used. It first divides the population into ‘clusters’, and then samples all the units within the selected clusters. (Easterby-Smith, Thorpe and Jackson, 2015, pp.80-81)

Non-probability technique can be applied when population is not exhaustive. Because of limited samples, random participant selection is not possible and it proves to be less time-consuming. There are various techniques to conduct this type of sampling e.g. Purposive, Quota, Snow ball, etc. (Acharya et al., 2013) Quota sampling divides the population up into different logical categories (e.g. male/ female). The aim is to make sure that each of the categories is represented according to the quota proportions. In purposive sampling, the researcher has a clear idea about the sample units required, according to the purposes of the study. Next step is to approach these potential sample members to check whether they meet the eligibility criteria. Only those members satisfying the criteria are chosen while the remaining members are rejected. Snowball sampling begins with a member who meets the criteria for inclusion in the study who is then asked to refer to others who would be eligible. (Bowling, 2011, p.208)

Since this research was associated with electronic communication between GPs and hospital laboratories in Ireland, it was not possible to include every general practitioner and laboratory scientist as participant in the interview process. So non-probability sampling was used with help of appropriate sample size of participants. Since the research was focusing on a specialized field, purposive technique was used in the beginning to identify a particular group of participants having the domain knowledge. But this single technique was enough since access to GPs and laboratory scientists was always difficult and was also subject to their availability with prior
appointments. So in addition, snowball technique was used since it was useful in growing network of the participants using referrals.

This technique is widely used in industry specific researches. In this technique, chosen contacts can nominate further contacts in their fields, who can be potential participants in the research. Preferred pattern of snowball technique will be exponential and non-discriminative snowball sampling. Even though snowball sampling is cost-effective due to its limited sample size. (Saunders, Philip and Thornhill, 2012, pp. 287-289) Using the snowball technique, the researcher was able to identify more participants through referrals from preliminary contacts.

3.6. Data Collection Instruments

In qualitative research, there are many ways in which data may be collected. Data is necessary for students to submit evidence or justification for everything that can be presented later e.g. findings, descriptions, new ideas, interpretations and explanations. It can be conducted in different ways like interviews, structured observations and questionnaires. Interview can be either face-to-face, telephonic or internet based (e.g. Skype).

![Figure 31: Types of questionnaire (Source: Saunders, Philip and Thornhill, 2012, p. 451)](image)

In structured observations, peoples’ behavior over a certain period is studied. Here, researchers can request for permission to observe and take part in the daily lives of the people they study. Questionnaires focus on gathering responses from the participants against set of questions
specific to the research topic. (Maylor and Blackmon, 2005, p. 183) Questionnaires are an efficient data collection method when researcher knows the requirement and measurement of variables. They can be supervised personally, through mails, or electronically. (Sekaran and Bougie, 2010, p.236) Secondary data is the data interpreted from primary data and collected to obtain answers to the research questions. It saves cost & time in getting required research information. It can be either in written or electronic form and can be obtained internally or externally. Internal sources can be company database, reports, documents etc. External sources are journals, websites, books, government publications, reports from renowned companies or institutions etc.

As illustrated earlier, primary data for this research was collected by conducting interviews with GPs and laboratory scientists. Structured observation was not feasible choice for this research since GPs won’t allow observing day-to-day routine at work place due to risk of compromising patient privacy. Most of the interviews were conducted face-to-face after contacting individuals and getting their consent for participation. Apart from GPs and laboratory scientists, two individuals from HSE also agreed to provide inputs for the research.

Most of the secondary data was gathered by analyzing existing research journals & articles, Irish government healthcare publications & reports, websites highlighting current state of laboratory communication in Ireland etc. There were few journals available on discussion about overall health services in Ireland but information specific to GPs and hospital laboratories in Ireland was found on the website of Irish government agency HSE.

3.7. Data Analysis Procedures

It is essential in research to analyze the primary data collected to formulate new theory or prove existing hypotheses. In this research, primary data was the perceptions and opinions of general
practitioners and chief medical scientists in Ireland about issues in electronic communication and impact of MedLIS system. However, qualitative data collected using interviews may not represent experiences. Possible reason is that the qualitative data gathered through an interaction between the participant and the researcher may not reveal the full picture. Similarly, participants have different abilities in terms of reflecting their own thoughts and observations. Like participant observation, interviewing is a demanding task for researchers since they have to decide quickly which questions to ask, how to formulate them and in which order they should be posed. It is crucial for an interviewer that the questions suit the interviewee’s frame of reference i.e. the questions should match the research topic as it was introduced by the interviewer. Apart from this, the topic needs to be of concern to the participant and the questions need to be asked in a language that is understandable. (Boeije, 2010, pp.58-62)

With respect to this research, it was possible that some participating GPs might not be aware about new system MedLIS and some laboratory scientists might not have faced any problems communicating with GPs. So to make sense of this qualitative data, interviews were transcribed and analyzed to identify different patterns and to observe trends so that conclusions about relationship between variables could be formulated that could lead towards answers to research questions.

3.8. Ethics

According to Blumberg, Cooper and Schindler (2014, p. 121), ethics is defined as deciding right behavior and ways to conduct research in morally responsible manner. It also includes norms to follow during relationship between participants. According to Easterby-Smith, Thorpe and Jackson (2015, p.122), there are key principles to be followed during any research ethics –

- Ensure that no harm comes to participants.

- Respect the dignity of research participants.
• Ensure a fully informed consent of research participants.
• Protect the privacy of research participants.
• Ensure the confidentiality of research data.
• Protect the anonymity of individuals or organizations.
• Avoid deception about the nature or aims of the research.
• Declaration of affiliations, funding sources and conflicts of interest.
• Honesty and transparency in communicating about the research.
• Avoid any misleading or false reporting of research findings

Every industry research has to follow ethical code of conduct. Ethical issues can bring problems for researcher in three broad areas –

• Some participants may think observing actions/processes during research as unethical
• Possibility of getting incorrect data due to management pressures during fieldwork
• Using collected data ethically to protect interests of individual participants

(Easterby-Smith, Thorpe and Jackson, 2015, p.123)

According to Angst (2009), electronic medical records (EMR) and computerized physician order entry (CPOE) have definitely transformed the way health information was handled from a paper based system to digital system. But these innovations have also brought forward legal and ethical issues within healthcare industry, especially health information exchange (HIE) because EMRs now cross their predefined boundaries and interchange data with other systems. Mason (1986) suggested that there are four core ethical issues that must be addressed during healthcare system design – privacy, accuracy, property, and accessibility (PAPA). (Mason 1986, cited in Angst 2009, p.173) Electronic health record systems (EHR) have improved traditional healthcare by enabling health service providers to access patient data efficiently since the
treatment received by the patient depends on the information available to the physician. But it has also created new challenges in terms of possible access to private data by unauthorized personnel. So every system that needs to deal sensitive data about patients, have to address these concerns – (Kenny and Connolly, 2010)

- Security during data collection
- Improper access to the information
- Unauthorized use of information by individuals without patient consent
- Patients’ lack of control over their own information
- Data privacy during online data transmission over internet

Like research in specific field of study, healthcare industry related research also needs to collect primary data using various techniques and researcher made sure to follow these ethics in every phase of research.

Design strategy phase:

- Since the participants were general practitioners and laboratory professionals, they were informed about purpose & benefits of the research clearly before collecting primary data.

Design collection phase:

- No patient specific details like name, address, gender, diseases, medications etc. were captured during entire data collection & analysis process. This was to honor patients’ data privacy.
- Participation in the interview was voluntary for participants. They had right to refuse.
- Opinion expressed by one doctor was shared with another doctor to avoid influencing & confidentiality.

Since this research was based on healthcare industry, researcher followed ethics related to doctors, pathologists and patients in a way that didn’t harm the core purpose of the research.
The researcher contacted each individual participant and informed them about research topic and motive to avoid any misconception. Interview schedule was finalized with each participant only after his/her consent. There was no compulsion to attend the interview and they had right to withdraw from the process at any moment. Before actual interview process, researcher sent interview questionnaire document in advance to avoid any surprises. Researcher has assured their confidentiality and anonymity by assigning a unique Pseudonym to each participant and referring it in the report instead of his/her real name.

3.9. Limitations

As seen in any research, the methodologies used here are not without limitations. Research field and other elements like philosophy, strategy, approach etc. have their own weaknesses. First, the healthcare sector itself is subjected to many restrictions in Ireland. There are laws formulated by Data Protection Commissioner to protect patient identity. This is necessary since there is a potential risk of patient privacy breach during communication between GPs and laboratories. Even though this research is not going to focus on individual patients and no patient specific data is required for research, GPs and laboratory scientists may be hesitant to discuss. (Data Protection Commissioner, 2007) Second weakness comes from availability of participating general practitioners due to overburdened health services in Ireland. Workload on GPs in Ireland have risen due to factors like aging population, chronic diseases etc. (Dr. O’Riordan, 2015) Inductive approach implies on recording observations first and then builds theory based on it. In this approach, it may be possible to get incorrect observations from doctors which can lead to wrong results. Interviews also have their own limitations like delays in getting participants’ appointment, difficulty in understanding the context behind the interview questions, costs and time involved in interviewing individuals due to geographical location etc.
One of the limitations of this research is small sample size. This is because lack of availability of participants i.e. GPs and laboratory staff, due to their workload. So researcher had no option but to rely on only those respondents who agreed to engage in interview process. There are around 2500 practicing GPs in Ireland but the researcher was able to engage six general practitioners only, so the information collected was limited. Due to this, it is possible that the findings based on this information may not be accurate since these opinions of other GPs may be different than the opinions expressed by the participating GPs. Also some of the participating GPs were based in rural areas of Ireland. So it is possible that their exposure to MedLIS may be different than exposure of GPs in big cities. Similarly, the researcher had been able to involve laboratory staff like chief medical scientist or pathologist in 3 out 43 hospitals in Ireland. So their views may not reflect the views of the entire hospital pathology community.
Chapter 4. Research Findings and Analysis

As stated clearly in the first chapter, this research has two main objectives –

- To determine challenges perceived by Irish general practitioners and laboratory scientists in electronic communication between GPs and hospital laboratories
- To assess impact of new national laboratory information system, MedLIS on Irish general practitioners and laboratory scientists

Both these objectives have been gauged by semi-structured interviews using different methods like personal meeting, web, and e-mail communication, as the research topic requires interaction with the people in healthcare industry within the boundaries of Ireland only. The research narrows down further to GPs and laboratories so respondents were selected using purposive sampling since availability of general practitioners and laboratory managers in hospitals is very low due to privacy and confidentiality concerns. To engage more participants in the research process, snowball sampling technique has been used by collecting references of those who were willing to help, out of the selected participants.

In all, fourteen individuals agreed to engage in the interview process. Break-up of these fourteen participants was done in the following manner – six general practitioners, six people working in various hospital laboratories on different roles like Chief Medical Scientist, Biochemist, Pathologist, IT specialist etc. and two people working on HSE projects (Healthlink and MedLIS project).

Most of the interviews were face-to-face in nature while some interviews were on email. Interview questions had been adjusted on the basis of interviewee profile. So GPs were asked questions towards their experience in dealing with laboratories while the laboratory professional questions focused on order and results communication with GPs.
Some participants have agreed to participate in the interview process on the condition of anonymity. So their real names will not appear in the report; instead they will be mentioned here as anonymous. The table below summarizes the pseudonyms used to indicate individual participants.

People are working in hospital laboratories under various roles like Chief medical scientist, Pathologist, Biochemist, IT specialist etc. have been grouped together under ‘Laboratory-based Professional’ category.
**General Practitioners**

From the practice experience point of view, all the GPs that the researcher interviewed, have worked in Ireland for significant number of years and are capable of giving their opinion on various aspects of the healthcare system. They are from different geographical locations like Dublin, Drogheda, Arklow, Tramore and Carbury.

**Laboratory-based Professionals (Chief Medical Scientist, Consultant Pathologist, Biochemist)**

In this research, perception of laboratory professionals about challenges between GPs and pathology laboratories is equally important from hospital laboratory perspective. So in totality, the researcher interviewed six people working in various hospitals around Dublin. All these people are working in hospital laboratory domain on different roles like Chief Medical Scientist, Principal Biochemist, and Chemical Pathologist etc. Also the hospitals, where these people were working, are some of the premier health institutions in Ireland and these hospitals also have huge laboratory facilities that receive diagnostic test orders from hospital consultants as well as GPs. So interviews of these people can bring forward the challenges in communication with GPs. All these people are well versed with the laboratory information systems implemented at their workplace and when the researcher conducted interviews with them, it was noticed that every hospital facility uses different LIMS (Laboratory Information Management System) software.

**Health Service Executive (Healthlink and MedLIS project)**

Since the research is based on challenges in communication between GP and hospital laboratories, the role of HSE professionals is vital. MedLIS project implementation will be supervised by HSE in collaboration with Cerner. So any decision by HSE in relation to MedLIS will have profound effect on the outcomes of this research. Similarly, Healthlink is a brokering message system that handles transactions between laboratories and GPs. So interviews with HSE executives gave better clarity about government’s perspective on these issues.
### Profile

<table>
<thead>
<tr>
<th>Profile</th>
<th>Pseudonym</th>
<th>Work Location</th>
<th>Work Experience in Ireland (Years)</th>
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<td>GP5</td>
<td>Rural</td>
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</tr>
<tr>
<td>General Practitioner</td>
<td>GP6</td>
<td>Rural</td>
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### 4.1. Research Objective I

*To determine challenges perceived by Irish general practitioners and laboratory professionals in electronic communication between GPs and hospital laboratories*

In this section, the researcher focused on getting information from participants about

- their field experience as GP or laboratory professional
- their current IT systems to communicate with the other party and their level of satisfaction with the system
- volume of laboratory test orders sent or received from their system and their satisfaction with Healthlink
- Opinion about interaction between GPs and hospital laboratories in Ireland
Given below are the findings derived from the answers of general practitioners which were specific to research objective 1–

**a. Number of years working as General Practitioner in Ireland**

GPs engaged in the research have a good experience of practice in Ireland that varies from 10 years to 30 years. Two-thirds of the GPs have been practicing since 10 to 20 years while one-third GPs have more than 20 years of experience.

![Chart 3: GPs - practicing experience in Ireland](chart.png)

**b. Using software system to maintain patient records**

Practitioners GP1, GP2, GP3, GP4 and GP6 are using software systems to maintain day-to-day patients’ information within their clinics, which is 83% of the interviewed GPs. While GP3, GP4 and GP6 use Socrates software system, GP2 uses Helix system. Interestingly GP5 has answered ‘Not Applicable’ for this question indicating possible use of paper-based system.

**c. Using software system to communicate with hospital laboratories**

Since the research aims to know the issues between GPs and hospital laboratories and practitioners also require sending and receiving diagnostic test data, the researcher asked all practitioners about their current mechanism of interaction with laboratories. Except GP5, all other practitioners informed that they rely on Healthlink system for communication with laboratories. They also described their satisfaction level with Healthlink as 4 or 5 on the scale of 1 to 5. (4 indicate ‘Good’ and 5 means ‘Excellent’).
d. **Daily frequency of test orders**

Test ordering frequency is quite similar among all GPs. Most of GPs order around 11 to 20 tests per day for except GP5 who orders less than 10 tests a day from laboratories.

![Chart 4: Average number of tests ordered by GPs daily](image)

**e. Capability to send orders electronically**

When asked about sending test orders to laboratories electronically, 83% of GPs answered that they don’t have capability to order these tests from laboratories in electronic format. They still rely on traditional paper-based ordering.

![Chart 5: GPs capable of ordering tests electronically](image)

**f. Capability to receive results electronically**

There is an interesting observation here. All the participating GPs receive test results using Healthlink and they are satisfied with it.
g. **Comments about current state of communication with hospital laboratory**

According to GP2, laboratory staff is difficult to reach in case of discussion about patient results even though communication from laboratories to GPs using Healthlink is satisfactory. GP3 emphasized that GPs in Ireland should prefer electronic systems over paper-based systems since hospital laboratories are reluctant to perform diagnostic testing for GPs. Same sentiments were echoed by Practitioner GP6 who was unhappy with laboratories due to slow response time and sidelining orders from GPs. GP6 also complained about shortage of administrative and technical staff in laboratories which is causing delays and errors in the test results and in order to reduce these delays, communication with laboratories has to be improved. Practitioner GP5 made an interesting comment about the test results that a lot of staff time is spent in feeding the data on computers and still end up getting reports on papers.

After analyzing perceptions from GPs, let’s look at the findings of laboratory professionals from their answers specific to research objective 1–

a. **Laboratory professionals experience in Ireland**

Laboratory professionals, who participated in the interviews, have worked in pathology related fields in Ireland for quite some time. Their experience varies from 9 years to 25 years. Half of the professionals have 20 years or more experience.
b. **Using Laboratory Information Management System**

Professionals LP1, LP2 and LP5 use LIMS called ‘iLAB’ to manage patient test data. Similarly, LP3 and LP6 use ‘Telepath’ software while the laboratory where LP4 is working has implemented Apex LIMS.

c. **Capability to receive orders electronically from GPs**

With regards to the format in which the laboratories receive test orders from GPs, professionals LP1, LP2, LP4 and LP5 informed that their laboratories have no facility to receive diagnostic test orders from GPs electronically. They still receive orders in paper-based format which they need to feed in their systems manually. The only professional, whose laboratory receives orders electronically, was LP6.

![Chart 7: Hospital laboratories capable of accepting orders electronically](image)

**d. Capability to send test results electronically to GPs**

When asked about sending test results back to the GPs electronically, 67% of laboratory professionals informed that they use Healthlink to send diagnostic test results back to ordering GPs in electronic format. LP6 said that the hospital laboratory does have Healthlink but was not used by GPs.
e. **Daily frequency of test orders from general practitioners**

Out of six laboratory staff interviewed, a chief medical scientist works with blood transfusion department that doesn’t interact with GPs. 67% of the total participants informed that on an average, they receive more than 40 test orders exclusively from GPs.

f. **Comments about current state of communication with general practitioners**

According to professional LP1, current LIMS doesn’t have the feature to accept electronic orders from outside systems. So if the laboratories decide to go for electronic ordering, it would be definitely better than paper. But according to her, the phone based communication with GPs should be still necessary to confirm about the validity of tests or its results even after laboratories become fully electronic. Cost can be saved by reducing papers for printed report as per the comments from LP2. Professional LP4 emphasized that his hospital laboratory doesn’t
have Order-Comm application which a significant lag in terms of infrastructure. Though the hospital has planned for it in December, it won’t be used with GPs immediately. Professional LP5 expressed concern over limited budget with laboratories which may be imbalanced due to rise in the number of tests ordered by GPs that can be repetitive. In the interview, professional LP6 said that most GPs don’t pay laboratories for the services to private patients and many GPs are reluctant to implement electronic laboratory ordering which has caused manual receiving of orders at the laboratories and further transcription errors.

Finally, let’s look at the findings from the answers specific to the research objective 1 by HSE people –

When asked about communication between GPs and laboratories in Ireland, HSE1 expressed an opinion that since GPs are independent contractors with HSE, everyone has their own choice about implementing communication methods and electronic test ordering between them is necessary since both parties are unhappy with the paper-based system. But HSE has started taking steps towards it. According to HSE2, there is a lot of interaction between GPs and hospital laboratories due to Healthlink service. Many GPs in Dublin have accepted electronic ordering feature from Healthlink portal. GPs can integrate Healthlink services within their own EHR systems but they would need help and feedback from EHR vendors in terms of IT solutions. On the top of that, broadband internet access in Ireland is not uniform which causes problems for rural GPs operating in remote areas.
4.2. Research Objective II

To assess impact of new national laboratory information system, MedLIS, on the general practitioners and laboratory-based professionals in Ireland

To address this objective, the researcher conducted semi-structured interviews with GPs, laboratory professionals and HSE staff by asking questions specific to MedLIS. In this section, researcher focused on getting information from participants about

- their awareness about MedLIS
- perceived benefits of MedLIS
- opinion about MedLIS implementation
- expectations from HSE

Given below are the findings from the answers of general practitioners from their answers specific to research objective II –

a. Aware about MedLIS?

When GPs were asked whether they had heard about MedLIS, GP1, GP3 and GP5 confirmed that they had heard about MedLIS. GP3 and GP5 hadn’t heard anything specific about MedLIS except few references while GP1 knew that MedLIS will make patient data available 24 x 7. Remaining GPs had no idea what MedLIS is all about. Interestingly, all GPs who hadn’t heard about MedLIS were based in rural areas.

b. Benefits of MedLIS to GP practice

67% GPs felt that MedLIS won’t bring any benefits to their practice. All of them were happy with current Healthlink system. Another reason explained by GP3 and GP6 was that they weren’t aware about any benefits from MedLIS. Only GP4 thought that MedLIS will help the practice by opening access to more hospital laboratories rather than depending on a single hospital while GP5 didn’t answer this question.
c. **Comments and feedback on MedLIS**

According to GP1, most of the GPs wouldn’t have much or no awareness about MedLIS and its’ benefits to their practice. MedLIS is going to benefit hospital laboratories rather than GPs and it is not going to make much difference to GPs since they are happy with Healthlink service for laboratory results. MedLIS won’t make it easier for GPs for laboratory ordering so it makes sense that it will be effective only if it can make electronic test ordering easier for GPs. GP2 asserted that usability of MedLIS depends on the advantages it can offer to GPs e.g. quick and effective reporting feature. GP3 was in favour of switching to electronic system to communicate with laboratories but its success will depend on the possibility of integration of MedLIS with EHR. GP3 also was of the opinion similar to GP1 that integration with MedLIS should make test ordering to laboratories easier for GPs and it should also eliminate login to Healthlink to avoid multiple data entry. To explain integration concept, GP3 gave example of the Socrates system which has feature to integrate Healthlink to import patient results directly. GP4 was not happy with limited access of Healthlink to a single hospital and suggested that MedLIS can be useful if it can include access to more hospitals, it would benefit the GPs. GP5 didn’t make any comments specific to MedLIS but stressed on the paper printed reports that caused a lot of wastage and was also bad for the environment. GP6 expected that MedLIS should make test results available in time by avoiding delays.


d. **Expectations from HSE**

When asked about their opinion about expected measures from HSE, GP1 expected HSE to co-ordinate with IT vendors of GPs about MedLIS integration rather than imposing some rigid solution. GP2 was happy that MedLIS will make test reports available 24 x 7 but steps should be taken to improve communication from GPs to laboratories since sometimes contacting with them can consume a lot of time. GP3 complained that laboratories were reluctant to conduct tests by GPs and gave preference to hospital work in case of sophisticated and expensive tests. GP6 stated similar complaint about laboratories being partial towards hospital work compared to GP orders which is causing delays in getting results to GPs. So laboratories should have more professionals and administrative staff to tackle this problem. After going through the interviews with laboratory professionals, here are the findings from their answers associated with the research objective II –

a. **Aware about MedLIS?**

Interestingly, all laboratory professionals confirmed that they were aware about MedLIS. It seems HSE has done well in the awareness with laboratory professionals. LP1 was involved in procurement and evaluation of MedLIS and attended demo from Cerner. LP2 was also involved in MedLIS review at the workplace and had attended MedLIS workshop. According to LP3, MedLIS is going to benefit laboratories by improving communication between general practitioners and laboratories and also going to make diagnostic data available 24 x 7. LP5 expressed dissatisfactions with current LIMS ‘iLAB’ saying that it is inconvenient and inflexible. LP6 had also attended meetings with Cerner about MedLIS and participated in its implementation.
b. **Benefits of MedLIS to hospital laboratories**

In contrast to observations with GPs, all laboratory professionals felt that MedLIS is going to bring benefits to their hospital laboratories. Most common benefits noted from their conversations are - reduced paper-work, access to diagnostic data irrespective of test locations, and 24-hour availability of test results. According to LP1 and LP6, MedLIS will facilitate in maintaining patient diagnostic data together in a single database which will make results tracking easier when patient moves from one hospital to another. LP2 felt that the current LIMS has no unique patient id (IHI) to track referrals from other hospitals but MedLIS will make provision for IHI that can streamline the referral process. LP1 and LP3 agreed on the benefit of freedom from paper-based system. According to LP5, introduction of MedLIS will transform the test results being tied to patient instead of testing facility due to patient health identifier feature. This will also improve patient care and raise efficiency and laboratory results can be handled easily by different users like doctors, nurses etc. It will also make the patient data available in a single database. But LP4 had different thoughts on MedLIS. He felt that it would bring benefits to users more than the laboratory itself. Even though it will make laboratory operations less dependent on IT, laboratories may lose their control over daily functions due to MedLIS rigidity.

c. **Comments and feedback on MedLIS**

Almost all professionals have expressed positive feedback about MedLIS apart from doubts raised by LP4 and LP5. Professionals LP1, LP2 and LP6 favored adoption of MedLIS by GPs since it would help them place their test orders electronically. According to LP6, electronic ordering through MedLIS will streamline the communication with laboratories since it will reduce transcription errors in paper-based orders. According to LP1, MedLIS would have a big impact on health services in Ireland since it will eliminate misinterpretations of tests and bring
standards to diagnostic tests in terms of names, reference range, volume etc. LP2 felt that hospitals have no alternative to MedLIS adoption since it would provide a single system for all 43 HSE hospitals and it would also save the cost of sending printed reports. But LP4 raised concern over loss of some important features like auto-commenting in LIMS due to introduction of MedLIS and possible underutilization of IT infrastructure since most of the staff will not be familiar with MedLIS. LP5 noted some downsides of MedLIS. He felt that MedLIS may encourage GPs to order too many tests and it could have problems with patients’ security and data protection. Similarly, during migration from current LIMS to MedLIS, hospitals have to refer to the old system for patient data so a lot of efforts would be required.

d. **Expectations from HSE**

Regarding expectations from HSE, professional LP1 expected that hospital laboratories should get modern equipment and adequate staff in the laboratories. Apart from this, HSE should keep GPs updated about MedLIS progress. LP3 stressed that as of now, three different HSE projects are in progress but they need to be synchronized, may be with help of MedLIS. He also emphasized that MedLIS will bring immense benefits to blood transfusion department since hospitals can determine patients’ blood group by accessing records electronically. According to LP5, there are costs involved for laboratories which HSE should think about instead of thinking only about the expenses borne by GPs. He thinks so because laboratories have limited budget to manage their operations.

Finally, HSE members’ also expressed their opinions about MedLIS and its impact on Irish health services. When asked about their views on MedLIS, HSE1 explained that goal of MedLIS is to simplify electronic ordering between GPs and hospital laboratories. GPs also have a representative on government bodies and HSE will make sure that all stakeholders will be satisfied with the new system. With regards to MedLIS, it’s not a technically complex solution
and GPs don’t need a lot of support to maintain it. Any additional hardware required will be supplied to GPs by HSE. Since GPs are attached to hospitals, HSE doesn’t expect all GPs to go live on MedLIS from day one as implementation of MedLIS would happen in phases and individual hospitals would have to co-ordinate with their respective GPs. From HSE point of view, middle of 2019 is the expected deadline for all GPs to start with new system. There are three major benefits of MedLIS. First is reduction in duplicate tests for patients when moving from one hospital to another which will make laboratory more efficient. Secondly, health services will move towards unique patient identification logic that will help GPs and laboratories to avoid confusion about correct patient detection and eliminate ambiguity due to multiple records for the same patient. From laboratories perspective, they can utilize the available information more efficiently e.g. current systems require longer processing time to generate statistics about over-ordered tests. MedLIS can provide a powerful report writing and analyzing tool to help in this situation.

According HSE2’s opinion, there are many stakeholders associated with MedLIS project e.g. GPs, laboratories, IT vendors etc. HSE will involve all these parties to ensure that MedLIS will deliver expected benefits to GPs and laboratories. As of now, many GPs rely on Healthlink to receive diagnostic test results from hospitals. Introduction of MedLIS will not affect this and will continue to provide uninterrupted service. For GPs, this will be a big change because new system will be an improvement to the existing process of test ordering. They can also track samples with this system but the biggest advantage for them is electronic ordering and electronic receiving in one system. This will reduce a lot of paper-work and related errors.

4.3. Discussion

The qualitative data collected and the associated findings are specific to this research. They have helped the researcher in understanding perceptions of general practitioners and
laboratory professionals in Ireland about challenges in electronic communication as well as about the new system on the horizon, MedLIS. After analyzing the above findings, some interesting patterns have emerged –

- Most of the participating GPs use one of the standard practice management systems in Ireland - Helix, Socrates, CompleteGP and Helix Practice Manager
- All GPs rely on Healthlink to communicate with laboratories to receive test results
- Majority of GPs don’t have electronic test ordering capability and were not satisfied with paper-based ordering
- GPs practicing in rural areas are not aware about MedLIS and they don’t consider MedLIS as beneficial for their practices since they are satisfied with Healthlink
- Majority of the hospital laboratories are handling decent amount of workload from GPs in paper-based format and they are using Healthlink to push the test results back to requesting GPs
- All the participating laboratory professionals are aware about what MedLIS is and think that it would be beneficial to their hospitals
- Some of the professionals accept that lack of Order-Comm system is a major weakness in handling laboratory operations
- Some GPs and professionals point out that tracking patient data movement between hospitals is difficult due to absence of a unique patient identity number
- Few GPs are not satisfied with the way hospital laboratories function and their turn-around time. Their grievances are that the laboratories give more preference to hospital work over their test requests and shortage of staff is causing delays in receiving results on time
Chapter 5. Conclusion and Recommendation

This section is going to address the gaps in existing literature specific to the research topic and form a conclusion based on the findings and discussion in Chapter 4. The researcher has tried to reach as many participants as possible in his capacity, both in terms of GPs and laboratory professionals. Many respondents accepted to participate in the research after going through the research interview questions document while some didn’t participate due to the lack of time and other commitments. So the researcher is aware of the fact that findings are based on perceptions of a limited sample and may not represent the opinion of an entire community. But it has given a fair amount of insight about the problems that the researcher is trying to address.

With respect to the research objective I, the findings suggest that Irish GPs have a lot of communication with hospital laboratories – sending test orders and receiving test results and it has been observed that it doesn’t take place in a uniform format. GPs send orders using papers while laboratories send the results back electronically. This disparity has made the interaction less efficient and less effective in terms of resource utilization. Even though both GPs and laboratory professionals seem to be satisfied with Healthlink for communication with laboratories to receive test results, they have expressed their displeasure about ordering process which is still paper-based. This is because only 3 out of 43 hospitals have the capability to accept electronic orders from GPs using Order-Comm application. Paper-based orders force hospital laboratories to feed the incoming order data manually in their system which leads to two problems – delays in delivering services and mistakes in interpreting manual orders.

GPs seem to be worried about increased turn-around time by laboratories due to manual ordering process. They have also complained about hospital laboratories’ preference to hospital work over their test requests and reluctance to conduct blood test orders from them since laboratory budgets
are funded according to hospital workload instead of workload from GPs. Apart from this, non-electronic communication like phone calls between them are also prone to delays due to difficulty in reaching laboratory staff in case of emergency. On the other hand, laboratory professionals put the blame on lack of Order-Comm system for these delays. They have expressed concerns about GPs that they often hesitate to implement electronic ordering which force laboratories to accept manual orders from GPs and it has affected their efficiency. By adopting electronic approach, GPs can help laboratories to streamline diagnostic ordering and testing process and reduce errors at their end. Hospital laboratories also have limited budget in which they have to do justice to their own hospital requests as well as workload from GPs.

From the point of view of the research objective II, contrasting views about MedLIS have emerged from the discussions with GPs and laboratory professionals. Most GPs seem to be unaware of MedLIS and don’t see any potential benefits to go for adoption. Even though they agree that lack of electronic ordering system is a problem in making effective interaction with laboratories, they don’t seem to be keen on exploring MedLIS to improve it. Possible reason might be their satisfaction with existing functionality provided by Healthlink. For the GPs, 24-hour access to patient information is the primary benefit of MedLIS. On the contrary, all laboratory professionals seem to be aware about MedLIS since the system primarily deals with laboratories. Many of them are a part of review and implementation teams at their respective hospitals. They believe that MedLIS will improve their operations by making them more efficient. One of the important aspects of MedLIS highlighted by many professionals is the provision of unique patient identifier. Similar concept known as IHI (Individual Health Identifier), has been used in many countries. Using this identifier, GPs can easily track patients’ health information irrespective of the actual test location while hospitals can achieve interconnectivity i.e. patient’s record in one hospital can be viewed from another hospital through MedLIS. IHI prevents mismatching of patient’s data that can lead to delays, medical errors,
repetition of unnecessary testing, misdiagnosis, and overhead costs. Even though enforcing IHI has its own cost, savings will outweigh these costs after successful implementation. The IHI will also play an important role in other eHealth Ireland initiatives like e-Prescribing.

There are some concerns by laboratory professionals about MedLIS. According to them, it may encourage GPs to order unnecessary tests which will increase workload on laboratories affecting their budget. Another worry about MedLIS is about compromising with confidentiality and privacy of patient data since it is going to make the test results available to all participating hospital laboratories. So there has to be strong authorization mechanism to access this data. GPs think that MedLIS will be effective only if it integrates well with their own practice management software, e.g. integration of Healthlink with Socrates, which will avoid login to multiple systems.

To summarize the conclusion, this study has also revealed challenges in communication between GPs and hospital laboratories as –

• Lack of electronic ordering for GPs
• Transcription errors due to paper-based ordering
• Duplicate tests ordered by GPs
• Preference of laboratories to hospital work over test requests from GPs
• Limited budget available to hospital laboratories
• Long turn-around time for GPs to receive test results
• Absence of single patient identifier to track patient records
• Heterogeneous laboratory information management systems across Ireland

Study has also highlighted possible impact of MedLIS on health services in Ireland. Most of the issues identified will be taken care by MedLIS since it is going to enable unique patient identifier based on EMPI architecture. This number will ease movement of patients’ records between
different hospitals and make them available 24-hour to GPs irrespective of test location. It also has potential to reduce duplicate test orders by GPs. From blood transfusion perspective, MedLIS can help laboratory professionals to identify blood groups of the patients rather than relying on paper-based or telephonic information from GPs. As of now, electronic laboratory ordering system (Order - Comms) is in place at few hospitals only but with MedLIS, all 43 hospitals are expected to implement this module that will streamline their order receiving process. But it is also important for HSE that the integration of MedLIS with practice management system / EHR holds the key for success of the project from GP perspective since GPs would expect that this process should be as simple as possible. In short, MedLIS will have a positive impact on the interaction between of hospital laboratories and general practitioners in Ireland due to its ability to streamline the key processes.

**Recommendations for HSE**

HSE is trying to push the idea of single nation-wide laboratory information system and its associated benefits. So it has made efforts to reach maximum number of GPs through the laboratory managers that they deal with and spread awareness about MedLIS. But it doesn’t seem to be effective. Either it hasn’t reached the GPs practicing in rural areas or it hasn’t convinced the GPs about the possible improvements to their practices after MedLIS implementation. But HSE has already taken several positive steps towards making health services more efficient through ‘eHealth Ireland’ initiative and meetings with GPIT group. It has also organized workshops, seminars and demos for laboratory professionals in collaboration with Cerner. To create more awareness about benefits of MedLIS, HSE has involved laboratory managers in the participating hospitals and these managers are coordinating with the GPs associated with their respective practice areas. Apart from these activities, HSE should also convince GPs that integrating MedLIS with their system is not a complex and expensive endeavor so that it can achieve the target of connecting 100% GPs with laboratories within the mid-2019 deadline. Complete implementation of MedLIS in all hospitals in Ireland is
going take lot of time, so HSE should take proactive steps to keep GPs updated about the implementation progress in their associated hospitals. There should to be a lot of training sessions for both GPs and laboratory professionals about various modules in MedLIS. Even though MedLIS has been designed from laboratory information perspective, it would be interesting to monitor its adoption by GPs in Ireland.

**Recommendations for further research**

MedLIS is the new laboratory information system and its implementation has been planned in phases with total estimated period of around 4 years till mid-2019. Like every change from old system to new system, hospitals are going to face challenges during the transition period. So to probe into the difficulties during changeover process, further studies can be conducted in the hospitals selected for first phase of MedLIS implementation. It can evaluate challenges and risks associated with various requirements like IT infrastructure, time, cost, staff training etc. This analysis will help other hospitals to deal with possible uncertainties. Similarly, after successful implementation of MedLIS in first phase, new studies can be undertaken

- to gauge effectiveness of electronic ordering for GPs
- to evaluate benefits of patients’ record tracking using IHI for hospital laboratories
- to get perceptions of GPs about the interaction with laboratories using MedLIS

According to Harney (2012, pp.70-80), the Irish government uses different identifiers to track its services. Some of these identifiers are - Personal Public Service (PPS), Primary Care Reimbursement Scheme (PCRS), Client Identity Services (CIS), European Health Insurance Number, passport or driving license number etc. With so many distinct numbers, the government agencies find it difficult to locate someone easily across these departments. A new feasibility study can be carried out to gauge usefulness of IHI in these services and highlight its real potential in Ireland, not just in healthcare sector, but across all major government initiatives.
Chapter 6. Self-Reflection

6.1. Introduction

In the initial days of 2015, the researcher started thinking about taking a break from his job to try something new. Then he thought of further education. Since he is a self-sponsored student, he looked at the education cost as an investment that he should be able to recover in a couple of years. So the researcher expected that the degree should have a good recognition in Ireland and should also help him to find a decent job. Apart from this, the degree should make him ready with the skills that employers demand in job market. In 2015, the researcher took admission in DBS as Sept intake for MBA with Information Systems as his major since he had a prior experience of 20 years in the IT sector.

6.2. Kolb’s Learning Style

Each individual learns in different and unique way. Every individual has his/her own style of learning. People perceive and process information in many unequal ways. Learning style can be defined as the preferred way of an individual to obtain process and retain any sort of information, and it involves many factors such as time of the study, strategies of study, place to study and so on. Researchers have tried to relate learning style with different factors like time of the day, study strategies used, place of study, expectations from teachers and parents about learning etc. There are several learning styles that have developed on the basis of Kolb’s theory. Visual learners prefer learning by visualizing things like reading, looking at pictures, diagrams, charts, watching films, videos etc. to learn new information. Auditory Learners enjoy learning through audio information. They prefer to go to the classroom and listen to the lecturer. People in Kinesthetic category use hands-on tasks to learn new things using touch and feel. Finally, integrated learners are those people who use different combinations of these styles. (Van Blerkom, 2009, pp.9-12)
Experiential Learning Theory (ELT) was developed by David Kolb using circular diagram approach. It consists of four stages: Concrete Experience, Reflective Observation, Abstract Conceptualization and Active Experimentation. ELT emphasizes that this cyclic process learning should be continuous, and it begins when individuals perform action for the first time. (Kolb, 1984, pp.30-31) Concrete Experience is the first step in Kolb’s learning cycle. It means to begin with doing something new. Individuals, team, or organization will start learning by doing something which they are assigned as a task. Active participation is the key for learning. (Mobbs, n.d.) Here concrete experience means academic and professional knowledge that the researcher has acquired prior to his MBA program. The researcher has completed Bachelor’s degree in Computer Engineering from a reputed college in India and he is well equipped with industry experience. Second stage of learning cycle is reflective observation. In this stage after doing a task, the researcher takes time to observe, reviews his/her completed tasks and gathers data from experiences. (Mobbs, n.d.) The reflective observation includes the process of self-reflection and identification of the research problem area and the research question, which was initiated during the first semester with the Personal and Professional Development module. Abstract conceptualization is the process of making sense of events that have taken place and interpreting them and further understanding the relationship between them. At this stage researcher makes a comparison between what he has done and what he already knows. He may use theory from textbooks for explaining the events that he has developed. (Mobbs, n.d.) Active experimentation is the last stage in ELT.
Another learning style based on Kolb’s model is Honey and Mumford model. (Honey and Mumford 1986 cited in Reid 2005) It identified four individual learning styles as – activists, reflectors, theorists and pragmatists. Activists are very enthusiastic, and open minded. They are ready to take challenges and try new things. Reflectors have very deep observation skill. They can see the situation in different perspectives. They postpone their decision according to their requirement. These people maintain a low profile. Students with theorist style are very logical. They use logical steps to analyze the situation. They are good at analyzing quantitatively than qualitatively. They work as perfectionists and favor lateral thinking. Last learning style is pragmatist. They are focused on practical side and oppose the analytical thinking. They use practical situations rather than deep understanding. They look always for new ideas and theories.

6.3. Master of Business Administration

Everyone has his/her own different objective to learn new things. The researcher had his thoughts clear during admission time and he was looking for something more than plain textbook education like school. It was twenty-two years ago when the researcher had attended
college last time. So it was a challenge for him to see if he can learn something totally new after a long gap. Writing 3000+ words on a topic was also an exciting challenge. Learning at DBS helped him to know himself better. Getting Master’s degree from a European university was his aim since it is going to serve his future career prospect. A multicultural place like Dublin also allowed the researcher to mix and interact with people of various nationalities and even continents. The researcher always likes to meet & discuss people having different socio-cultural background. Doing masters at a location away from home country gave him an opportunity to interact with students of different cultures & background. It broadens one’s vision about the world since it can get many surprises after meeting people coming from different culture.

6.4. Learning Experience

DBS MBA program started in September 2015 and researcher has successfully completed both the semesters. The researcher has background in the IT industry so his specialization subjects were related to the field. Prior knowledge of healthcare domain and major modules made him well equipped to develop a dissertation. The researcher studied various modules that involved writing assignments by going through relevant articles and referencing them using Harvard referencing style but he managed to adopt the new way of academic writing. Not only during the development of this dissertation, but also at classes, the researcher has continued to analyze, reflect upon those to develop concepts and then apply those in the study. Classes provided for the MBA were especially based on case studies which are real situations. Among the modules taught in college, the researcher had no prior background in many of them, like financial analysis, international management, business strategy etc. In each of these modules, he learnt many new things that helped him to study new concepts.
International Management: Euro currency and Euro-zone, managing cultural differences, managing overseas operations, useful models like Hofstede, Porter’s 5 forces etc., PESTEL analysis, globalization, leadership and change management corporate governance


Business Strategy: Strategic planning, Five Forces model, Strategic capabilities, Culture and strategy, International strategy, Strategies in action

Performance Driven Marketing: Introduction to marketing, connecting with customers, Building brands, pricing strategies, Value proposition

Innovation and IT Management: Innovation basics, Types of innovations, Innovation design and timeline, Customer touch-point

6.5. Skills Developed

Time Management

In the MBA program, assignments were a part of the curriculum for continuous assessment throughout the trimesters. Even though each module had its own complexity and submission deadlines, sometimes the researcher had to submit two or three assignments at a time. From that pressure, he learned how to manage time efficiently, how to work under pressure and meet deadlines. These skills are very important in the present competitive world.

Research and Investigation

In the MBA program, the researcher had to submit many assignments which were based on practical approaches and some were case studies approach. These assignments and case studies taught crucial research skills during the written assignments. It also improved his analytical skills, problem solving skills, decision making skills, managerial skills etc. These skills are very important to the present globalization market. After completing the course, the researcher has
become aware about importance of research. A good research is carried out with influential articles which are trustworthy. So now the researcher knows how to find accurate resources that guarantee reliability and precision to papers.

**Team Work**

There were few group assignments in two modules – business strategy and performance driven marketing where the researcher had to work with other students as a team. In both scenarios, there were students from different nationalities. So working with them was a unique experience. The researcher played the role of a team member and learned how to work for team purpose, since other team members had a different academic background and culture. Key learning was how to plan and execute certain task without getting into trouble and without creating problems for themselves. They worked for one common goal - the team work.

**Decision Making**

Decision making is not an easy process. There are many ways in which people take decisions and one’s personality does affect the decision making. The researcher was tolerant towards decisions made by his fellow team-mates since people can make mistakes. Sometimes he encouraged people to perform tasks in a way that they find easy to adopt and keep communication at an informal level. He liked to learn new subjects earlier but now at this stage of life, he likes to enhance his existing skills. He believes in multi-tasking people so that it helps in avoiding excessive workload on selected members. Highlight of the course was emphasis on studying by analysis, making decisions and suggesting possible solutions to the real world business problems. The program has sharpened the researcher’s decision making skills since it was taught, keeping in mind the need of managers to take right decisions in the highly competitive business world.
6.6. Dissertation

This dissertation is possible due to study and hard work by the researcher throughout the course duration. In the first semester, he initiated with a thought process about this topic because of his prior IT and healthcare knowledge. The researcher also prepared research proposal for the research method subject as a part of the course. Feedback on this proposal by PJ Paul in first semester and by Brid Lane in second semester was very helpful in re-structuring the proposal by correcting mistakes in literature review and research methodologies. When the researcher successfully completed all the modules, he received a formal email from DBS informing him about assigning Mr. John Lamont as the dissertation supervisor. The researcher then contacted him to confirm his appointment. John responded and arranged the first meeting. In that meeting, John discussed the core idea behind the research topic. He explained step by step procedure regarding meetings and what was going to be covered in every meeting. In every meeting, John was highly motivating, made relevant suggestions and allocated the following tasks. At every stage of research, the researcher completed all the assigned tasks and submitted them to John, who proposed some corrections to make sure that the research is not going off the track. These were total five face-to-face meetings between the researcher and the supervisor.

6.7. Moving Ahead

As an MBA graduate, the researcher will be able to combine his new knowledge with the past experience and apply it to new circumstances in future. The Masters program has empowered him with skills that will enable the researcher to, analyze and solve complex unstructured business problems. The researcher is now confident that he can be good and fit for managerial roles in different organizations; He is thankful towards the MBA program and dissertation which led to his improvement in various skills.
Bibliography


Appendices

Appendix A: Research Invitation Email to participants

Dear {Contact Firstname},

My name is Rajesh Tukdeo and I am a student pursuing Masters in Dublin Business School. As this is Level 9 course, a dissertation is an integral part of the Masters program. My supervisor for the dissertation is Mr. John Lamont and the subject of my dissertation is 'the challenges in electronic communication between doctors General Practitioners (GPs) and pathology laboratories in Ireland, and the potential impact of the MedLIS system' that is planned for introduction starting later this year.

I understand that the current system for the transfer of diagnostic test results to GPs are transmitted to doctors is via a web portal called 'HealthLink' rather than by direct communication. Similarly, I understand that most doctors GPs still use paper based ordering of tests for patients. Based on my experience from the USA, where I worked with a company involved in such systems, I am researching the potential impact of the new MedLIS system on both laboratories and on GP practices.

To this end, I would be interested in having face to face interviews using a number of standardized questions that I will send out in advance. This process won't take more than 10-15 min. of your busy schedule.

If you are willing to engage with me on this topic, I will collate all the data I collect through these interviews, and analyze it for the purposes of my Masters dissertation. My deadline for submission is the middle of August and I would hope to conclude my interviews by the third week in July.

I want to assure you that, while your participation will be acknowledged in the final report (with your permission), your replies, will be kept confidential and will not be shared with others without proper consent.

I am grateful to you for considering this request and look forward to hearing from you soon.

Many thanks.

Rajesh Tukdeo
Dublin Business School
Appendix B: Semi-structured Interview Questions to General Practitioners

1. For how long are you working as general practitioner in Ireland?

2. Do you use any software system to maintain patient data electronically? (EMR/EHR)

3. Do you use any software system to communicate with the pathology/hospital laboratories?

4. On an average, in a day how many patients do you refer to the hospital laboratories for tests?

5. Do you send these test orders to hospital laboratories electronically?

6. If yes, then which system do you use to send orders electronically?

7. How do you receive test results from hospital laboratories?

8. On the scale of 1 to 5, where will you rate your experience with Healthlink?

9. Are you aware about the new laboratory system “MedLIS” that is going to be introduced in Ireland soon?  □ Yes  □ No

10. If yes, what have you heard about MedLIS?

11. Do you think adopting MedLIS will be beneficial for your practice?  □ Yes  □ No

12. If yes, what would be the benefits of MedLIS?

13. In your opinion, how is the current state of infrastructure to communicate GPs with hospital laboratories?

14. According to you, which of the following reasons will be critical in adopting MedLIS by GPs in Ireland?

15. Please list any additional measures that HSE can take to improve laboratory services.

16. Any additional comments that you want to give.
Appendix C: Semi-structured Interview Questions to Laboratory-based Professionals

1. For how long are you working in clinical laboratories in Ireland?

2. Do you use any software system to maintain patient data electronically? (LIMS)

3. Do you use any software system to communicate with the general practitioners?

4. On an average, in a day how many orders do you receive from GPs?

5. Do you receive these orders from the GPs electronically?

6. If yes, then which system do you use to receive orders electronically?

7. How do you send those results back to GPs?

8. On the scale of 1 to 5, where will you rate your experience with Healthlink?

9. Are you aware about the new laboratory system “MedLIS” that is going to be introduced in Ireland soon? □ Yes □ No

10. If yes, what have you heard about MedLIS?

11. Do you think adopting MedLIS will be beneficial for your hospital? □ Yes □ No

12. If yes, what would be the benefits of MedLIS?

13. In your opinion, how is the current state of infrastructure to communicate laboratories with GPs?

14. According to you, which of the following reasons will be critical in adopting MedLIS by hospitals in Ireland?

15. Please list any additional measures that HSE can take to improve laboratory services.

16. Any additional comments that you want to give.