



**Cape Peninsula
University of Technology**

**DATA GOVERNANCE IN HEALTHCARE INFORMATION SYSTEMS:
A SYSTEMATIC LITERATURE REVIEW**

by

NOMPUTUMO LINAH NGESIMANI

Thesis submitted in fulfillment of the requirements for the degree

Master of Technology in Information Technology

in the Faculty of Informatics and Design

Department of Information Technology

at the Cape Peninsula University of Technology

Supervisor: Prof. Ephias Ruhode

Co-Supervisor: Dr. Patricia-Ann Harpur

Declaration

I, Nomputumo Linah Ngesimani, declares that “Data Governance in Healthcare Information systems: A Systematic Literature Review”, reflects my own unaided work and the thesis has not been submitted for academic examination for any degree. Furthermore, the sources I have quoted and used are approved by means of references.

Signature: N.L. Ngesimani

Date: 16.11.2021

Abstract

This study aimed to investigate data governance relative to challenges associated with healthcare information systems, by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review. The study adopted a systematic literature review to collect and analyze data regarding the aim of the study. A combination of keywords on web search engines was used to obtain relevant research studies. The books, conference papers, journal articles and theses recognized as relevant to conduct the study, summed to 46 studies. The researcher conducted the study over the period 2010–2020.

The outcome of the data analysis reflects that a larger number of studies focused on healthcare information systems (14 papers), followed by data governance (12 papers), performance strategy (6 papers), competitive advantage (5 papers), data governance contingency model (4 papers), and process harmonization (5 papers).

The study shows that there is limited evidence concerning the findings on healthcare information systems (HIS) success and DG in South Africa, since data governance is still in its infancy. Healthcare has ultimately changed through political, social and technological factors. However, various organizations see data governance as a promising method of maintaining its value as an organization asset and of ensuring data quality.

This study contributed theoretically towards the body of knowledge, by reviewing challenges and guidelines relating to data governance within the healthcare environment. It contributed practically to the body of knowledge through understanding the healthcare information's systems status. It also contributed methodologically and significantly to systematic literature review strategies. The study created an opportunity for future research to propose an extended version of the data governance contingency model, and to implement and evaluate the model within a South African context.

Keywords: Adoption, Data governance, Data governance contingency model, Digitalization, eHealth, healthcare information systems, Qualitative data analysis, Systematic literature review.

Acknowledgements

The entire honor goes to my Heavenly Father for preserving my life and giving me the knowledge, understanding, wisdom and power to strive throughout the entire journey of this study.

I desire to extend my gratitude to the following people who have made my master's journey possible:

- My research supervisor, Professor Ephias Ruhode – thank you for the supervision and support throughout the research project. I also thank you for availing yourself and the time you contributed from the beginning to the end of this journey.
- My research supervisor, Doctor Patricia-Ann Harpur - thank you for the endurance, brilliance and time that you spent contributing to this study, and the encouragement you gave me to press continue towards my goal of getting a master's degree.
- To the Cape Peninsula University of Technology employees – thank you for scheduling the meeting in the challenging time of Covid-19 lockdown to make the defence proposal possible. In addition, the Department of Information Technology thank you for accepting me to conduct this research.
- My spouse, Sakhele Ngesimani – I appreciate your kindness, support, inspiration and the prayers you contributed towards this study.
- My child, Liyabusa Ngesimani - thank you for your prayers.
- My fellow master's students - you became a family to me; your support helped me to persevere and strive to reach my study goal.

Dedication

I dedicate this thesis to my grandfather, Ginyamathe Jim, my mother, Nobahle Jim, my father, Welile Biko, my husband, Sakhele Ngesimani, my aunt, Nobangela Jim, and my son, Liyabusa Ngesimani. It was my heart's desire to make my family proud, and with this mindset, I persevered until I reached my research journey and its goal.

TABLE OF CONTENTS

1	Chapter 1: Introduction to the Research	1
1.1	Introduction.....	1
1.2	Preface - Systematic literature review.....	1
1.2.1	Reasons for performing an SLR	2
1.2.2	Features of an SLR	7
1.2.3	Advantages of an SLR.....	9
1.3	Background to the research problem.....	9
1.4	Statement of the research problem.....	9
1.5	Aim, rationale, research questions and objectives	11
1.5.1	Aim of the study.....	11
1.5.2	Rationale of the study.....	11
1.5.3	Research questions and objectives	11
1.6	Delineation of the research.....	12
1.7	Ethical considerations associated with conducting an SLR.....	12
1.8	Dissertation Structure	13
1.9	Summary.....	14
2	Chapter 2: Theoretical Foundations.....	15
2.1	The concept of healthcare information systems.....	15
2.2	The concept of data governance	19

2.3	Data governance contingency model.....	21
2.3.1	Competitive strategy.....	24
2.3.2	Performance strategy	25
2.3.3	Process harmonization	25
2.4	Researcher’s background beliefs and biases.....	27
2.5	Summary.....	27
3	Chapter 3: Research Design and Systematic Literature Review (SLR) Method	28
3.1	Research design.....	28
3.1.1	Research philosophy and paradigm	30
3.1.2	Research approach	31
3.1.3	Research strategy	34
3.1.4	Methodological Choice: Mono method.....	34
3.1.5	Research time horizon.....	37
3.2	Method: Systematic literature review (SLR).....	39
3.2.1	Traditional vs SLR	39
3.2.2	Guidelines from the experts for a systematic literature review execution	40
3.2.3	A four-phase strategy	40
3.2.4	Quality assessment of the study.....	55
3.2.5	Data collection methods – in relation to other researchers’ methods and SLR.....	57
3.2.6	Research Tools	59

3.3	Summary.....	60
4	Chapter 4: Data Analysis.....	61
4.1	Introduction.....	61
4.2	A. Transformation – Competitive advantage.....	62
4.2.1	Digital transformation.....	62
4.2.2	Healthcare innovation.....	62
4.2.3	IT strategy and IT structure.....	63
4.2.4	Organizational competence.....	63
4.2.5	Technology challenges.....	64
4.3	B. Effectiveness - Data governance.....	66
4.3.1	Big data.....	66
4.3.2	Healthcare challenges.....	66
4.3.3	Improved data governance.....	66
4.3.4	Internet of Things.....	67
4.4	C. Performance - DG contingency model.....	69
4.4.1	Contingency and organizational fit.....	69
4.4.2	Data governance (DG).....	69
4.4.3	Organizational innovativeness.....	70
4.5	D. Adoption – Healthcare information systems (HIS).....	72
4.5.1	Digitalization.....	72

4.5.2	Healthcare	72
4.5.3	HIS adoption.....	73
4.5.4	HIS challenges	73
4.5.5	Implementation.....	73
4.6	E. Harmonization – Process harmonization	75
4.6.1	Data challenges.....	75
4.6.2	Data harmonization	75
4.6.3	EHR analysis.....	75
4.6.4	Healthcare transformation	76
4.7	F. Dynamics - Performance strategy.....	78
4.7.1	Digital healthcare.....	78
4.7.2	EHR adoption	78
4.7.3	Improved healthcare services.....	78
4.7.4	Organizational performance	79
4.7.5	Professional development	79
4.8	Summary.....	79
5	Chapter 5 Conclusions and Recommendations	83
5.1	Revisiting the aim, rationale and the research question	85
5.2	Summary of the main points: MRQ1	85
5.2.1	SQ1: What are the features of HIS?	86

5.2.2	SQ2: What is meant by DG success?.....	86
5.2.3	SQ3: What influences are noted on DG?.....	87
5.3	Summary of the main points: MRQ2.....	87
5.3.1	SQ4: What are the performance strategies that have been explored for improved healthcare?.....	87
5.3.2	SQ5: What competitive strategies have contributed to data governance success?.....	88
5.3.3	SQ6: What process harmonization is currently in place to manage data?.....	88
5.4	Research themes and findings	89
5.5	Limitations of the study.....	92
5.6	Delimitations of the study.....	92
5.7	Recommendations.....	92
5.8	Implications of the findings	93
5.8.1	Theoretical contribution	93
5.8.2	Practical contribution	93
5.8.3	Methodological contribution.....	93
5.9	Directions for future research.....	94
5.10	Reflection	94
5.11	Summary.....	94
	References.....	95
	Appendix A: Institution Ethical Clearance	104
	Appendix B. Systematic Literature Review	105

B.1 Search items	105
B.2 Academic publications – final selection of articles	106
B.3 Quality assessment criteria – article details and criteria	108
Appendix C: Synthesized Codebook.....	110
C.1 Category A: Transformation	110
C.2 Category B: Effectiveness	111
C.3 Category C: Performance.....	112
C.4 Category D: Adoption.....	113
C.5 Category E: Harmonization	114
C.6 Category F: Dynamics.....	115
Appendix D: Networks - Code Snippets from the Secondary Data.....	116
D.1 Category A: Transformation – Competitive advantage network.....	116
D.2 Category B: Effectiveness – Data governance network.....	117
D.3 Category C: Performance – DG Contingency model network.....	118
D.4 Category D: Adoption – Healthcare information systems network	119
D.5 Category E: Harmonization – Process harmonization	120
D.6 Category F: Dynamics – Performance strategy network.....	121
Appendix E: Categories, Items and Authors	122
E.1. Category A:Transformation – Link between Category A, items and authors	122
E.2. Category B: Effectiveness – Link between Category A, items and authors.....	123

E.3. Category C: DG contingency model - Link between Category C, items and authors.	124
E.4. Category D: Adoption - Link between Category A, items and authors.....	125
E.5. Category E: Harmonization - Link between Category F, items and authors	126
E.6. Category F: Dynamics - Link between Category F, items and authors.....	127
Appendix F: Mendeley PDF Files.....	128

LIST OF FIGURES

Figure 1-1 Representation of the thesis report.....	14
Figure 2-1 Provinces of South Africa	16
Figure 2-2 A framework that incorporates people, process and technology (Lee et al., 2018).....	20
Figure 2-3 Data governance contingency model adapted from Weber et al. (2009).....	23
Figure 2-4 The new competitive strategy model (Pisano & Hitt, 2015).....	24
Figure 2-5 Process harmonization model (Trienekens, Romero & Cuenca, 2016).....	26
Figure 3-1 Research onion (Saunders et al., 2019).....	30
Figure 3-2 Search strategy	42
Figure 3-3 A selection of references stored in Mendeley	42
Figure 3-4 Final articles for the SLR	45
Figure 3-5 Codebook for authors	47
Figure 3-6 Codebook for items	48
Figure 3-7 Code groups of categories, themes and items.....	51
Figure 3-8 Network diagram for the category, theme, items and authors	52
Figure 3-9 A systematic guide to literature review development (Okoli, 2015)	58
Figure 4-1 Network diagram for Category A: Transformation, themes, items and authors.....	65
Figure 4-2 Network diagram for Category A: Effectiveness, themes, items and authors	69
Figure 4-3 Network diagram for Category E: Performance, theme, items and authors.....	71
Figure 4-4 Network diagram for Category A: Transformation, theme, items and authors	74

Figure 4-5 Network diagram for Category D: Harmonization, theme, items and authors 77

Figure 4-6 Network diagram for Category B: Dynamics, theme, items and authors 81

Figure 4-7 Conceptual model of categories and items 82

LIST OF TABLES

Table 1-1 Examples of systematic literature review studies	3
Table 1-2 Literature reviews vs systematic reviews (Robinson & Lowe, 2015).....	8
Table 2-1 The Evolution of Healthcare Information Systems (Grandia, 2017).....	18
Table 2-2 Relationship between research questions and research objectives	27
Table 3-1 Comparison of quantitative and qualitative research approaches (Miles & Huberman, 1994; Mack et al., 2005).....	36
Table 3-2 Search items used for the selection of reviewed articles	41
Table 3-3 Extraction levels.....	44
Table 3-4 Systematic literature review studies.....	46
Table 3-5 Categories A. Transformation, B. Effectiveness, C. Performance D. Adoption, E. Harmonization, F. Dynamics	50
Table 3-6 List of iterations for inclusion criteria	54
Table 3-7 Quality assessment outcomes	56
Table 3-8 Research tools used for data collection adapted from Harpur (2018).....	59
Table 5-1 Guidelines which inform the improvement to performance of healthcare information systems.....	84
Table 5-2 Relationship between research questions and research objectives	85
Table 5-3 Research themes and findings.....	89

Glossary

Abbreviations	Explanations
AI	Artificial intelligence
BDAS	Big Data Algorithmic Systems
BI	Business intelligence
BOLD	Big, Open and Linked Data
CAQDAS	Computer-Assisted Qualitative Data Analysis software
DG	Data governance: the management of the integrity, availability, usability and security of data in an organization
DHS	District health system
DoH	Department of Health
DQ	Data quality
DQM	Data quality management
EHI	Electronic health information
EHR	Electronic health record
EMR	Electronic medical record
ERM	Enterprise risk management
GT	Grounded theory
HDI	Human data interaction
HIS	Healthcare information system: a system designed to manage healthcare data
HIT	Health information technology
IoT	Internet of Things
IS	Information systems
IT	Information technology
MDM	Master data management
ML	Machine learning

Abbreviations	Explanations
MRQ	Main research question
QAC	Quality assessment criteria
SA	South Africa
SAHRC	South African Human Rights Commission
SLR	Systematic literature review: a type of review that uses systematic methods to collect, analyze and interpret already-published data.

1 Chapter 1: Introduction to the Research

1.1 Introduction

In the digital age, information systems (IS) play an important role in many industries. IS are tools that assist organizations to manage their data. Organizations invest in IS to drive their businesses to success in the changing world of information technology (IT). The business components comprise of technology, people and processes. Without data, these business components are inactive, for data is treated as the lifeblood of the organization (Russom, 2012).

Organizations, also sometimes called entities, are facing a common goal that defines them as entities. The types of organizations include higher education institutions, business entities, and government departments, for example healthcare. In the case of healthcare, the primary goal is to provide good health to people. The success of healthcare depends on data that flows within an organization. Data is regarded as the most valuable asset in any organization in this digital era (Lee, Rawstron, Henderson, Applewhite & Guy, 2018). Many organizations see DG as a promising method of maintaining data as a valuable asset (Otto, 2011a ; Otto, 2011b).

This study explores data governance (DG) relative to challenges associated with healthcare information systems (HIS) via an SLR. In Section 1.2.1, the study justifies the purpose for a systematic literature review (SLR), outlines feature of an SLR (Section 1.2.2) and shares the advantages of adopting an SLR as a data collection method (Section 1.2.3). Furthermore, the SLR aims to address the research questions and associated objectives outlined in Section 1.5.3.

1.2 Preface - Systematic literature review

Kitchenham and Charters (2007) suggest that an SLR is a strategy of assessing and interpreting all existing papers that are pertinent to the study. Siddaway (2014) defines an SLR as a method that addresses problems resulting from conflicting findings, produced by researchers. Piper (2013) points out that systematic reviews permit complete, unbiased and literature-wide assessment of study results, design and quality. Okoli (2015) argues in detail that a systematic literature review when properly done, is valuable and turn into a highly cited part of the study that researchers pursue, when undertaking a new investigation. Furthermore, such freestanding reviews summarize the evidence that is available to identify gaps in a research. The method identifies, integrates and critically evaluates such findings.

1.2.1 Reasons for performing an SLR

Various authors highlight various reasons for undertaking an SLR:

- To synthesize the empirical confirmation of the limitations and benefits of a particular method;
- To recognize gaps in the existing research to provide directions for more investigations in these areas;
- To give a background or framework in order to correctly locate the activities of the current research (Kitchenham and Charters, 2007).
- An SLR gives the opportunity to provide a structured and rigorous approach to conduct a standalone literature review (Okoli, 2015); and
- The rigorous, systematic approach aim minimize bias (Siddaway, 2014).

The justifications listed above are relevant to the investigation undertaken in this study.

Different studies used SLRs. Table 1-1 illustrates the use of systematic literature reviews in general, in governance, in healthcare information systems, and in using a data governance contingency model.

Table 1-1 Examples of systematic literature review studies

	Topic	Purpose	What did this study do?	Source
General	Ecological Urban Planning and Design	Consider an environmentally based urban design and strategy model.	Highlighted theories and concepts that could underpin an environmentally based urban planning and design paradigm.	(Heymans, Breadsell, Morrison, Byrne & Eon 2019)
	Eating conditions over the period 2000–2018	Provide a thorough view of the studies that report the occurrence of various eating disorders and their evolution.	Examined and compared 94 papers with correct eating conditions diagnosis and 27 with wide-ranging eating conditions diagnosis.	(Galmiche, Déchelotte, Lambert & Tavolacci, 2019)
	Understanding blockchain technology	Proposes to explore the method in which blockchain technology is likely to effect supply chain rules and practices.	Conducted an SLR of practitioner and academic literature.	(Wang, Han & Beynon-Davies, 2019)
	Social media for knowledge-sharing	Provide understanding of the existing state of research concerning social media use for sharing knowledge.	Reviewed the accuracy and value of previous articles focused on the social media.	(Ahmed, Ahmad, Ahmad & Zakaria, 2019)
	Assessments validity literature in dining practices.	A quantitative systematic method was used to map out the current landscape of validity in dining practices.	Pointed to an improvement of understandings of validity by conceptualising legitimacy of the organization.	(Le, Arcodia, Novais & Kralj, 2019)

	Topic	Purpose	What did this study do?	Source
Governance	Data governance (DG) and cloud DG	Provides a way for future researchers in DG to assist them to detect areas in DG study.	Examined 52 studies for relevant published work for DG for cloud, and for non-cloud computing.	(Al-ruithe, Benkhelifa & Hameed, 2018)
	Enabling organizational strategy implementation.	Proposes guidelines linked to project governance, scaffolding the implementation of strategy in organizations.	Examined and compared 271 studies from professional and academic and sources.	(Musawir, Abd-Karim & Mohd-Danuri, 2019)
	Fragmented sustainability governance.	Provides the needed adequate governance solutions in order to address global sustainability challenges.	Applied a mixed-method approach and a reference network analysis to develop the resulting contributions.	(Heidingsfelder & Beckmann, 2020)
	Improved understanding of agile project Governance.	Purpose to give understanding of practices for project governance in agile projects.	Identified and categorized agile project governance practices that provide a synthesis in a six-dimensional framework.	(Lapp, Karvonen, Lwakatare, Aaltonen & Kuvaja, 2020)
	Qualitative comparative analysis.	Provide and examine a thorough mapping of qualitative comparative analysis applications and the sub-fields of corporate governance.	Reviewed 19 articles from both academic and professional literatures.	(Cucari, 2019)

	Topic	Purpose	What did this study do?	Source
Healthcare Information Systems	Adoption of healthcare information systems (HIS).	Provides an outline of important barriers that are delaying developing countries to deploy HIS.	Examined 18 identified papers' articles from academic and professional sources.	(Hasan, 2019)
	The use of internet of things in healthcare.	Tailor of IoT-based technologies are necessary to address these challenges in healthcare.	Reviewed and analyzed sixty relevant papers from both academic and professional literatures.	(Ahmadi, arji, Shahmoradi, Safdari, Mehrbaakhsh & Alizadeh., 2019)
	Health Influence Valuations in middle-and low-Income Countries	Apply a method to identify important factors to improve health-effect assessment in middle- and low-income countries.	Examined 57 studies from academic and professional literatures.	(Thondoo, Rojas-Rueda, Gupta, de Vries & Nieuwenhuijs en, 2019)
	Adoption of electronic health record.	Identify the used adoption theories in electronic healthcare records implementation.	Reviewed 18 identified papers that appeared in 17 international journals and conferences.	(Sadoughi, Khodaveisi & Ahmadi, 2019)
	Using eHealth to support colorectal cancer survivors.	Address which categories of eHealth supports delivered to colorectal cancer survivors over the past 20 years.	Examined and analyzed 15 studies from both academic and professional literatures.	(Ayyoubzadeh , Kalhori, Shirkhoda, Mohammadzadeh & Esmaeili, 2020)

	Topic	Purpose	What did this study do?	Source
Data governance contingency model	A DG contingency approach.	Outlines the DG model, which comprises of responsibilities, quality roles and decision areas.	Identified the contingency factors that influence the model configuration.	(Wende & Otto, 2007)
	A contingency-based approach for platform ecosystems.	Introduce an approach that can address different possibilities, governance goals, and characteristics of platform ecosystems.	Utilized case and presented a case study to display the effects and support of the deployment of the method in practice.	(Lee, Zhu, Jeffrey & 2018)
	Designing DG model.	Find appropriate and effective technique for designing data governance model.	Followed a case study within the case organizations and used methodology is canonical action research.	(Vänskä, 2013)
	Framework for designing DG for cloud computing.	Presents the primary search towards developing essential DG programs for cloud computing.	Discussed why it is essential to develop essential DG programs for the cloud computing and provides perspective.	(Al-ruithe, Benkhelifa & Hameed, 2016)

1.2.2 Features of an SLR

To be able to lay the foundation of the characteristics of an SLR, it is important to look at the features of a traditional literature reviews.

- Traditional reviews are unstructured and are not suitable for publication journal (Robinson & Lowe, 2015); and
- Important publications can get missed (Boell & Cecez-Kecmanovic, 2010).

An SLR is easy to distinguish from a traditional literature review. A systematic literature review offers reliability and repeatability (Okoli, 2015). Ryan (2010) lists the features of an SLR as follows:

- Researchers continually start by describing a review protocol that explains the research question and methods employed to perform the review of the study.
- An SLR has a research strategy that allows the researchers to identify relevant literature as much as possible.
- The research strategy report enables the readers to access the completeness, rigor and repeatability of the process.
- Explicit exclusion and inclusion criteria are required to evaluate each possible primary study.
- From each primary study, the information to be obtained is specified and evaluated, using the quality criteria.

A detailed comparison of an SRL and a traditional literature review is in (Section 3.2.1)

Table 1-2 illustrates the summary of the difference between traditional and systematic literature review.

Table 1-2 Literature reviews vs systematic reviews (Robinson & Lowe, 2015)

Traditional literature review	Methodological stage	Systematic review
Presents context and existing thinking that without a precise question, is general, and includes various aspects of a topic.	Emphasis of review.	Uses a specific question to provide evidence to underpin a research. A stand-alone research, it should be conducted before undertaking additional research, especially in a higher degree thesis.
Uses a random process to find papers, regularly searching few databases. Not systematic and usually use grey literature.	Data collection methods.	Searches of various identified databases using defined search terms; depending on the question, a related systematic search of grey literature is occasionally included.
Take home messages are utilized in the review.	Data extraction methods.	Used data extraction tool to recognize detailed pieces of information.
Papers of up to 150 papers or more.	Number of studies incorporated in the review.	Usually fewer than 50 studies; often less than 10.
The writer interprets the implication of the results.	Methods for data analysis.	Recognises cited data analysis methods, rigour of conduct research, and strength of evidence.
Prose paper, seldom supported with drawings.	Data presentation methods.	Related table/chart of included studies.
Not appropriate for publication of Journal.	Publication	Might be appropriate for publication of journal.
Instructions informed by proof of several types drawn from included studies.	Result	Instructions depend on evidence from reviewed studies.

The issues listed in Table 1-2 justify the reason why the researcher used an SLR strategy.

Since the study aim was to explore data governance relative to challenges associated with healthcare information systems, the researcher adopted an SLR method considered as suitable for this study.

1.2.3 Advantages of an SLR

An SLR adds rigour to the search strategy and minimizes bias (Okoli, 2015). Ryan (2010) pinpoints several advantages of an SLR that differ from a traditional review:

- A recognized methodology, which minimizes bias in the outcome of the study, although the publication of bias in the literature does not protect it.
- Can give evidence about the impact of an occurrence over a wide range of empirical methods and settings. If studies provide trusted outcome, SLRs give evidence that the phenomenon is strong and transferrable.
- The grouping of data using meta-analytic techniques is possible with quantitative studies, enhancing the possibility of noticing actual effects that minor studies are incapable of noticing.

1.3 Background to the research problem

The healthcare industry is identified as one of the biggest industries of the economy in many countries (Yang, Li, Mulder, Wang, Chen, Wu, Wang & Pan, 2015) . In the past decade, there has been a rapid digitalization in many industries. Healthcare in particular, has also undergone digitalization with an increase in use of healthcare information systems (HIS) (Mehta & Pandit, 2018). As a result, a large amount of data in healthcare is in digital form. Healthcare organizations put their trust in HIS for their efficiency. Furthermore, Fleissner, Jasti, Ales and Thomas (2014) point that data needs to be correct from the point of capture to the point of use, because incorrect data can lead to incorrect decisions.

Data welfare has brought about the use of terminologies like data governance (DG), business intelligence (BI), data quality management (DQM), big data and master data management (MDM), amongst others. Of interest is DG, because it covers several of the terms mentioned above, hence the backbone of DG is on governance of data.

1.4 Statement of the research problem

As the scope of data integration broadens, industries are pushing forward to make sure that liability and compliance needs are achieved (Russom, 2012). Data is recognized as the most vital asset in

an organization (Panian, 2010). The researchers added that data is the representation of the customers, employees and suppliers in an organization, the organization's transactions, activities and its outcomes. The difficulties of collecting, keeping and processing data, has increased many problems related to data, especially in data governance (Dasgupta, Gill & Husain, 2019).

The research portrayed that data integrity issues are one of the challenges that affect DG success (ECRI Institute, 2015). Missing data in electronic health records (EHR) may lead to unintentional bias (Beaulieu-Jones & Moore, 2017). Data integrity is referred to as the accurate, consistent and complete data (Katz, 2015). Failures that result from incomplete, inaccurate and inconsistent data, impact DG success (Russom, 2012). Without data governance, the implemented technology may function as designed, but the data produced from the technology may be mistrusted (Fleissner et al., 2014)

Kim and Cho (2018) argue that the introduction of a technology can increase risks if policy preparation is not in place. Organizations should govern data anytime it crosses its boundary. DG is not a technical application, but it is about guidelines, policies, standards and organizations. Furthermore, they point out that DG is needed to supply and share correct and thorough information about present status with stakeholders. As organizations recognize the value of data and the data challenges they face, many organizations have started exploring data governance (Dasgupta et al., 2019).

To improve the value of data, organizations need to organize policies, processes and standards for the improvement, management and usage of data to generate good structure for the organization, and to build the infrastructure that supports technology (Panian, 2010). This has led to the emergence of data governance as a discipline. According to Weber, Otto and Österle (2009), a call is opened for organizations to explore and use a DG model that could guide the success of their HIS.

Although the DG contingency model has been applied in many DG contexts, it has not been reviewed in relation to healthcare industries (Weber et al., 2009). In summary, a preliminary review of the factors highlighted in this section shows scant support for DG issues in guideline format. Practical guidelines for data governance (DG) measures that could be useful for practitioners are lacking and a SLR could help to collate facts on already published efforts for this form of guideline. Al-Ruithe et al. (2018) highlighted that future work is required in the field of DG, due to a shortage of research in this field. Although a lot of research is growing in IS in the field of DG, as the more organizations recognize data as an important asset, there is a need for research in the data governance field (Alhassan, Sammon & Daly, 2016). Furthermore, Webster and Watson (2002) lament the point that IS researchers tend to be unfamiliar with the need for structure and format in reviews. So, this study

answers the calls from Al-Ruithe et al. (2018); Alhassan et al. (2016) and Webster and Watson (2002) who noted a gap in the research field of DG in IS.

Therefore, the problem that this research seek to address is that there are challenges related to healthcare information systems and data governance in healthcare.

1.5 Aim, rationale, research questions and objectives

This section defines the aim of the study, introduces the rationale and explains the questions and objectives for the study.

1.5.1 Aim of the study

This study aims to explore data governance relative to challenges associated with healthcare information systems, by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review.

1.5.2 Rationale of the study

The rationale of the study is to consolidate pertinent and recent knowledge, producing a set of guidelines, which informs the improvement regarding performance of healthcare information systems. The study conducted an SLR to achieve its aim. The researcher collected a population sample of 142 research articles. The acquired information from SLR enhanced the understanding of the researcher concerning the status of the healthcare research.

1.5.3 Research questions and objectives

To address the scope of this research study, the study posed two main research questions (MRQ) and six secondary questions (SQ1, SQ2, SQ3, SQ4, SQ5 and SQ6). The secondary questions serve to answer the main research questions.

Table 1-3 below illustrates the relationship between the research questions and the research objectives of this study.

Table 1-3 Relationship between research questions and research objectives

Research questions	Associated research objectives
MRQ1: How does healthcare information systems influence the possibility of data governance success?	
SQ1: What are the features of HIS?	SO1: To understand the features of HIS
SQ2: What is meant by DG success?	SO2: To acquire information about DG success
SQ3: What influences are noted on DG?	SO3: To understand influence noted on DG
MRQ2: What are the components of a data governance contingency model?	
SQ4: What are the performance strategies that have been explored for improved healthcare?	SO4: To explore the data challenges that affect the healthcare performance strategy
SQ5: What competitive strategies have contributed to data governance success?	SO5: To gain information about the competitive strategies that have contributed to data governance success
SQ6: What process harmonization is currently in place to manage data?	SO6: To identify process harmonization that is currently in place to manage data

Note: MRQ = Main research question; SQ = Secondary question; SO = Secondary objective

The research questions and objectives tabulated in Table 1-3 above concretize guidelines for the study and inform the research design and methods, namely a systematic literature review outlined in Chapter 3.

1.6 Delineation of the research

Although the researcher-consulted literature published in many differing contexts, the focus of this study is challenges and issues associated with healthcare information systems and DG in South African contexts. The study used web-search engines and academic databases to collect data. When searching the literature and analyzing data, the researcher considered ethical responsibilities which include avoiding misinterpretation of the original research and checking all details. The study was limited to a review of literature published between 2010 and 2020, as data governance in healthcare information systems is still in its infancy.

1.7 Ethical considerations associated with conducting an SLR

This study addresses various ethical considerations. Wager and Wiffen (2011) highlight several ethical issues that need to be taken into consideration when researchers are conducting a systematic literature review:

- **Avoid duplicate publications:** The suppression of negative finding and repeated publication of positive findings may result in a negative impact.
- **Avoid plagiarism:** The study avoided the use of somebody's data, words and images without consent and declaring it as my own.
- **Ensuring accuracy:** Ensured accurate extraction of data to avoid any attempt for biased results.

1.8 Dissertation Structure

CHAPTER ONE: Introduction

The first chapter consists of the introduction, systematic literature review, background of the research problem, statement of the research problem, aim, rationale, research questions and sub questions. The chapter also explain the research objectives, aim, delineation of the study, contribution and ethical considerations.

CHAPTER TWO: Theoretical foundations

The second chapter focused on the literature review. It starts by discussing the concepts of healthcare information systems and of data governance. This is followed by an in-depth discussion on a data contingency model, consisting of the performance strategy, competitive strategy and process harmonization.

CHAPTER THREE: Research design and systematic literature review method

The third chapter describes the research design followed by the research philosophy and paradigm, and lastly it gives a detailed discussion on the research method used in the study.

CHAPTER FOUR: The emphasis of this chapter is based on analysing data for the study.

CHAPTER FIVE: This chapter discusses the findings, and recommendations and it concludes the study.

Figure 1-1 illustrates the flow of the study from Chapter 1, which is the introduction to the research to Chapter 5, the conclusion and recommendations of the study.

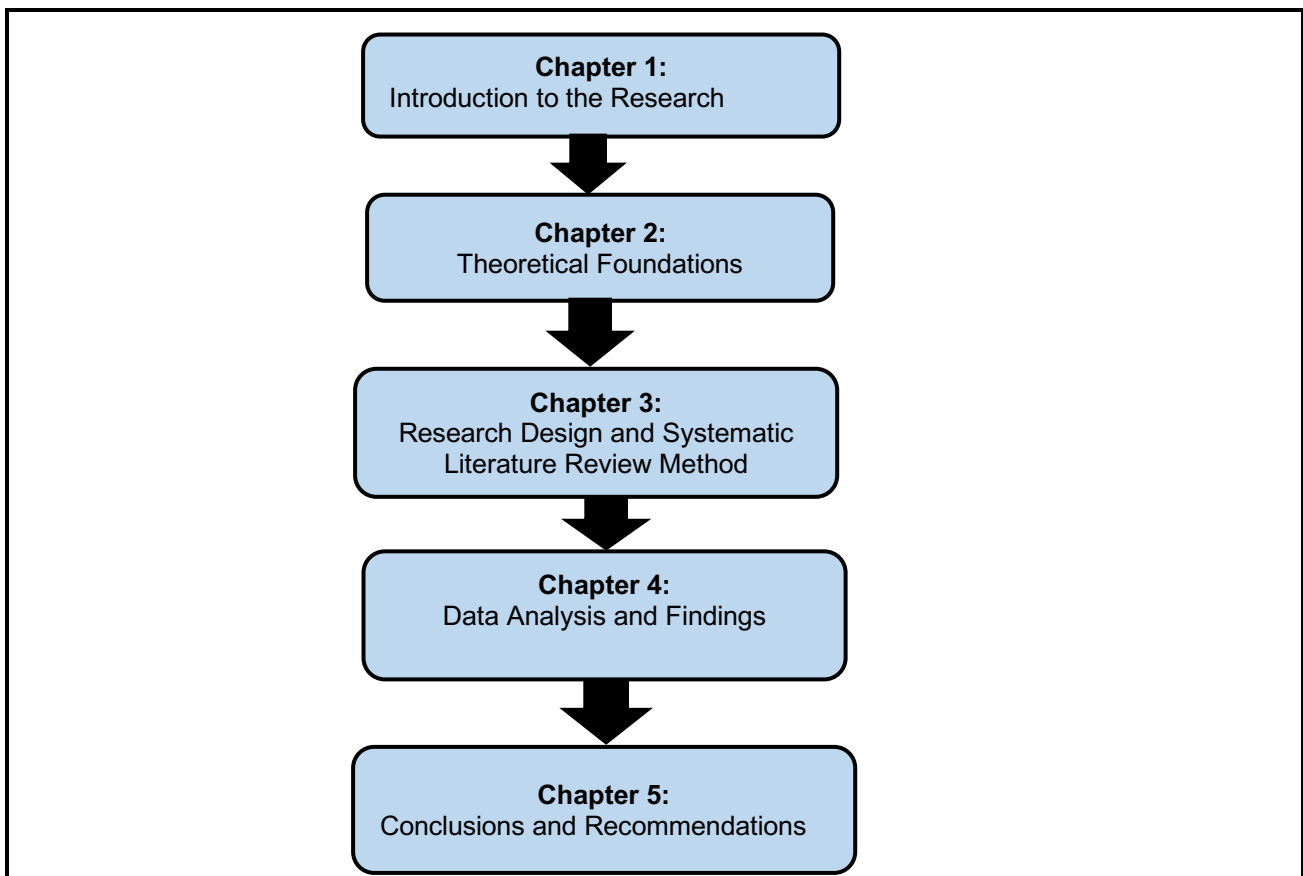


Figure 1-1 Representation of the thesis report.

The image above illustrates how the study flows from the introduction of the research, followed by the theoretical foundations, which leads to the research design and systematic literature review method, data analysis and findings, and lastly to the conclusions and recommendations of the study.

The questions and objectives of the research for the study guided the researcher to search for the theoretical foundations in Chapter 2.

1.9 Summary

Chapter 1 began with the introduction to the research, then a brief introduction of the systematic literature method, which included the reasons for performing an SLR, features of an SLR and the advantages of an SLR. The researcher explained the background to the research, the statement of the research problem, aim, rationale and the research questions and objectives of the study. This chapter also encapsulated the delineation of the research, ethical considerations and finally, the dissertation structure.

2 Chapter 2: Theoretical Foundations

This chapter reviews three different theoretical perspectives: the concept of healthcare information systems (HIS) (Section 2.1), the concept of data governance (DG) (Section 2.2) and the concept of the DG contingency model (Section 2.3). This model comprises three components: performance strategy, competitive strategy and process harmonization (Weber et al., 2009). Facets of this model underpin the study, providing relevant guidelines, whilst informing DG success within a healthcare context.

2.1 The concept of healthcare information systems

Healthcare is described as the joined operation of public health and personal medical facilities (Visser, Bhana & Monticelli, 2012). Improving the health of individuals and communities is crucial in SA. The healthcare industry in South Africa (SA) consists of public and the private sectors (South African Human Rights Commission, 2009). The public healthcare industry in SA consists of the primary, secondary, and tertiary care practice, managed by the provincial Department of Health (DoH).

Mahlathi and Dlamini (2013) state that the health facilities in SA are administered by nine provincial DoH divisions, namely:

- Western Cape;
- North West;
- Northern Cape;
- Mpumalanga;
- Limpopo;
- Kwazulu-Natal;
- Gauteng;
- Free State; and
- Eastern Cape.

Figure 2-1 shows the map of the nine provinces in South Africa.

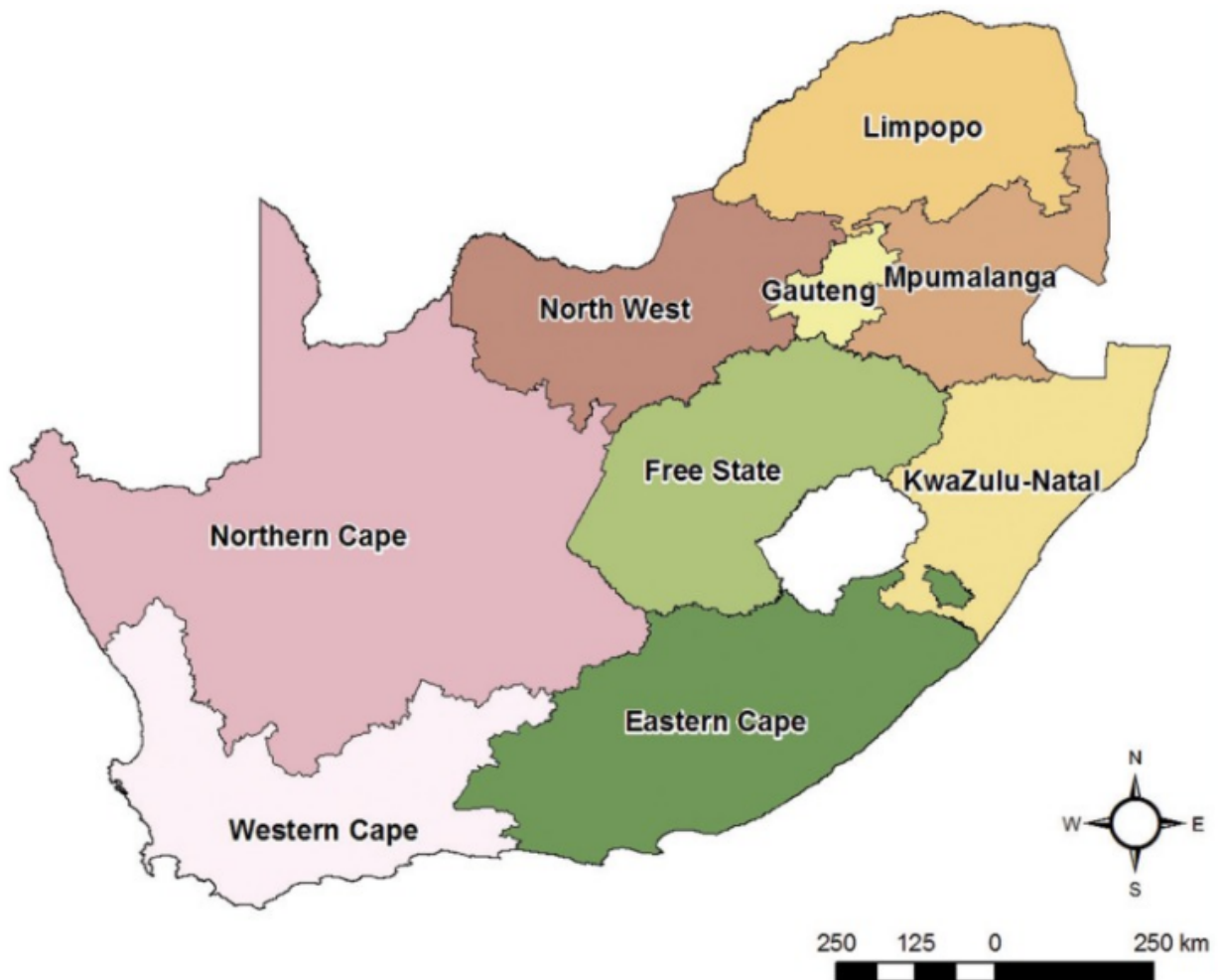


Figure 2-1 Provinces of South Africa

In all the nine provinces of South Africa, people may contact both public and private healthcare services. However, the contact to private healthcare services depends on affordability. Government funds the public sector and their services are offered to all South African citizens free. Many patients contact healthcare services through the District Health System (DHS). The DHS is the preferred system that provides services within the primary healthcare (Mahlathi & Dlamini, 2013).

Healthcare has changed significantly in recent decades. HIS is a set of software and hardware that is used to automate data of healthcare processes in health institutions (Vaganova, Ishchuk, Zemtsov & Zhdanov, 2017). Almunawar and Anshari (2012) define HIS as the intersection between healthcare's businesses process and IS to deliver better healthcare services. The purpose of HIS is to contribute to decent, high-quality patient care.

Electronic health records and Electronic Medical Records (EMR) are important terminologies used in HIS (Almunawar and Anshari, 2012). EMR is a digital patient's medical record that can be manipulated by an authorized staff and clinicians in one healthcare organization whereas EHR refers to a digital patient's medical record that conforms to nationally recognized interoperability standards and that can be manipulated by an authorized staff and clinicians across more than one healthcare organization (Ishigure, 2011). The history of healthcare information systems is important in order to track how HIS has evolved today. Table 2-1 tabulates the evolution of healthcare information systems.

Table 2-1 The Evolution of Healthcare Information Systems (Grandia, 2017)

Decade	Drivers of healthcare	Drivers of IT	Outcomes of HIT
1960s	<ul style="list-style-type: none"> • Medicaid/ Medicare 	<ul style="list-style-type: none"> • Costly mainframes 	<ul style="list-style-type: none"> • Mutual accounting systems
1970s	<ul style="list-style-type: none"> • Administrative systems (Broadened) • Processing systems (Departmental) 	<ul style="list-style-type: none"> • Smaller computers • Enhanced connectivity 	<ul style="list-style-type: none"> • Enlarged administrative systems • Limited hospital department automation
1980s	<ul style="list-style-type: none"> • Diagnosis-related Group 	<ul style="list-style-type: none"> • Networking • Personal computers • Cheaper storage 	<ul style="list-style-type: none"> • Integrated hospital systems • Managed administrative systems • Limited departmental systems
1990s	<ul style="list-style-type: none"> • Competition, consolidation • Integrated hospital 	<ul style="list-style-type: none"> • Enlarged distributed computers • Cheaper hardware 	<ul style="list-style-type: none"> • Enlarged hospital departmental solutions • Rise of integrated EMR
2000s	<ul style="list-style-type: none"> • More integration 	<ul style="list-style-type: none"> • Mobility • Evolution of cloud computers 	<ul style="list-style-type: none"> • Rise of clinical decision support • Big operational departmental systems • Rise of data warehousing
2010s	<ul style="list-style-type: none"> • Regional HIS • Global HIS 	<ul style="list-style-type: none"> • Intelligent technologies • Mobile and Big data 	<ul style="list-style-type: none"> • Rise of data storages
2020s	<ul style="list-style-type: none"> • Big data • Internet of Things (IoT) 	<ul style="list-style-type: none"> • Cloud adoption • Cloud storage 	<ul style="list-style-type: none"> • Rise of unstructured data • Rise of hackers

Almunawar and Anshari (2012) inform that the introduction of healthcare information systems (HIS) was mainly to utilize the internet to provide better healthcare. Today a healthcare organization depends on HIS on all levels of activities (Grandia, 2017). Today's focus in HIS must be on performance improvement. In spite of the vast opportunities that lie in HIS to change the healthcare industry, there are many evident challenges. These challenges stem from the interaction of organizational, human, and technology factors that influence the need for HIS. Due to the linking and sharing of the growing amounts of data, there is a necessity of using a DG model that would guide HIS organizations (Weber et al., 2009).

2.2 The concept of data governance

Data governance (DG) is described as the policies, processes, organization, technologies and standards essential to manage data and ensure the quality, availability, accessibility, auditability, reliability and safety of data in an organization (Panian, 2010). Russom (2012) argues that DG is usually shown as a committee, an organizational structure or an executive-level board that forms and applies procedures and rules for the technical management of data that the business use across an enterprise. DG in healthcare is a developing trend, due to the increase of data globally. As the data challenges arise across the organizations, it is important that enterprise data must have these attributes:

- **Accessibility:** to confirm that data is accessible, irrespective of their structure or source.
- **Availability:** to ensure the availability of data and applications how, where and when required by the users.
- **Quality:** to ensure the accuracy, integrity and completeness of data.
- **Consistency:** to ensure that the implication is reconciled and consistent throughout all processes, organizational units and systems.
- **Auditability:** to ensure the availability of audit trails and controls on data.
- **Security:** to ensure that the access to the data is well secured (Panian, 2010).

Security and privacy of data are key concerns associated to data storage and usage in healthcare (Yang, Li, Elisa, Prickett & Chao, 2019). The competitive position, image, and the reputation of the healthcare organization would suffer if an unauthorized individual would access and modify healthcare data (Panian, 2010). Security and privacy of data refers to the protection of data stored via server, computer or any other form of electronic media (Zhang & Yuan, 2016).

The data is expected to be kept confidential, have integrity and always available for use when needed. Most of the data governance also propose the security requirements by establishing the role of information or data security officer to guarantee the secure activities such as data access (Zhang & Yuan, 2016). Moreover, data privacy determines the quality of data; meaning that data will be good in quality by how it is good in privacy.

DG allows corporate-wide responsibilities and decision rights for data quality management. In the digital era of employing new technologies, organizations consider data governance. Lee, Rawstron, Henderson, Applewhite and Guy (2018) state that technology alone will not make DG function effectively. In order to attain a holistic data governance function, organizations must adopt a framework that includes people, processes and technology in order to accomplish an effective DG function. A proper data governance framework will enable organizations to govern the data that flows within the organization and control processes for the implemented technology to function effectively.

Figure 2-2 illustrates the framework that includes people, processes and technology to achieve an effective data governance.

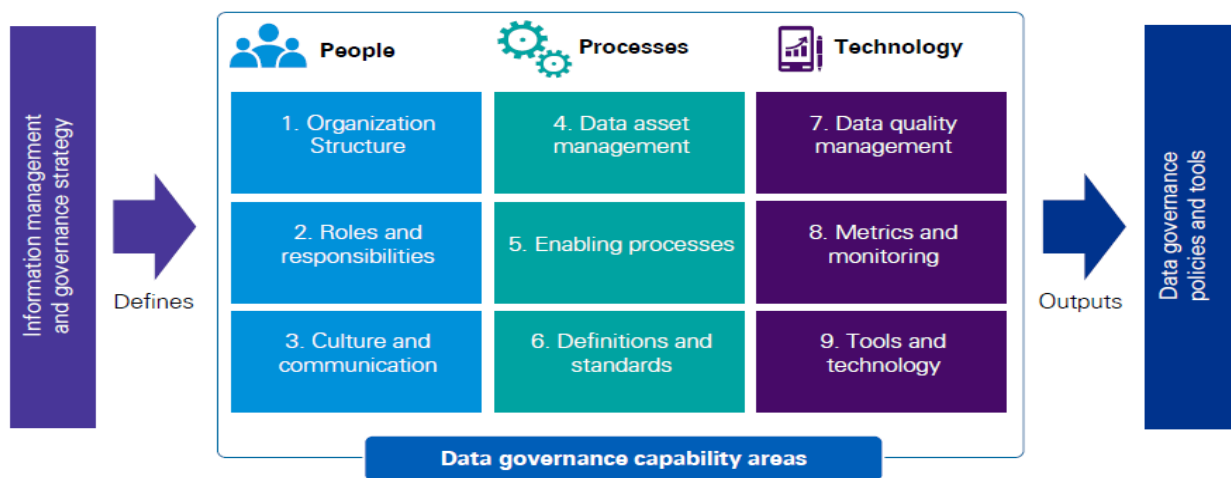


Figure 2-2 A framework that incorporates people, process and technology (Lee et al., 2018)

The following themes emerged from the framework illustrated in Figure 2-2, namely People, Processes and Technology.

Lee et al. (2018) defines the data governance capability areas as follows:

- Organization: Create a DG organization that consists of support and C-level, assuring its mandate to establish, manage and publish DG processes.
- Responsibilities and roles: Recognize subject matter professionals to support the organization and operational initiatives, by showing clear responsibilities for data stewards, data consumers and data owners.
- Communication and culture: Create clear governance processes that give structure to data stewards and other personnel.
- Data asset management: Organize a plan for the maintenance of data asset to articulate how to manage exponential development in data volumes and complexity.
- Facilitating processes: Embed DG practices into project pipelines, budget management and resource allocation within the organization.
- Standards and definition: Create collective processes to support the ongoing management and oversight of data taxonomies, business rules and dictionaries.
- Management of data quality: Ensure adequate DG illustration on Change Advisory Boards to inform alterations in source systems that may result in data inconsistency.
- Monitoring and metrics: Automate detection capabilities and data quality monitoring.
- Technology and tools: Create robust DG rules to assist in developing cloud-based technologies and architecture to enable available feedback systems to record gaps and improvement opportunities.

With the increased adoption and the rise of Cloud Computing, DG is receiving a growing interest among researchers although DG is still under researched (Al-ruithe et al., 2016). Even though DG is highly recognized of its importance, the area of DG is still under-researched and under developed (Al-ruithe et al., 2018). Although it is not a new concept, data governance (DG) is relatively new in healthcare (Fleissner et al., 2014). A DG contingency model may help each organization with a set of precise contingency guidelines (Weber et al., 2009). Panian (2010) identifies the following DG goals:

- Ensure that the data meets the requirements of the business;
- Manage and protect data; and
- Lower the costs for managing the data.

2.3 Data governance contingency model

DG research highlights that the structure of the organization should fit all companies alike (Weber et al., 2009). Each organization requires a clearly defined DG configuration that suits a set of specific

contingencies. This study will explore three of the seven contingency factors from the DG contingency model. A contingency is anything that is not easy to predict for the future, and which influences the organization's structure and performance.

Figure 2-3 illustrates the data governance contingency model.

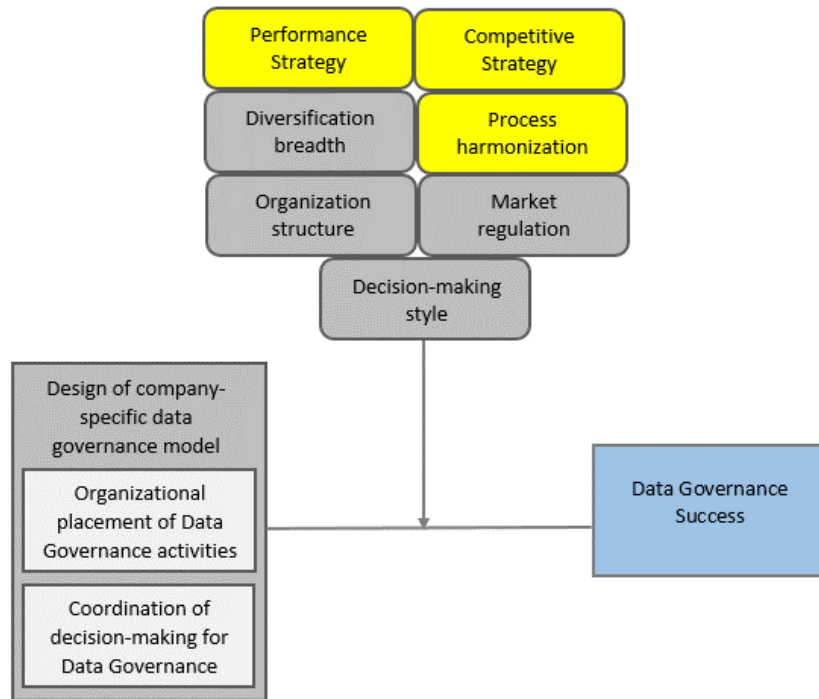


Figure 2-3 Data governance contingency model adapted from Weber et al. (2009)

The contingency approach to data governance presented in Figure 2-3 explains the link between successful DG and the design of the DG model. There are seven contingency factors: breadth, competitive strategy, decision-making style, degree of process harmonization, performance strategy, degree of market regulation diversification and organization structure, that influence the contingency approach to DG (Weber et al., 2009). The study explores how the three contingency factors (performance strategy, competitive strategy and process harmonization) guide DG success.

The study does not cover diversification of breadth, decision-making styles, degree of market regulation, and organization structure, as these factors are out of scope and will be suitable for future study. Contingency factors determine whether the DG design model will have a positive influence on DG successes in an organization. The following themes emerged from the DG contingency model: data governance, competitive strategy process harmonization, and performance strategy.

2.3.1 Competitive strategy

Strategy matters because it provides an organization with the exact directions. Pisano and Hitt (2015) define competitive strategy as a set of decisions essential to guide organizational goals. Implementing a competitive strategy contributes to a competitive advantage. The researcher highlights three categories of factors that affect the process of strategy formulation that need to be considered.

Figure 2-4 suggests three groups of factors affecting the process of strategy formulation that need to be considered when creating a highly competitive modern organization (Pisano & Hitt, 2015).

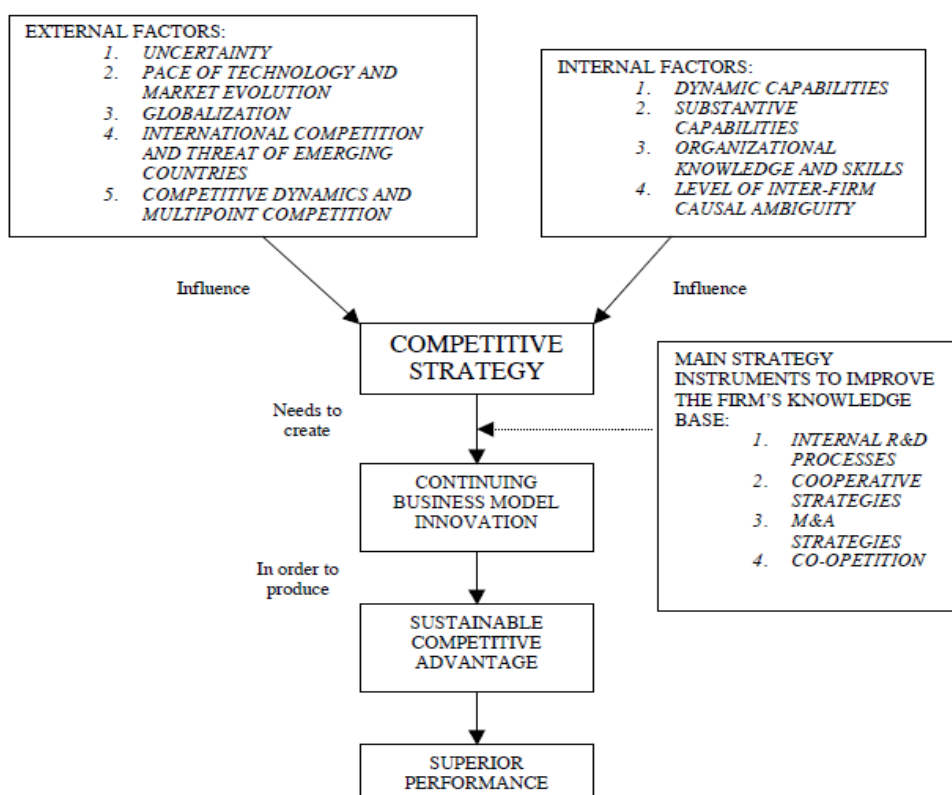


Figure 2-4 The new competitive strategy model (Pisano & Hitt, 2015)

The first group in the model above consists of external factors, which include uncertainty, the pace of technology and market evolution, globalization, the competition on international level, and the additional threat represented by emerging countries, competitive dynamics and multipoint competition.

Decision makers need to consider that the second group consists of internal factors for the organization, to emphasize their organization's competitiveness. The external factors are: merger and

acquisition strategies dynamic and substantive capabilities, organizational knowledge and skills, and the level of inter-firm causal ambiguity (Pisano & Hitt, 2015). The third group is the main strategic actions the organization can employ to enhance its knowledge base. These factors include internal research and development processes, cooperative strategies, merger and acquisition strategies, and co-coopetition. The analysis of these three groups is necessary to improve a good competitive advantage and to obtain a higher performance level.

2.3.2 Performance strategy

The data governance (DG) model illustrates the influence of performance strategy on DG (Weber et al., 2009). Governing styles differ in top-performing organizations depending which metric they put an emphasis on. Weill and Ross (2005) distinguish between three performance strategies: asset utilization, growth, and profit. Performance strategy is a contingency factor that determines the success of DG within an organization. For an organization to lead with one specific strategy, it requires culture and focus to achieve that goal.

2.3.3 Process harmonization

Harmonization is defined as an action describing and configuring many uniformed processes supporting an organization's goals and improvement (Pardo, Pino, Garcia & Piattini, 2012). Process harmonization will result in successful robust business operations in an organization (Siviy, Kirwan, Marino & Morley, 2008). Figure 2-5 illustrates a conceptual model on process harmonization.

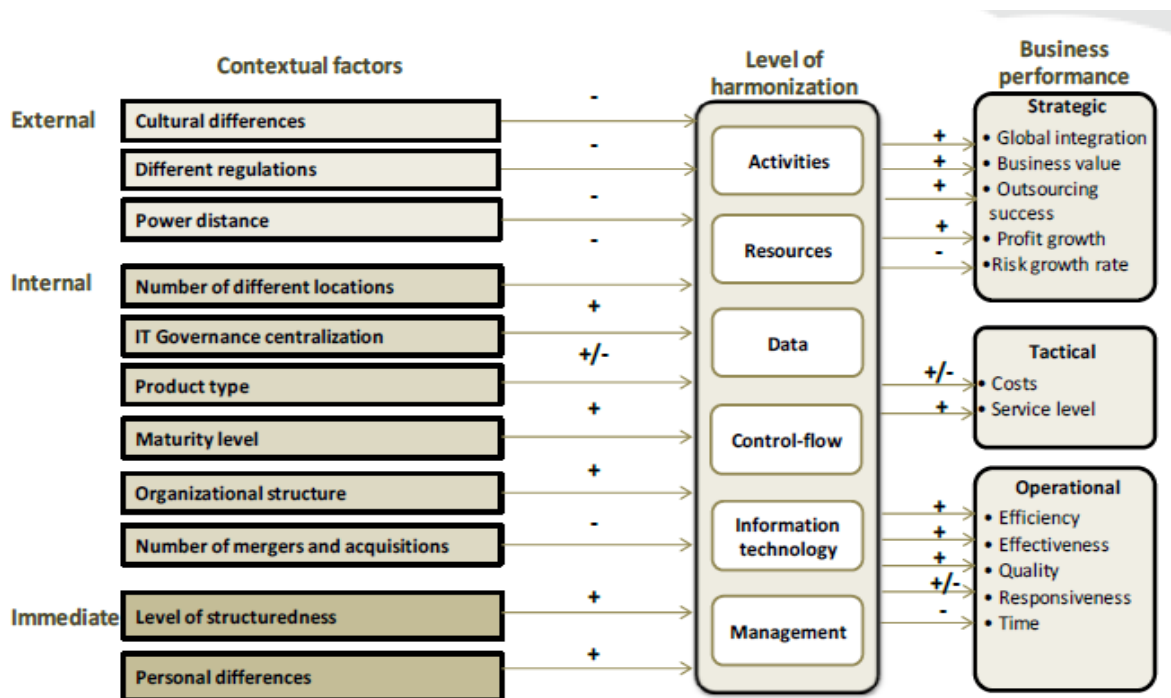


Figure 2-5 Process harmonization model (Trienekens, Romero & Cuenca, 2016)

A conceptual model on process harmonization depicted above illustrates three parts. The first part of the model illustrates three different levels in the organizational context: external, internal and immediate. Within each level, there is a group of contextual factors. The second part distinguishes six features of process harmonization that can be separated when evaluating the level of harmonization of business processes (Trienekens, Romero & Cuenca, 2016).

The third part of the model presents the elements of business performance affected by transitions in the level of process harmonization. In this study, the focus will be on the first and second part of the model, which involve the effect of contextual factors on various features of the harmonizing process.

Based on the above theoretical foundations, Table 2-2 confirms the validity of the research questions.

Table 2-2 Relationship between research questions and research objectives

Research questions	Associated research objectives
MRQ1: How do healthcare information systems influence the possibility of data governance success?	
SQ1: What are the features of HIS?	SO1: To understand the features of HIS
SQ2: What is meant by DG success?	SO2: To acquire information about DG success
SQ3: What influences are noted on DG?	SO3: To understand influences noted on DG
MRQ2: What are the components of a data governance contingency model?	
SQ4: What are the performance strategies that have been explored for improved healthcare?	SO4: To explore the data challenges that affect the healthcare performance strategy
SQ5: What competitive strategies have contributed to data governance success?	SO5: To gain information about the competitive strategies that have contributed to data governance success
SQ6: What process harmonization is currently in place to manage data?	SO6: To identify process harmonization that is currently in place to manage data

Note: MRQ = Main research question; SQ = Secondary questions; SO = Secondary objective

2.4 Researcher’s background beliefs and biases

The researcher is working in the insurance institution as an Analyst Programmer and not close to the Data Governance department. Recently the researcher has fulfilled the role of a Data Engineer, in order to utilize the skills that the researcher has acquired while conducting this study. The research questions posed in Table 2-2, which are a repeat of the research questions in Table 1-3, led to the research design and chosen methodology in Chapter 3.

2.5 Summary

This chapter focused on the theoretical foundations of the study. It explained the concept of healthcare information systems, the concept of data governance and the data governance contingency model. The data governance contingency model was divided into three aspects, competitive strategy, and performance strategy and process harmonization. The last part of this chapter focused on the researcher’s background and belief in relation to the study.

3 Chapter 3: Research Design and Systematic Literature Review (SLR) Method

Chapter 3 focuses on explaining the proposed methods adopted in the study. It starts by discussing the research design, which consists of the research purpose, research philosophy and paradigm, research approach, research strategy, research methodological choice and research time horizon. It also focuses on the SLR method adopted in this study. Finally, this chapter explains the ethical issues considered when conducting an SLR.

3.1 Research design

A research design is a type of inquiry in a quantitative, qualitative and mixed methods approaches that give precise directions for procedures in a research study (Creswell, 2013). The aim of the research design used in this study is to provide a transparent view of the research structure. Kilani and Kobziev (2016) suggest that the research design allows the researcher to outline all the tools and methods required for the research, e.g. research philosophy, research approach and research methodology. The researchers add that the research design is like a plan of actions that allows the researcher to move the methodology stage to the following stage.

Although this study was initially, deductive being based on concepts contained in existing models, subsequent analysis followed an inductive strategy whereby it synthesized emergent themes and factors grounded in the SLR literature. According to Creswell and Yilmaz (2013), after categorization of the five key qualitative research approaches, which are, – case study, ethnography, grounded theory approach, narrative approach and phenomenological approach – this study simulated a grounded theory approach. Grounded theory (GT) strategy is a research method that involves simultaneous data collection and analysis, using comparative techniques and offers tools for developing theories (Charmaz, 2011). GT is a qualitative research approach to develop and generate a theory from the data that the researcher gathers in a research study (Johnson & Christensen, 2014). Due to the nature of the study, which is an SLR, themes emerged from the final list of articles.

GT enables the researcher to collect inductive data relies on moving back and forth between data collection and analysis (Charmaz, 2011). Khan (2014) suggests a grounded theory is an approach for collecting data in qualitative research methods, which is entirely centered on data rather than an attempt to form theory from data. Since this study was qualitative and ultimately followed an inductive strategy, a grounded theory approach was most suitable.

Research purpose

This study aims to explore data governance relative to challenges associated with healthcare information systems, by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review. Research purpose is an important stage of the research design that assists to formulate answers to problems. It allows the researcher to consolidate existing knowledge and develop new structures and methods. According to Van Wyk (2012), the research purpose is driven by the research problem or question and it emphasizes the logic of the research. Research purpose allows the researcher to explore, describe and synthesize the existing knowledge.

Since this study, aims to explore data governance relative to challenges associated with healthcare information systems by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review, exploratory research was most appropriate for this study.

Exploratory research

Van Wyk (2012) points out that this is the most appropriate and useful research design for projects that has scanty existing research on the subject matter. Exploratory research seeks to investigate and understand what is happening to search questions about the phenomenon (Gray, 2013). It is vital when there is no adequate knowledge about a phenomenon. The researcher in an exploratory research has the advantage to decide whether it is worthy to research the issue or not.

Saunders, Lewis and Thornhill (2007) highlight several ways of conducting exploratory research:

- Interview gurus in the field;
- Focus group interviews; and
- Search for literature.

The aim of the exploratory research is to find the boundaries of the environment where problems, situations, or opportunities of choice are possible to exist (Van Wyk, 2012).

The construction of the research methodology is based on the theoretical concept of a research onion, proposed by Saunders, Lewis and Thornhill (2019). Figure 3-1 illustrates the research onion.

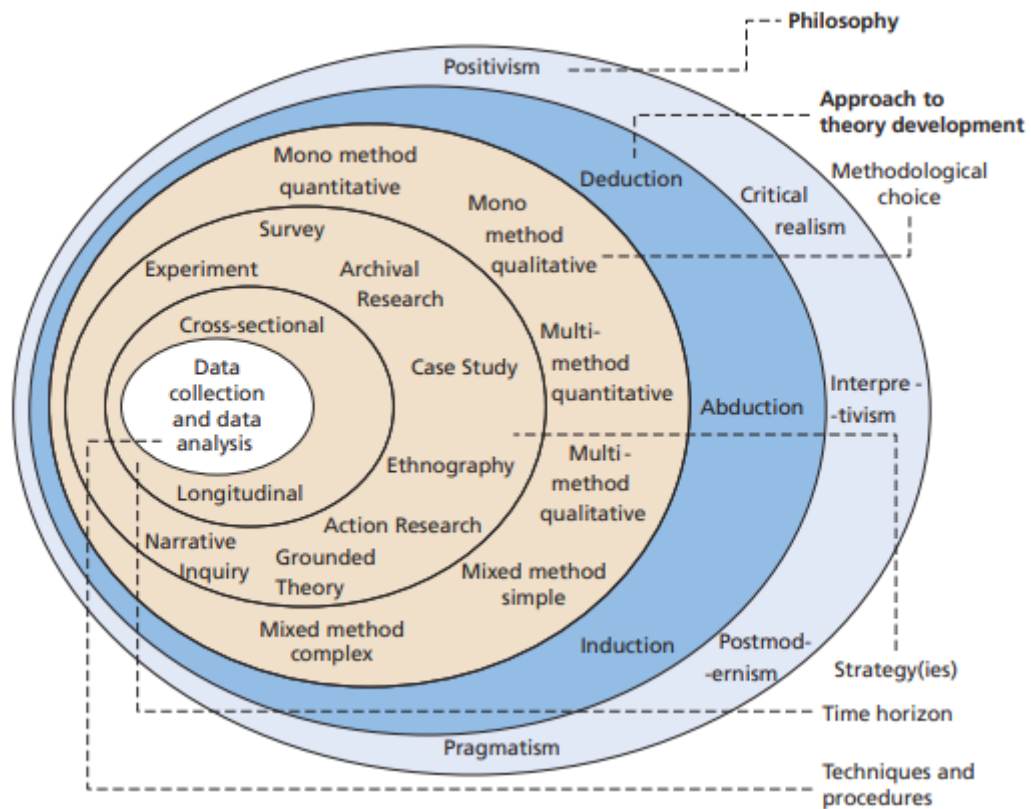


Figure 3-1 Research onion (Saunders et al., 2019)

Saunders et al. (2019) highlight that the research methodology starts with the research- philosophy approach to theory development, methodological choice, strategies, defining horizons and lastly the methods and procedures of data collection and analysis.

3.1.1 Research philosophy and paradigm

This is an information technology (IT) study; therefore, the focus of the study is on the exploration of data governance in healthcare information systems, using a systematic literature review. According to March and Smith (1995), IT has drawn attention to scientific research, because of its ability to impact the effectiveness of organizations both negatively and positively. Science involves two major philosophical approaches to research – objective and subjective approaches (Holden & Lynch, 2004).

The focus of the subjective philosophy is on humans operating in the world by sense-making, automatically changing the context they live in (Huizinga, 2007). Interpretive studies attempt to explore people’s experiences and their views (Gray, 2013). According to Noordin and Masrek (2016), the qualitative research often holds the interpretivist paradigm, whereas the quantitative research holds the positivist paradigm.

Johnson and Christensen (2014) highlight that a research paradigm is a perspective or a worldview about a research, held by a number of researchers, that is established on a set of common expectations. This study aims to explore data governance relative to challenges associated with healthcare information systems, by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review. This means that the researcher pursued to understand, interpret and make sense of the phenomena (Jebreen, 2012). Therefore, this study falls under the subjective philosophy approaches and the interpretive paradigm was the suitable procedure for it.

3.1.2 Research approach

Research is a systematic exploration into and study of sources and materials to uncover facts and highlight new conclusions. Creswell (2013) reflects that a research approach is a plan and a procedure that breaks down broad research assumptions into detailed techniques of data collection and analysis.

Creswell pinpoints three research strategies that researchers may follow: qualitative, quantitative and mixed procedures:

- Qualitative methods – inquiries that focus primarily on the collection of words, phrases and meanings in a study;
- Quantitative methods – a research approach that focuses mainly on the collection of numerical data in a study; and
- Mixed methods – an investigative approach that contains the features of qualitative and quantitative methods in one study (Creswell, 2013).

The focus of the quantitative research is theory testing and hypothesis, whereas the qualitative research focuses on testing and description of what is seen locally, and sometimes develop new theories and hypotheses (Johnson & Christensen, 2014). Qualitative approach is a bottom-up approach, while quantitative research is known as a top-down approach.

Qualitative research is a method of investigating and understanding the meaning individuals or groups ascribe to a social problem or to a human being (Creswell, 2013). The researcher further explains that the process of a qualitative approach includes, emerging procedures and questions; gathering data in the setting of the participants; inductively analyzing the data, building from specifics to general themes and using interpretation to create meaning of the data. This form of research inquiry honors an inductive style, which is a bottom-up approach.

Miles and Huberman (1994) highlight that qualitative researchers select different procedures and approaches to reach their aims. These include conversation analysis, cooperative inquiry, discourse analysis, ethnography, grounded theory and phenomenology, amongst others. Moreover, qualitative research is used when the researcher desires to learn or discover more about the topic, or when little is known about the topic (Johnson & Christensen, 2014).

The qualitative research process is mainly inductive meaning that the researcher generates meaning from the data gathered in a particular field (Creswell, 2013). The nature of the qualitative research is exploratory (Gray, 2013). Since the aim of the study is to explore the status of data governance in healthcare information systems, the qualitative research is considered the most appropriate for this study.

Furthermore, Miles and Huberman (1994) point out that a qualitative research is characterized by the following elements:

- The data have priority; the theoretical framework derives directly from the data.
- Researchers need to be careful because qualitative research is bound to context.
- Researchers engage themselves in the natural setting of individuals whose thoughts and feelings they want to investigate.
- The emphasis of the qualitative researchers is on the opinions of individuals involved in the research, their interpretations, meanings and perceptions.
- Researchers that adopt a qualitative method, use analysis, descriptions and interpretations.
- The association between the researched and the researcher is close and focuses based on equality as humans.
- The data collection and analysis process progress together, and in some forms of qualitative research, they cooperate.

Thomas (2003) points that the purpose of adopting an inductive approach is to:

- Summarize a large and mixed unprocessed data into a brief condensed format;
- To indicate clear associations between the research objectives and the research findings extracted from the unprocessed data; and
- To build a theory or framework about the basic structure of processes or experiences which are apparent in the raw data.

Gray (2013) points out that in an inductive approach, plans are made to gather data and the data collected is analyzed to see if there are any patterns that emerge that suggest relationships between variables. Creswell (2003) states that a researcher gathers evolving data to form themes from the data. It might be possible to build generalizations, relationships and even theories from the observations.

The fundamental purpose of the inductive approach is to permit research findings to emerge from the themes inherent in unprocessed data, without the hindrance enforced by the structured methodologies (Thomas, 2003). In this study, the inductive approach refers an approach that uses a detailed reading of the secondary data to develop concepts, themes and guidelines from the data through the researcher's interpretations of the data (Jebreen, 2012). The purpose of this approach is to produce a set of guidelines, which informs the improvement regarding performance of healthcare information systems. The inductive approach attempts to construct consistencies, patterns and

meanings (Gray, 2013). The study aims to explore the status of data governance in healthcare information systems, and to understand the meaning of the data, the inductive approach was the most appropriate for the study.

3.1.3 Research strategy

The research strategy is a blueprint to determine how the researcher will collect data and be enabled to answer the research questions. The purpose of this interpretivist study was to investigate the status of data governance in healthcare information systems. The initial approach to theory development was deductive (Figure 3-1) (Saunders et al., 2007), as it originated in aspects of the data governance model (Figure 2-3, Section 2.3). Thereafter, an inductive approach provided the backbone for the elicitation of framework guidelines, resulting from the systematic literature review (Table 5-1).

Data was not collected according to a traditional survey strategy, which includes questionnaires and forum discussions disseminated among a specific group of respondents. However, the systematic literature review methodology adopted in this study did collect data from a wide range of academic publications, which served as sources of data. In some cases, other literature reviews were surveyed for relevant guidelines. A full summary of surveyed literature sources can be reviewed in Appendix B.2. This approach is informed by Kitchenham et al. (2009).

3.1.4 Methodological Choice: Mono method

According to Bryman and Bell (2011), there are three research methods to choose from:

- Mono-method;
- Mixed method; and
- Multimethod.

In a mono-method, the researcher gathers either quantitative or qualitative data. In mixed methods, the researcher gathers both quantitative and qualitative data, with the intention of using these methods equally in the research study. In a multimethod, both the qualitative and quantitative methods are used with the intention to use one perspective when analyzing the data collected.

Bryman and Bell (2011) point out that a qualitative research is a strategy that puts emphasis on words rather than numbers as in data collection and analysis. Qualitative research focuses on the 'qualitative phenomenon' which involves quality (Rajasekar, Philominathan & Chinnathambi, 2006). Hanson, Balmer and Giardino (2011) explain the qualitative research method as an interpretative method

whose aim is to observe phenomena noted in natural environments. Qualitative research extracts data in the form of images, words, and observations.

Qualitative and quantitative research can be combined. Furthermore, he added that the mixed method involves collecting data both qualitatively and quantitatively. Miles and Huberman (1994) indicate that there are some differences between quantitative and qualitative approaches. Table 3-1 illustrates the differences that many writers have explored between quantitative and qualitative methods.

Table 3-1 Comparison of quantitative and qualitative research approaches (Miles & Huberman, 1994; Mack et al., 2005)

	Quantitative	Qualitative
Aim	Investigation of the practices of participants and their life. Exploring, theory development from data.	Exploration for causal explanations. Testing, hypothesis and prediction.
Purpose	Focus is broad. Procedure-oriented. Bound in context.	Focus is narrow. Product-oriented. Free in context.
Sample	Participants, informants. Sampling components, for example, time, place and concepts. Theoretical and purposive sampling. Flexible sampling.	Participants, respondents. Randomized sampling. Sample frame fixed before research.
Data collection	Non-standardized, in-depth interviews. Participant observation. Videos, photographs, documents.	Standardized interviews, questionnaire. Structured, tight observation. Papers. Randomized controlled trials.
Analysis	Thematic, fixed comparative analysis. Ethnographic analysis, grounded theory.	Statistical analysis.
Result	A story, a theory, an ethnography.	Quantifiable outcome.
Relationships	Direct participation of a researcher. Close research relationship.	Partial participation of a researcher. Research relationship distant.
Rigour	Authenticity, trustworthiness. Transferability and typicality.	Reliability, external/internal validity. Generalizability.
General framework	Pursue to approve hypothesis about a phenomena. Instruments use a more firm style of classifying and eliciting answers from questions. Use highly structured approaches such as surveys, structured observation and questionnaires.	Pursue to investigate phenomena. Tools use more iterative, flexible style of categorizing eliciting answers to questions. Use semi-structured approaches, for example, focus groups, participants, observation and in-depth interviews.
Analytical objectives	To quantify variation. To predict causal relationships. To describe characteristics of a population.	To define variation. To explain and define relationships. To define individual experiences. To define group norms.
Question format	Close-ended.	Open-ended.
Data format	Mathematical (obtained by assigning numerical values to responses).	Word-based (obtained from audiotapes, videotapes, and field notes).
Flexibility in study design	Study design is firm from start to end. Participant answers do not control or influence how and which questions researchers ask next. Study design is subject to numerical expectations and circumstances.	Certain features of the study are flexible. Participant's answers affect how and which questions researchers ask. Study design is repetitive, i.e., data collection and research

A qualitative research makes it possible to explore topics that are not properly understood, leading to more investigation, either by qualitative or quantitative methods (Hanson et al., 2011). Furthermore, the researcher added that a qualitative researcher makes use of the inductive approach during data analysis.

The purpose of qualitative research is for clarifying, defining and interpreting collected data. This approach allows the researcher to use different methods such as collection of documentary materials, group interviews, observation, and unstructured interviews (Myers, 2009). The qualitative approach uses an inductive data analysis to provide a transparent understanding and does not test hypothesis. According to Mack et al. (2005), the benefit of qualitative methods in an exploratory research is the use of open-ended questions, which have the capacity to evoke answers that are:

- Culturally and meaningful salient to the participant;
- Unexpected for the researcher; and
- Exploratory and rich in nature.

Since the study aimed to explore the status of data governance in healthcare information systems, the study was inductive in nature and the qualitative approach was the most suitable.

3.1.5 Research time horizon

Most researchers frequently use cross-sectional surveys. Recently, authors, editors and reviewers have conveyed the growing concern about the strength of this approach (Rindfleisch, Malter, Ganesan & Moorman, 2008). In this study, a cross sectional survey was chosen because it is less expensive and can be conducted in a short time (Hemed & Tanzania, 2015). Academic publications included in this systematic literature review were selected between 2010 and 2020. This decision represented a snapshot in a certain period of time (Kesmodel, 2018)..

Survey methodologies are often used in cross-sectional studies with the following characteristics:

- It happens at a single point in time;
- It excludes manipulating variables;
- It permits researchers to look at numerous characteristics simultaneously;
- It is used for prevailing characteristics in a known population; and
- It can inform what is happening in an existing population (Cherry, 2019).

Based on certain circumstances, the outcome obtained from cross-sectional data, displays validity when compared to the outcome acquired from longitudinal data (Rindfleisch, Malter, Ganesan, Moorman, 2008). Unlike the longitudinal studies that look at a group of people over a prolonged period, cross-sectional studies define what is happening now.

Hemed and Tanzania (2015) points out the benefits that make cross-sectional studies useful to researchers:

- They take little time to conduct and are inexpensive;
- Risk factors and many outcomes can be assessed;
- Valuable for public health planning; and
- There is no loss to follow up.

It is easy to compare different variables simultaneously in a cross-sectional study (Institute for Work & Health, 2015). The data collected for this study was short-term and at one point in time. Cross-sectional study involves observing data from the population at one precise point in time (Cherry, 2019).

Since the study aimed to explore data governance relative to challenges associated with healthcare information systems by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review, a cross-sectional study was considered the most suitable for this study.

The next section (Section 3.2) details the systematic literature review methods underpinning this study. It addresses both data collection and analysis.

3.2 Method: Systematic literature review (SLR)

Section 3.2.1 differentiates between the traditional literature review and SLRs, justifying the structured approach used in this study. The guidelines from different experts in Section 3.2.2 are a foundation that directs the systematic literature review implementation. The four-phase strategy is in Section 3.2.3. A quality assessment process that reviews whether the final search results have been adequate is in Section 3.2.4. Section 3.2.5 explains the data collection methods adopted in the study in relation to other people. Section 3.2.6 focuses on the research tools used in this study.

The study uses literature to justify the need to address the questions mentioned in Section 1.5.3. Since the study is qualitative in nature, a sampling technique was used in the selection process, through a choice of search such as keywords and phrases. The researcher used the list of guru articles, for example Okoli (2015). From the sources, six themes emerged.

The study used *ATLAS.ti V8*, a Computer Assisted Qualitative Data Analysis Software (CAQDAS) tool to analyze data. The researcher imported the final selection of studies for the SLR into *ATLAS.ti V8*. All these articles were stored under the documents folder in *ATLAS.ti V8*.

3.2.1 Traditional vs SLR

Although this study adopted an SLR, it is important to distinguish between the traditional literature review and the SLR in order to justify the chosen method. The researcher used an SLR to gather secondary data. In comparison to the traditional literature review, an SLR uses a properly-defined approach to view the literature for a specific topic (Ryan, 2010).

Traditional reviews evaluate and summarize a body of literature and draw results for the particular topic in question (Cronin, Ryan & Coughlan, 2008). They collect information pertinent to what is known about the topic. Its vital purpose is to provide the reader with a complete familiarity in perceiving current knowledge and featuring the importance of new research. In comparison to a traditional literature review, an SLR uses a clear approach to review literature within a particular subject field.

Traditional reviews try to sum up a number of studies, whereas SLRs use a precise and clear approach to review literature in a particular subject field. Boel and Cecez-Kecmanovic (2010) point out that SLRs are of interests, because of the significance they have in the literature- search process. Furthermore, an SLR helps to analyze, assess and interpret research pertinent to a specific research topic (Kitchenham, 2004).

Cronin et al.(2008) argue that the aim of an SLR is to give a full as possible list of all published and unpublished studies on a specific subject field. Kitchenham and Charters (2007) reflect that the purpose of the SLR is to identify primary studies relevant to the research question through an unbiased search strategy. Okoli (2015) argues that an SLR defines the content and quality of the knowledge of the previous studies that are available. Furthermore, the researchers added that the one factor that distinguishes a systematic literature review from a traditional review is the rigor of the search process.

3.2.2 Guidelines from the experts for a systematic literature review execution

These key guidelines scaffold the systematic literature review process, namely structure (Boell & Cecez-Kecmanovic, 2010), a systematically phased approach (Okoli, 2015), inclusion and exclusion criteria (Harpur, 2018) and quality assessment criteria (Inayat et.al., 2014).

3.2.3 A four-phase strategy

This study aims to explore DG relative to challenges associated with healthcare information systems, by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review. A four-phase strategy was applied during the systematic literature review: Phase 1 Planning, Phase 2 Selection, Phase 3 Extraction and Phase 4 Execution (Okoli, 2015).

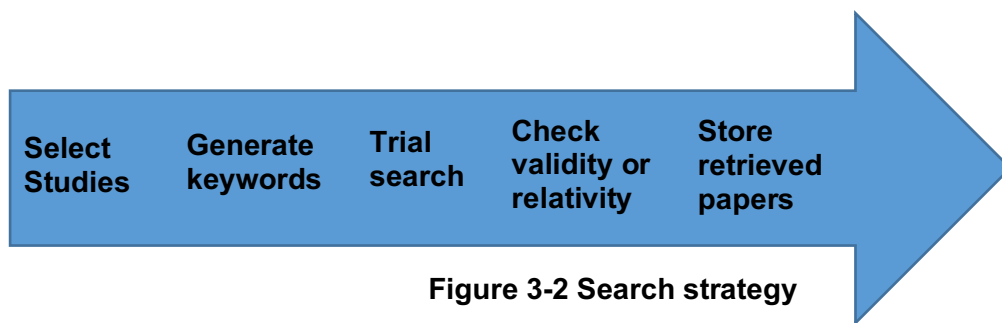
Phase 1 Planning: Identifies the purpose and drafts the protocol

The first phase consists of two steps, namely, to identify the purpose of the SLR and to draft the protocol. The intention of the research is to answer the questions posed from the perspective of previously published data on the topic. The research questions determined the focus of the planning stage. Table 3-2 shows a selection of keywords and phrases as search criteria used in *Google Scholar*. The full list of the search items is in Appendix B.1.

Table 3-2 Search items used for the selection of reviewed articles

Search Keywords
Data governance AND competitive advantage
Data governance AND digitization AND healthcare
Data governance AND healthcare
Data governance AND healthcare information systems
Data governance AND eHealth
Data governance AND electronic health records
Data governance AND electronic medical records
Data governance AND performance strategy
Data governance AND process harmonization
Data governance framework
Improving data governance AND healthcare
Improving data governance AND eHealth

The search strings and keywords were based on the research questions to retrieve as many papers as possible and to minimize bias. The researcher derived the key words from the research questions to find relevant papers. Key words encapsulated data governance and healthcare information systems. The researcher extended the search by using many keywords using the AND operator. The key words were captured in *Google* and *Google Scholar* to retrieve articles that are relevant to this study. This process resulted to 142 published papers which included conference papers, books, blogs, chapters, reports and journals. The review focused mainly on published journal articles, conference papers and e-resources. Figure 3-2 shows an overview of the search strategy the researcher used in this study.



The researcher stored all the screened articles in *Mendeley* for bibliography and in-text citations (Harpur, 2018). *Mendeley*, a tool that allows researchers to manage PDFs, documents and citations through a desktop client version (Parabhoi, Seth & Pathy, 2017). Figure 3-3 shows screened articles grouped according to the emergent themes, authors, titles, year in which it was published, and the date the article was added in *Mendeley*.

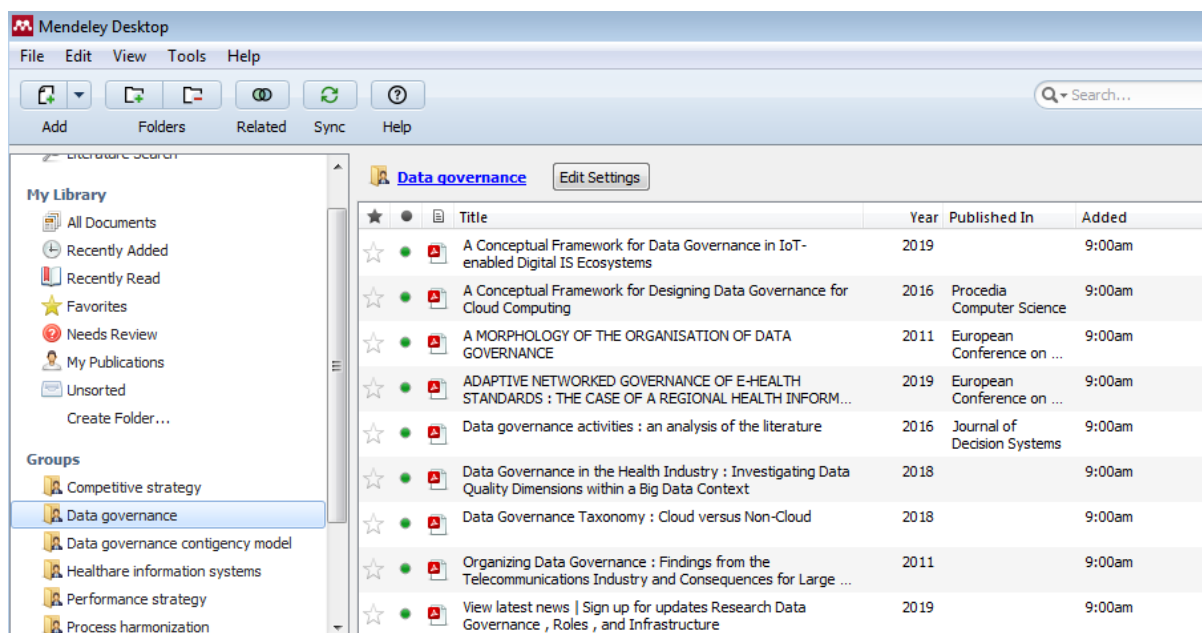


Figure 3-3 A selection of references stored in Mendeley

Mendeley has a search box, which assisted the researcher in searching the articles by author or title. *Mendeley* has the functionality of adding, sorting and deleting articles, which helped the researcher to move articles around and delete the articles that were not relevant for this study.

This first step requires a clear identification of the purpose and intended goals (Okoli, 2015). It consolidates existing knowledge, synthesizing a set of guidelines that informs aspects of DG. A review

protocol provides a clear review of procedure to be followed where a confined strategy assists to select primary studies and to conduct the SLR (Kitchenham, 2004). The review protocol supports the replication of the SLR for further studies and it minimizes the bias of the search (Okoli, 2015). In this study, the review protocol was applied in the field of DG in HIS in South Africa.

From the Planning – Phase 1, iteration 1 led to a group of 142 articles. The Selection – Phase 2 shows the articles that went through the selection process. The Planning phase included the use of *ATLAS.ti* V8 for data analysis, followed by the Extraction – Phase 3. Lastly, Execution– Phase 4 set the stage for writing the results of a systematic literature review.

Phase 2 Selection: Practical screen and search for literature

This is the second phase of the SLR strategy, which consists of two steps, namely, application of a practical screen and the search for literature. This step is also called the screening for inclusion, whereby certain studies were considered for review and other studies were eliminated (Okoli, 2015). The study excluded papers not relevant to this SLR through abstract reading. Excluded are non-English publications relevant to HIS, as well as those that are not full papers.

Re-reviewing of papers for the second time, by means of keywords and abstracts, focusing on the research questions and the objective of the study. Screen-published studies on DG in HIS that provided broader information in healthcare, based on titles, abstracts and date were studied. Only literature published from the years 2010–2020 was analyzed to determine the status of DG in HIS within the South African context.

Additionally, the review was conducted on DG decisions, performance in HIS, and data management, DG challenges and DG processes. A total number of 142 papers were collected. These papers included academic resources, peer-reviewed journal articles, conference papers, unpublished masters, and doctoral theses.

The details of the literature were explained and justified according to how they assured the search's comprehensiveness (Okoli, 2015). Boell and Cecez-Kecmanovic (2010) highlighted that a successful search procedure is not one that occurs in high recollection, but rather one that results in high accuracy. Searching for literature provides a clear, in-depth understanding of the field of study. Furthermore, it also improves the way to search literature.

Pertinent papers from the web search engines and digital databases were covered. The study reviewed studies published from 2010–2020. The investigation assisted in providing a picture of the current state of DG in HIS research in South Africa.

Phase 3 Extraction: Extraction of data and appraisal of quality

The researcher used *ATLAS.ti V8*, a Computer Assisted Qualitative Data Analysis Software (CAQDAS) tool, to import the last selection of articles for the SLR. *ATLAS.ti V8* helped the researcher to link different codes of quotations to create networks (Lewis, 2015). Selection of articles included themes that emerged from the research topic, problem, questions and objectives.

After the inclusion of all the identified studies for the review, appropriate information was systematically extracted from each study (Okoli, 2015). The data was extracted according to the relevant publications, correctly recording the information acquired from the selected publications. The study extracted phrases, words and quotations from the selected articles during the Extraction phase.

The Extraction phase consisted of four levels of extraction (EL1 – EL4).

The summary is outlined in Table 3-3.

Table 3-3 Extraction levels

Level	Dimension	Purpose
EL1	Source attributes	To develop content and context
EL2	Categories	To combine a group of concepts
EL3	Sub-categories	To explore the middle-level perceptions
EL4	Items	To define linkages

Note: EL = Extraction level

The extracted articles were screened for exclusion, whereby quality-oriented criteria were used to determine which studies were included and which not (Okoli, 2015). It is not easy to determine values for all used concepts when extracting data, because the values depend on the contents and studies (Staples & Niazi, 2007). Figure 3-4 is a screenshot taken from *ATLAS.ti V8* for the articles imported into *ATLAS.ti V8*.

Systematic literature review

- Documents (46)
 - ▶ D 1: DPS5 Explaining performance in healthcare 2019 Vainiera et al. (3)
 - ▶ D 2: DPS2 Healthcare IT strategic alignment: Recommendations and challenges 2018 Alsharif et al. (2)
 - ▶ D 3: DPS4 Information technology and business level strategy 2013 Drnevich & Croson (1)
 - ▶ D 4: DPS3 The digitization of patientThe digitization of patient care 2018 Atasoy et al. (12)
 - ▶ D 5: DCA5 Flexible collaboration infrastructures and healthcare 2019 Wetering & Versendaal (1)
 - ▶ D 6: DPH3 A harmonized DQ assessment in healthcare 2016 Kahn et al. (6)
 - ▶ D 7: DPH4 Defining and conceptualizing data harmonization 2018 Schmidt et al. (2)
 - ▶ D 8: DPH1 Standardization for mastering healthcare transformation 2017 Blobel (4)
 - ▶ D 9: DDG4 A conceptual framework for DG in IoT-enabled digital IS 2019 Dasgupta et al. (6)
 - ▶ D 10: DDG2 A conceptual framework for designing DG 2016 Al-Ruithe et al. (4)
 - ▶ D 11: DDG9 A morphology of the organisation of data governance 2011 Otto (1)
 - ▶ D 12: DDG5 Adaptive networked standards of health 2019 Fossum et al. (1)
 - ▶ D 13: DDG1 Data governance activities: an analysis of the literature 2016 Alhassan et al. (5)
 - ▶ D 14: DDG7 Data governance in the health industry 2018 Juddoo et al. (4)

Figure 3-4 Final articles for the SLR

Table 3-4 displays a list of the final articles for the systematic literature review. The articles are categorized according to the six themes, namely CA Competitive advantage, DG Data governance, DM Data governance contingency model, HS Healthcare information systems and PH Process harmonization. The prefix before each theme, such as CA is an abbreviation for each theme. *ATLAS.ti* V8 does allow the document numbers to be changed. E.g., D5, D36, D37, D41 and D46 are not sorted. The researcher created a code as a prefix for each article after the document number, 'D9: DDG4'. D represents the document number in the list, CA; the abbreviated name of the theme and 5 is the article number.

Figure 3-4 and Table 3-4 illustrates a selection of the final articles for an SLR. The full list of the entire systematic literature review article is in Appendix B.2.

Table 3-4 Systematic literature review studies

ID	Article details - abbreviated title	Author(s)	Origin	CA	DG	DM	HS	PH	PS
DCA1	Digital transformation in healthcare	Gopal et al. (2019)	INT	■	-	-	-	-	-
DCA2	Artificial intelligence and data science for developing intelligent HIS	Gujral et al. (2019)	INT	■	-	-	-	-	-
DCA3	Does Innovation impact the performance of healthcare?	Moreira et al. (2017)	INT	■	-	-	-	-	-
DCA4	The impact of enterprise risk management on competitive advantage	Saeidi et al. (2019)	INT	■	-	-	-	-	-
DCA5	Flexible collaboration infrastructures and healthcare information exchange	Wetering & Versendaal (2019)	INT	■	-	-	-	-	-
DDG1	Data governance activities: an analysis of the literature	Alhassan et al. (2016)	INT	-	■	-	-	-	-
DDG2	A conceptual framework for designing data governance	Al-Ruithe et al. (2016)	INT	-	■	-	-	-	-
DDG3	Data governance taxonomy	Al-Ruithe et al. (2018)	INT	-	■	-	-	-	-
DDG4	A conceptual framework for DG in IoT-enabled digital IS	Dasgupta et al. (2019)	INT	-	■	-	-	-	-
DDG5	Adaptive networked standards of healthcare	Fossum et al. (2019)	INT	-	■	-	-	-	-
DDG6	Data governance – Trustworthiness	Janseen et al. (2020)	INT	-	■	-	-	-	-
DDG7	Data governance in the health industry	Juddoo et al. (2018)	INT	-	■	-	-	-	-
DDG8	We need to think about DG for dementia in a digital era	Milne & Brayne (2020)	INT	-	■	-	-	-	-
DPS6	Developing and AI-enabled practice in healthcare	Wiljier & Hakim (2019)	INT	-	-	-	-	-	■

Note: CA = Competitive advantage, DG = Data governance, DM = Data governance contingency model, HS = Healthcare information systems, PH = Process harmonization, PS = performance strategy

Table 3-4 represents a sample of the final list of studies for an SLR. The full list of the SLR studies is included in Appendix B.2 Academic publications – final selection of articles. The colors distinguish the codes, e.g. Orange = Competitive advantage. The articles are sorted in ascending order by themes and ascending order by author. The researcher created a codebook from the articles in Figure 3-4. There are various types of coding in *ATLAS.ti V8*, namely:

- Auto coding;
- Code in Vivo;
- List coding;
- Open coding; and
- Quick coding.

From the five types of codes listed above, this study used the Code in Vivo and the Open coding. The Code in Vivo enabled the researcher to select the keywords in each article, whereby the selected text was used as a code. The open coding enabled the researcher to enter a new code name to code the highlighted segment. The code manager enables the researcher to list all the codes created from the keywords. In the code manager, the researcher was able to create new free codes, rename, duplicate, merge or split codes and drag and drop codes. In Figure 3-5, the researcher shares an excerpt of the codebook for authors associated with articles as displayed earlier in Figure 3-4.



Figure 3-5 Codebook for authors

In Figure 3-5, the researcher created a codebook for authors extracted from the literature sources, in order to link the themes and the code snippets to the relevant author. The code of authors emerged from the data and are sorted alphabetically. Code A means author and then the author number is linked to it, e.g. (A01). The black colour serves to identify the codes for authors from other codes, as there is a codebook of items with different colours according to themes. The full list of the codebook is in Appendix C.1 – C.6.

Figure 3-6 represents the screen shot of a section of the codebook of the study as synthesized from *ATLAS.ti.V8*.

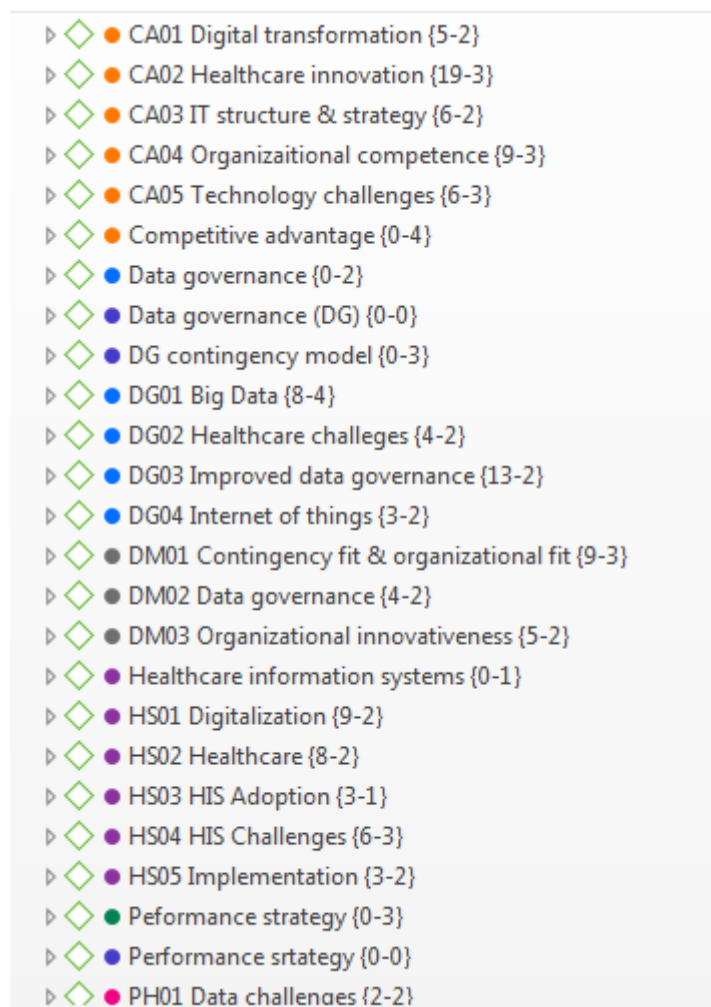


Figure 3-6 Codebook for items

The researcher grouped the codes in themes, sorted the themes in alphabetical order, and prefixed each theme with the theme abbreviation and code number, for example (CA01). The researcher evolved the themes intuitively based on the theme from the literature. The colours served to distinguish the category to which each item belongs, for example, the pink colour identified codes linked to the Process harmonization theme. After the codebook creation, the researcher moved each code to each relevant code group. The code group manager enabled the researcher to list all the code groups and their relevant items and to create, rename or delete code groups and remove items.

The researcher gleaned six concepts from the literature sources that led to the proposal of six categories:

- Adoption – prepare for new change and evolve;
- Dynamics – training in emerging AI technologies;
- Effectiveness – implement proper data governance;
- Harmonization – align healthcare system processes;
- Performance – explore contingency factors; and
- Transformation – install intelligent technologies.

The list of the categorized items is as follows:

- Category A: Transformation
- Category B: Effectiveness
- Category C: Performance
- Category D: Adoption
- Category E: Harmonization
- Category F: Dynamics

Table 3-5 shows the six proposed categories, sub-categories, and the items associated with each category.

Table 3-5 Categories A. Transformation, B. Effectiveness, C. Performance D. Adoption, E. Harmonization, F. Dynamics

Category	Sub-category	Items
A. Transformation	Competitive advantage	CA01 Digital transformation
		CA02 Healthcare Innovation
		CA03 IT strategy and IT structure
		CA04 Organizational competence
		CA05 Technology challenges
B. Effectiveness	Data governance	DG01 Big Data
		DG02 Healthcare challenges
		DG03 Improved data governance
		DG04 Internet of Things
C. Performance	DG contingency model	DM01 Contingency fit and organizational fit
		DM02 Data governance
		DM03 Organizational innovativeness
D. Adoption	Healthcare information systems	HS01 Digitalization
		HS02 Healthcare
		HS03 HIS adoption
		HS04 HIS challenges
		HS05 Implementation
E. Harmonization	Process harmonization	PH01 Data challenges
		PH02 Data harmonization
		PH03 EHR analysis
		PH04 Healthcare transformation
F. Dynamics	Performance strategy	PS01 Digital healthcare
		PS02 EHR adoption
		PS03 Improved healthcare services
		PS04 Organizational performance
		PS05 Professional development

Note: HS = Health information systems, PS = Performance strategy, DG = Data governance, PH = Process harmonization, DM = Data governance contingency model, CA = competitive strategy

Figure 3-7 illustrates a screenshot from *ATLAS.ti V8*, which shows the link between the items and each category. Appendix C.1–C.6 displays the full list of categories and items. The different colours distinguish the items for each category.

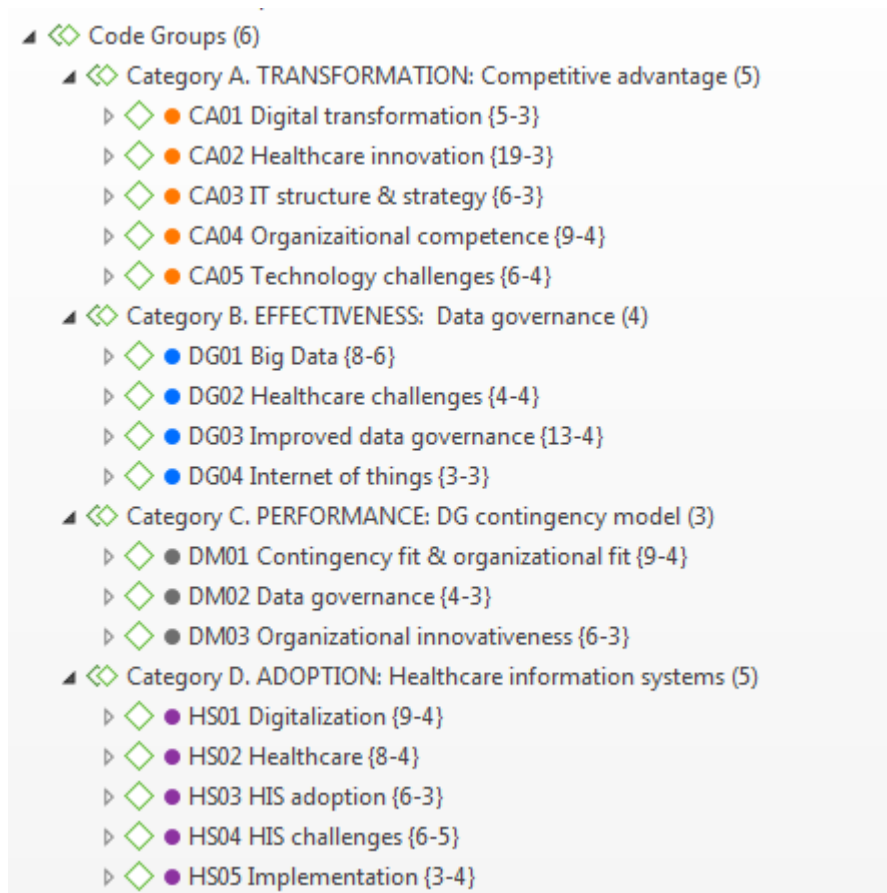


Figure 3-7 Code groups of categories, themes and items

Figure 3-7 above shows the code groups of six categories, themes and items for each theme. There are five items under Category A: CA01 Digital transformation, CA02 Healthcare innovation, CA03 IT structure & strategy, CA04 Organizational competence and CA05 Technology challenges. The full list of all the categories is in Appendix C. The different colours serve to differentiate the themes from one another. The Code Group Manager enabled the researcher to open group in networks for further analysis. In the Code Group Manager, the researcher was able to create, delete and rename networks.

Figure 3-8 illustrates an example of a network diagram that links category to a theme as well as items and authors that contributed to each theme. Appendix D.1–D.6 shows a full view of each category, theme, items, authors, and code snippets for each.

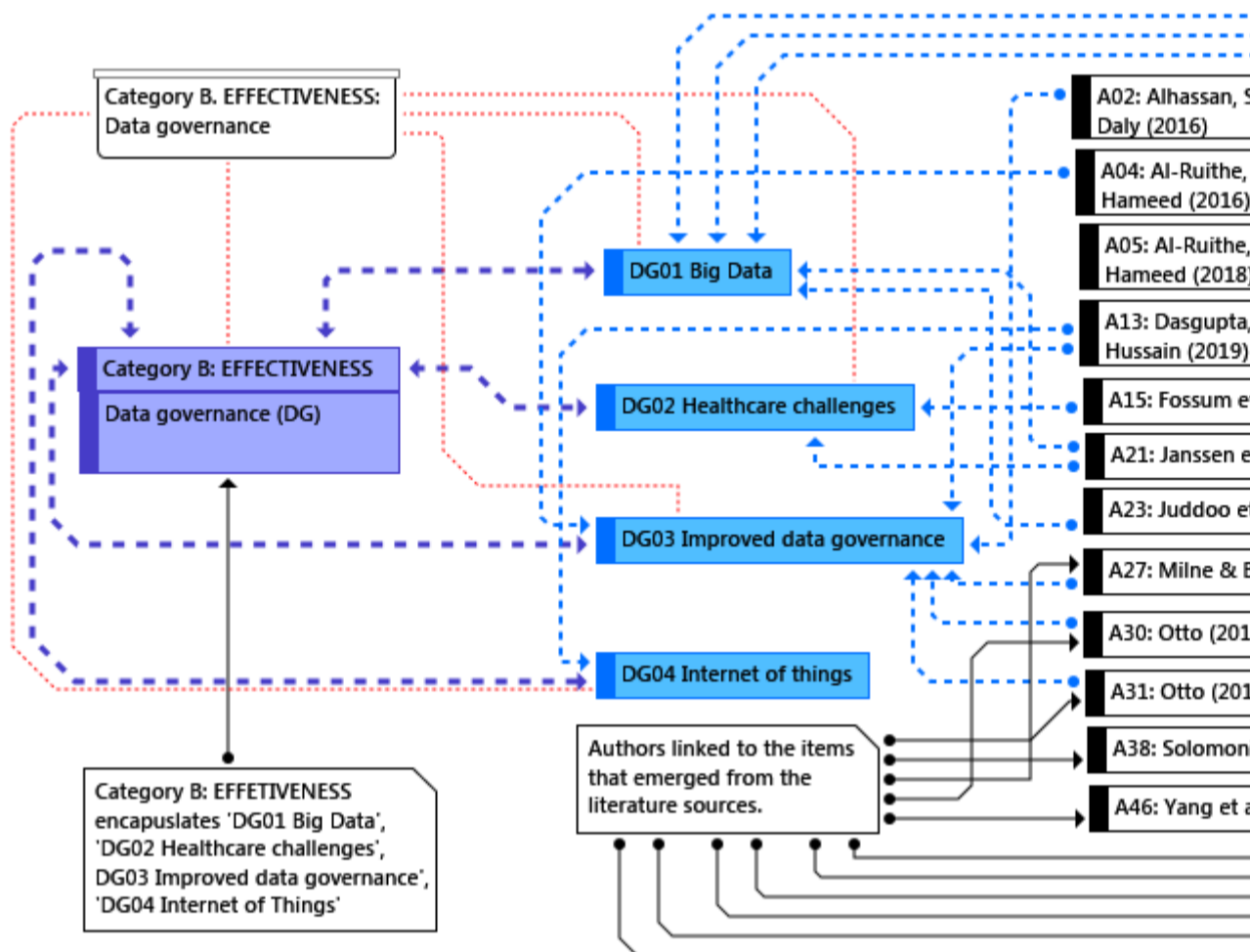


Figure 3-8 Network diagram for the category, theme, items and authors

Figure 3-8 above is the analysis of the code snippets (quotations) from the articles. The Network Manager assisted the researcher to view the items in each group, the code snippets extracted from the articles, and the relevant authors for each code snippet. From the analysis of the codes in Figure 3-5 and Figure 3-7, the researcher was able to create a visual representation of the theme, items and associated authors. The blue dotted lines show a link for the authors that contributed to each item. The purple dotted lines illustrates that the items, DG01 Big Data, DG02 Healthcare challenges, DG03 Improved data governance and 'DGO4 Internet of Things are associated with Category C that is directly connected to the theme Data Governance through the link of the red dotted lines.

Selection criteria of the study

The aim of the criteria for study selection is to classify the primary studies that give direct evidence about the research question (Kitchenham & Charters, 2007). Based on the research questions, the study applied the inclusion (I1 -I4) and exclusion (E1 – E4) criteria. The inclusion for the 142 articles is in Phase 1 Selection.

The study applied the following inclusion criteria to decide whether the article should be included in the study:

- I1: Addresses the use of data governance in healthcare information systems;
- I2: Pertains to healthcare contexts;
- I3: Includes articles published between 2010 and 2020;
- I4 Having an abstract available; and
- I5: Includes an academic, peer-reviewed journal or a conference proceeding.

The exclusion of articles was based on the criteria below:

- E1: Does not address data governance in healthcare information systems;
- E2: Does not research healthcare contexts;
- E3: Is not a suitable recent publication;
- E4: Does not have an abstract; and
- E5: Is not an academic or a peer-reviewed journal.

Iteration 1 included several scans of extracted literature sources. The study followed several methods, which includes snowballing. These methods are a foundation of the first selection defined in Phase 1 – Planning, which consists of 142 studies. During iteration 2, the application of exclusion criteria led to a reduced count of 38 articles. Iteration 3 bridged the noted gaps connected to competitive strategy,

data governance, data governance contingency model, performance strategy and process harmonization, which led to the addition of nine articles, resulting to 46 publications. The steps from the first to the final set of publications are presented in Table 3-6.

Table 3-6 is a summary of three iterations (1 to 3) which includes the exclusions as well as addition of articles. Iterations 1 and 3 consist of a single activity, while iteration 2 consists of five exclusion criteria.

Table 3-6 List of iterations for inclusion criteria

Iteration	Definition	CA	DG	DM	HS	PS	PH	Total
1	Initial screen: First iteration results	8	32	8	66	17	11	142
2	E1: Does not address the use of DG in HIS	1	15	1	40	2	0	57
	E2: Does not research healthcare context	2	3	0	2	5	2	14
	E3: Is not a suitable recent publication	0	0	2	2	2	0	6
	E4: Does not have an abstract	2	4	2	7	3	3	21
	E5: Is not an academic or a peer-reviewed journal	0	0	0	1	1	2	4
	Result of iteration two: reduction	3	10	3	14	4	4	38
3	Addition of articles to fill the gap	2	2	1	0	2	1	8
	Result of iteration three: addition	5	12	5	14	6	5	46

DG = Data governance (adapted from Harpur, 2018)

Note: CA = Competitive advantage; DG = Data governance; DM = Data governance contingency model; HS = Healthcare information systems; PS = Performance strategy; PH = Process harmonization; I = Inclusion; E = Exclusion

3.2.4 Quality assessment of the study

The quality evaluation serves to check whether the end search results have been adequate and offers support for the scope of the review. Kitchenham and Charters (2007) informed that on top of the inclusion or exclusion criteria, it is vital to assess the quality of primary studies:

- To provide a thorough view of exclusion and inclusion criteria;
- To explore whether quality differences give an explanation for differences in the outcome of the study;
- As a means of weighting the importance of individuals' studies when results are being synthesized;
- To determine the state of inferences and guide the interpretation of findings; and
- To direct recommendations for future study.

The study followed four quality assessment criteria (QAC) informed by Inayat et.al (2014) that were customized to fit this study:

- QAC1: Are aims or objectives of the article in line with those of the study?
- QAC2: Does the article focus on issues in the data governance context?
- QAC3: Is there an easily identified framework?
- QAC4: Based on findings, are they worthy of the synthesis of guidelines for data governance?
Do the findings indicate that the article is worthy of the synthesis of guidelines for data governance?

The evaluation of each article was examined in alignment to the study of Kitchenham (2009), using the four questions of criteria as listed above. A measure was applied where Yes = 1; Partially = 0.5 and No = 0 (Kitchenham et al., 2009; Harpur, 2018).

Table 3-7 shows an illustrative example of the finalized evaluation outcomes reported in Appendix B.3

Table 3-7 Quality assessment outcomes

ID	Article details - abbreviated title	Author(s)	QAC1	QAC2	QAC3	QAC4	Index
DCA1	Digital transformation in healthcare	Gopal et al. (2019)	1	1	1	1	4
DCA2	Artificial intelligence and data science for developing intelligent HIS	Gujral et al. (2019)	1	1	0.5	1	3.5
DCA3	Does Innovation impact the performance of healthcare?	Moreira et al. (2017)	1	1	0.5	1	3.5
DCA4	The impact of enterprise risk management on competitive advantage	Saeidi et al. (2019)	1	1	1	0.5	3.5
DCA5	Flexible collaboration infrastructures and healthcare information exchange	Wetering & Versendaal (2019)	1	1	0.5	1	3.5
DDG1	Data governance activities: literature analysis	Alhassan et al. (2016)	1	1	1	1	4
DDG2	A conceptual framework for designing data governance	Al-Ruithe et al. (2016)	1	1	1	1	4
DDG3	Data governance taxonomy	Al-Ruithe et al. (2018)	1	1	1	1	4
DDG4	A conceptual framework for data governance	Dasgupta et al. (2019)	1	1	0.5	1	3.5
DDG5	Adaptive networked standards of healthcare	Fossum et al. (2019)	1	0.5	0.5	0.5	2.5
DDG6	Data governance – Trustworthiness	Janseen et al. (2020)	1	1	0.5	1	3.5
DDG7	Data governance in the health industry	Juddoo et al. (2018)	1	1	0,5	0.5	3
DPS6	Developing and AI-enabled practice in healthcare	Wiljier & Hakim (2019)	1	1	0.5	1	3.5
Overall aggregated indices			1	0.8	0.7	0.8	3
			100%	75.7%	69.6%	76.1%	75%

Note: QAC1 = Are aims of the article in line with this study? QAC2 = Does the article focus on issues in DG context? QAC3 = Is there an easily identified framework or set criteria? QAC4 = Do the findings indicate that the article is worthy of the synthesis of guidelines for data governance? Based on findings, are they worthy for the synthesis of guidelines for data governance?

All scores for each article were totaled, resulting in an index with minimum and maximum scores of 0 and 4 (Alrasheedi, Capretz & Raza, 2015; Harpur, 2018). The sum of the aggregated index for the final articles selected is 75% shows that a conclusion based on these values indicates that the quality of an SLR was satisfactory (Harpur, 2018).

Phase 4 Execution: Synthesis of studies and writing of review

Execution is the fourth phase, comprising two steps, namely, the synthesis of studies and the writing of the review.

This phase is also known as analysis, whereby facts extracted from the studies are combined by using a qualitative or a quantitative technique, or both (Okoli, 2015). This step collects, combines and summarizes the results of the selected publications. Since the study explores measures associated with DG that may improve HIS performance, the qualitative research is deemed appropriate.

In an SLR, the process needs to be reported in full detail so that other researchers can reproduce the review results (Okoli, 2015). Standard principles of reporting the findings of the SLR through journal publications will follow.

3.2.5 Data collection methods – in relation to other researchers' methods and SLR

According to Boel and Cecez-Kecmanovic Boell (2010), SLRs are of specific interests for the significance they have on the process of literature searching. Okoli (2015) points out that researchers when doing research for its predetermined steps that allows the evaluation of search integrity currently choose an SLR.

A researcher needs to consider the following important steps when doing an SLR (Gough, Oliver & Thomas, 2012). Researchers propose that the following structured phases from Okoli (2015) and Kitchenham (2004) are relevant to the successful construction of SLRs:

- **Identify the Purpose:** to clearly identify the intended goals and purpose of the study.
- **Draft the Protocol:** to confine a strategy for the selection of primary studies.
- **Search for Literature:** clearly explaining and justifying literature details to guarantee the completeness of the search.
- **Apply Practical Screen:** to determine which studies will be included or excluded.
- **Appraise Quality:** to rate papers for elimination due to insufficient quality.
- **Extract Data:** the applicable data will be systematically extracted from each study;
- **Synthesis of Studies:** to combine facts extracted from studies using qualitative or quantitative techniques.
- **Write the Review:** report the outcome of the review in detail.

This SLR adopted a three-prong strategy. Firstly, it focused on healthcare information systems. Secondly, it addressed DG issues and challenges. Lastly, it explored DG guidelines via an explicit collection of relevant sources.

Finally, the review navigated recently published sources regarding three components of the DG contingency model, namely Performance strategy, Competitive strategy, and Process harmonization.

The SLR method adopted in this study served to gather, analyze and interpret previously published data. This study is based on the eight-step approach recommended by Okoli (2015) as outlined in Figure 3-9 below.

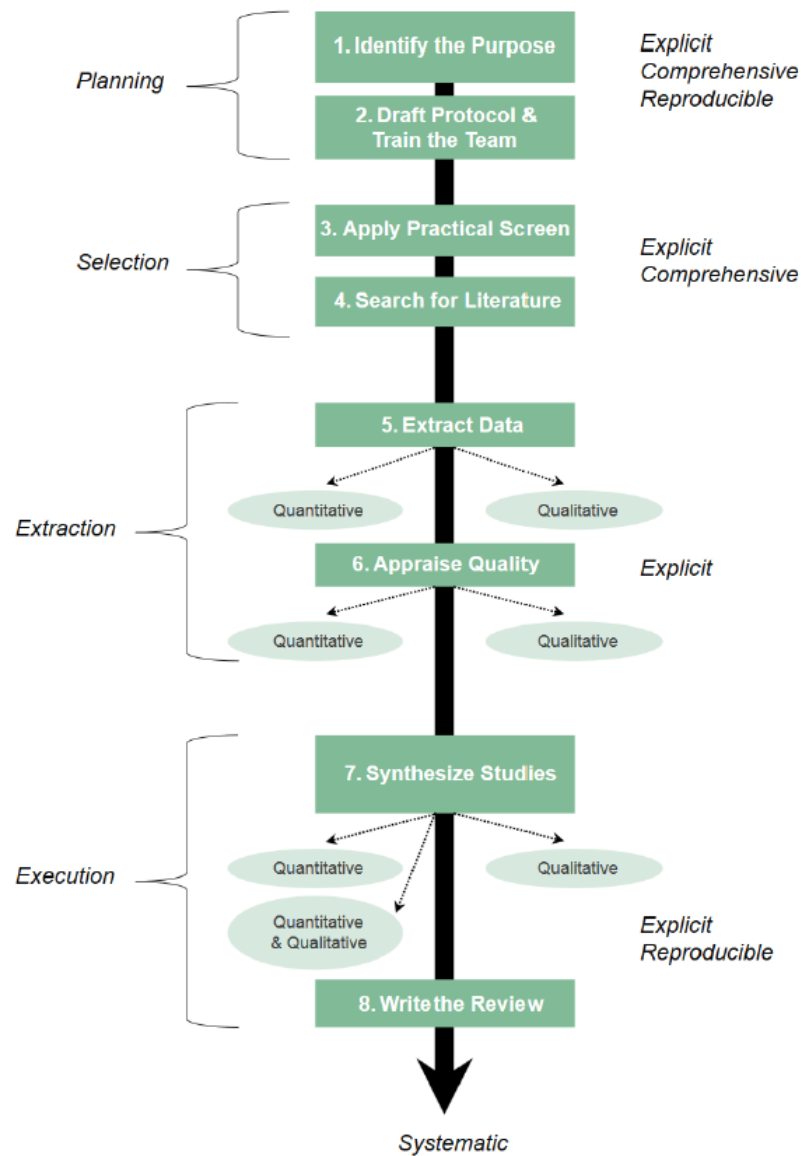


Figure 3-9 A systematic guide to literature review development (Okoli, 2015)

The four phases depicted above contain eight steps necessary when conducting an SLR. These phases are planning, selection, extraction and execution (Okoli, 2015).

3.2.6 Research Tools

Table 3-8 illustrates the research tools used in the study for data collection to achieve the research purpose.

Table 3-8 Research tools used for data collection adapted from Harpur (2018)

Research Tool	Purpose	Usage
<i>ATLAS.ti V8</i> http://atlasti.com/	A qualitative data analysis tool used for coding and linking of quotations to create networks.	Used for analyzing literature sources.
Google Drive https://www.google.com/drive/	A file storage that was developed by Google.	Allows users to store and backup files in Google servers.
<i>Mendeley</i> https://www.mendeley.com/	A desktop software used for arranging research articles.	Helps to import bibliographic material from Google Scholar.
Microsoft Office Suite: Word, PowerPoint and Excel https://www.office.com/	Programs useful for creating presentations and templates for the research.	Support for diagram and writing report for thesis.

For data analysis, this study used a thematic analysis, because it followed an interpretive approach. Thematic analysis is used to analyze categorizations and display themes that are connected to data. It explains data in great detail, while dealing with various subjects through interpretations (Alhojailan, 2012). It provides understanding and description of answers through discovering patterns and creating themes. Themes come from the secondary data through an inductive approach.

The six phases of thematic analysis directed the data analysis (Braun & Clarke, 2006):

- **Step 1:** Familiarizing yourself with data – understanding data and taking down preliminary ideas.
- **Step 2:** Developing preliminary codes – coding exciting points of the data and combining data applicable to each code.
- **Step 3:** Looking for themes – combining codes and collecting data applicable to each possible theme.
- **Step 4:** Revising themes – checking if the themes work concerning the coded extracts (Level 1) and the whole data set (Level 2).
- **Step 5:** Describing and naming themes – continuing refining and analyzing of each theme and developing clear meanings and names for each theme.
- **Step 6:** Generating the report – selection of clear, compelling examples of extract, final analysis of selected extracts, relating back to the analysis of the research question and literature, producing a scholarly report of the analysis.

The systemic-literature-review method enabled the research to collect the relevant articles and to store a final list of articles in *ATLAS.ti.V8*. In the next section, Chapter 4, the researcher analyzed the data and extracted the findings from the relevant sources.

3.3 Summary

This chapter comprised two parts, research design and the method used to collect data, which is a systematic literature review. The first part, research design contained the research philosophy and paradigm, research approach, research strategy, methodological choice and research time horizon. The second part, systematic literature review method encapsulated a comparison of a traditional and systematic literature review method, guidelines from the experts for an SLR, SLR as a four-phase strategy, quality assessment of the study, data collection methods in relation to other peoples' methods and SLR and the research tools.

4 Chapter 4: Data Analysis

The focus of this chapter is on analyzing data gathered from studies through an SLR. The researcher followed the stages of qualitative analysis suggested by Miles and Huberman (1994). Informed by Friese (2014) the study outlined categories of data by colouring all tags that belonging to a category and adding the tags to a code group. It covers the data collection process from the articles and the use of a thematic analysis approach.

4.1 Introduction

This chapter is a continuation of Chapter 3, discussing the research design and methodology. Since this study aims to explore the status of data governance in healthcare information systems, an SLR was used to collect and analyze the literature on data governance in healthcare information systems. This study viewed a sample of 46 studies from the studies on data governance in healthcare information systems that were the most suitable studies for the objective of this research.

The study employed the *ATLAS.ti V8* analysis tool to manage, extract, compare and explore the data. The researcher imported all articles that were eligible for the systematic literature review into *ATLAS.ti V8*. The researcher grouped the articles according to the six themes that emerged from the literature review. From the six themes, three themes emerged from the data governance contingency model: Performance strategy, Competitive strategy and Process harmonization. The other three themes emerged from the data: Data governance, Data governance contingency model, and Healthcare information systems.

The researcher created a codebook of items derived from the six themes. The study investigated issues and aspects concerning the three DG contingency aspects, and it generated questions that would acquire more information and understand the current state of the healthcare from the collected data. The section below focusses on the six categories of data, themes that emerged and items associated for each theme Adoption – Healthcare information systems, Dynamics – Performance strategy, Effectiveness – Data governance, Harmonization – Process harmonization, Performance – DG contingency model and Transformation – Competitive advantage.

4.2 A. Transformation – Competitive advantage

Transformation encapsulates the following items: Digital transformation, Healthcare innovation, IT strategy and IT structure, Organizational competence and Technology challenges.

4.2.1 Digital transformation

Nowadays, the amount of data in digitisation is amazing; therefore, it is the backbone of the organizations in this digital era. The digital change in healthcare, through the establishment of a rich healthcare data foundation and integration of technologies like artificial intelligence (AI), internet of things (IoT) and machine learning (ML), is a key component in tackling these challenges (Gopal, Suter-Crazzolara, Toldo & Eberhardt, 2019), as mentioned in Section 4.2.1. Although healthcare organizations have started digital transformation projects, few of them have reached digital maturity.

4.2.2 Healthcare innovation

Innovation is field that is studied universally and it is important for every organization that desires to maintain and achieve competitive advantage (Moreira, Gherman & Sousa, 2017). The researcher added that healthcare organizations are facing a rising need for innovation to give new treatments to patients and to become competitive. Gujral, Shivarama and Mariappan(2019) argue that the rise of the new technologies like big data, AI, and machine learning, is an aid to achieve healthcare goals for competitive advantage. The utilization of big data and informatics improves healthcare, as informatics functions as the link between technology and big data. Furthermore, the role of Artificial Intelligence is to transform changes in healthcare.

Gujral et al.(2019) state that the primary goals of health informatics include the availability of applications, while Artificial Intelligence supports the development and use of knowledge in healthcare. The author adds that little is recognized about the nature of innovativeness in healthcare organizations concerning performance.

Moreira, Gherman and Sousa (2017) mention the innovation categories:

- Service/Product innovation;
- Process innovation;
- Organizational innovation; and
- Marketing innovation

The researchers highlighted that there is a correlation between service innovation and organizational innovation. Furthermore, the researcher added that process and service innovations influence operational performance.

4.2.3 IT strategy and IT structure

There are two groups of Information technology (IT), namely, Information Technology strategy and Information Technology structure. IT strategy pertains to information processing needed by organizations, which has been explored by several researchers, whereas IT structure pertains to the ability of an organization to process information (Saeidi et al., 2019). IT strategy results in a sustainable competitive advantage. A well designed IT strategy and IT structure through enhanced strategic use of IT, IT environmental scanning and Proper IT structure and IT strategy, would lead to strengthen the enterprise risk management (ERM) function. Furthermore, IT strategy and IT structure have a direct effect on the competitive advantage.

4.2.4 Organizational competence

Organizations need to move from and enhance traditional ways to new ways, in order to improve competitive advantage. Wetering and Versendaal (2019) point out that exchanging data and health information will improve cost-effectiveness, efficiency quality and safety of healthcare practices. Saeidi, Saeidi, Sofian, Saeidi, Nilashi, and Mardani (2018) highlight that ERM indicates a positive influence on competitive advantage in an organization. By maintaining a proper ERM, organizations will be able to determine the risks and have a better chance to identify and manage the risks. It is vital for the organization to address and acknowledge the risks they face, so that they could be prepared at all times and be ahead of their competitors. By identifying the risks in time, the organization can quickly adapt to the rapidly changing environment.

Furthermore, healthcare organizations will experiment and take on more technologies, namely, AI, advanced analytics, big data, IoT and ML (Gopal et al., 2019).

4.2.5 Technology challenges

Today organizations are facing a number of challenges. Globally, healthcare providers are faced with the challenge of enhancing patient outcomes whereas maintaining costs (Gopal et al., 2019). What drives these challenges is the demand for technological advancements and the demand for chronic disease management of the aging population. The author added that in healthcare, a bigger challenge than the volume of data is the variety of data. Saeidi et al. (2019) state that to enhance the competitive advantage is the biggest challenge in healthcare. Healthcare data remains highly siloed, because of these challenges and the largely untapped value.

The digital change in healthcare, through the integration of technologies like AI, ML, IoT and the formation of a rich healthcare data foundation is known as an important component to tackle these challenges (Gopal et al., 2019). Organizations are advised to use enterprise risk management (ERM) as an organizational control device to cope with the challenges and uncertainties in the environment, arising from changes, deregulation, globalisation, market regulation and quick technological advancement (Saeidi et al., 2019). Figure 4-1 illustrates the network diagram for Category A: Transformation, theme, items and the authors that contributed to each item. The full list is in Appendix D.1- D.6.

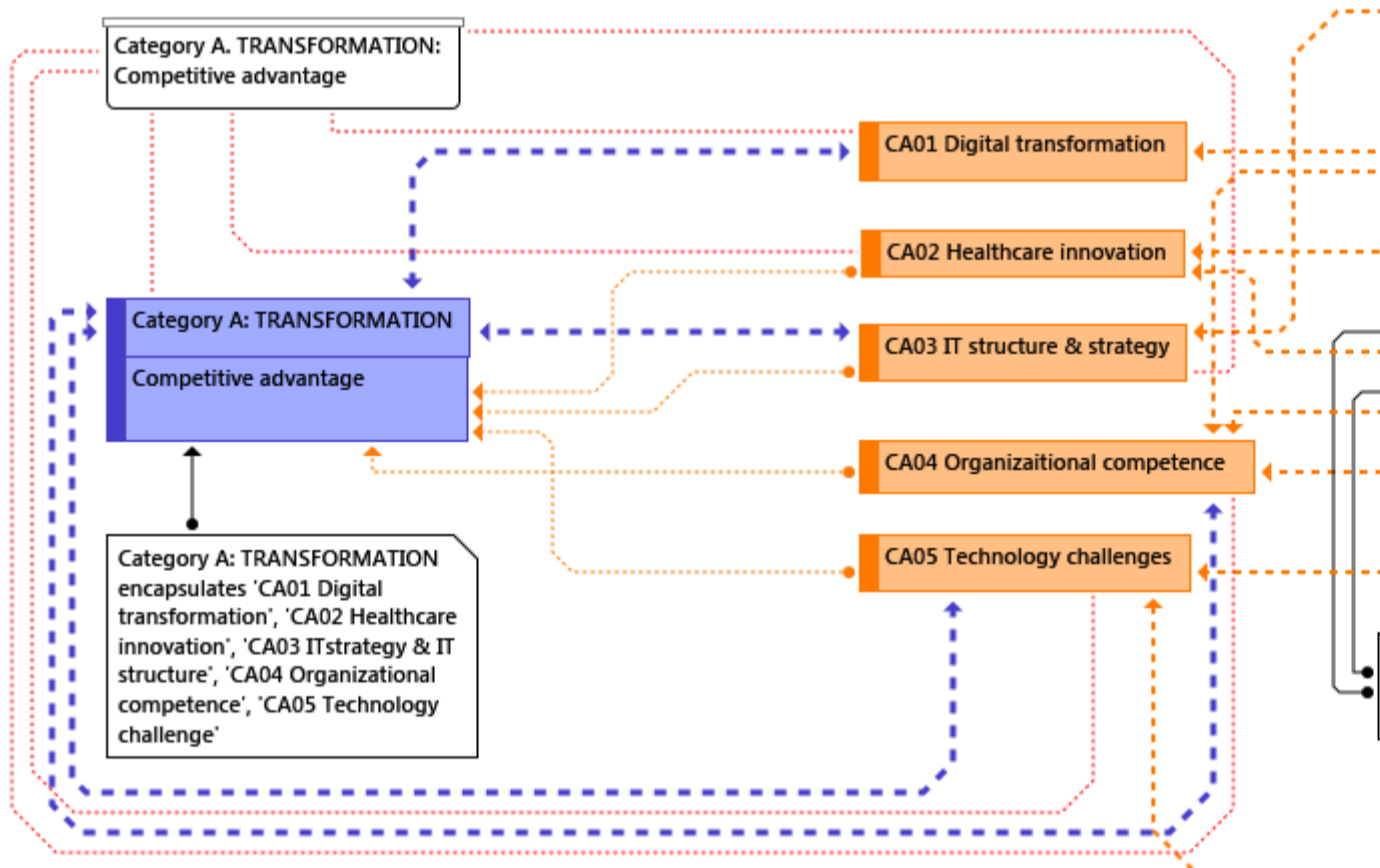


Figure 4-1 Network diagram for Category A: Transformation, themes, items and...

4.3 B. Effectiveness - Data governance

The following are the items that emerged under data governance: Big data, Data governance, Healthcare challenges, and Internet of things (IoT).

4.3.1 Big data

Today the rise of data is becoming a matter of concern in the health industry, including big data. Big data is characterized by its variety, velocity and veracity (Yang, Dehmer, Yli-Harja & Emmert-Streib, 2020). Janssen et al. (2020) argue that the emergent of big data, Open and Linked Data (BOLD), allows Big Data Algorithmic Systems (BDAS) that are usually based on Artificial Intelligence (AI), neural networks and machine learning (ML). Yang et al. (2020) point that AI provides the possibility to uncover important information that is hidden in huge amounts of complex data. The authors added that EHRs being a source of big data, supply a multitude of health-associated clinical information about patients. Although big data is proposed as a solution to issues, DG is a promising approach to govern data which is an asset in an organization (Otto, 2011a ; Otto, 2011b). However, the value of data is threatened by loss of integrity (Solomonides, 2019).

4.3.2 Healthcare challenges

Healthcare professionals usually strive to facilitate smooth transfer of patients together with the necessary information about them (Fossum, Fossum, Hanseth & Sanner, 2019). Janssen et al. (2020) indicate that healthcare providers depend on the data which is not just big, open and linked, but also dynamic, diverse and running at high speeds in real time. The researcher added that to cope with such data is challenging. Furthermore, organizations are progressively developing advanced DG capabilities to overcome such challenges.

4.3.3 Improved data governance

As the healthcare is evolving, the adoption of new technologies need to be a thorough consideration, which includes the deployment of DG for them to improve. DG is a rising topic in the information systems field (Alhassan et al., 2016). With a suitable DG, businesses can make intuitive decisions by putting context to the data, and by changing the information into knowledge and intelligence (Dasgupta et al., 2019).

Recently, the volume of data used within the organizations has significantly increased, playing a vital role in business operations (Alhassan et al., 2016). Otto (2011a) and Otto (2011b) point out that IS

practitioners and researchers consider DG as a promising approach for organizations to maintain and improve their data quality. The data governance will add value and present an opportunity to the organization when aligned with the goals of the organization as a whole. Milne and Brayne (2020) argue that new approaches to governance can enhance data access. Furthermore, the research in DG domain is growing regarding information systems, as there is a necessity to research this field as more organizations value data as a valuable asset.

A review of the DG shows a lack of research that explicitly studies activities for governing data (Alhassan et al., 2016). Al-Ruithe, Benkhelifa and Hamed (2016) highlight that due to the rise of cloud computing and the increased adoption, DG is an increased desire among researchers, however, the topic is still under researched. Organizations that are future thinkers, believe that the implementation of effective data governance is the only method that could solve the data issue (Al-ruithe, Benkhelifa & Hameed, 2018). The area of DG is still under researched and underdeveloped, despite its recognized importance. This has resulted in a necessity to improve research in DG, in order to benefit its practice. With a suitable DG, businesses can generate wise decisions by placing context to data; converting the information into knowledge and intelligence.

4.3.4 Internet of Things

Nowadays, Internet of Things (IoT) is a growing concept in healthcare (Dasgupta et al., 2019). Information or data governance is an important component of IoT that enables digital information systems in an organization. This rise of using IoT brings about new devices and applications being manufactured. The internet makes information easily available for the provider via their websites.

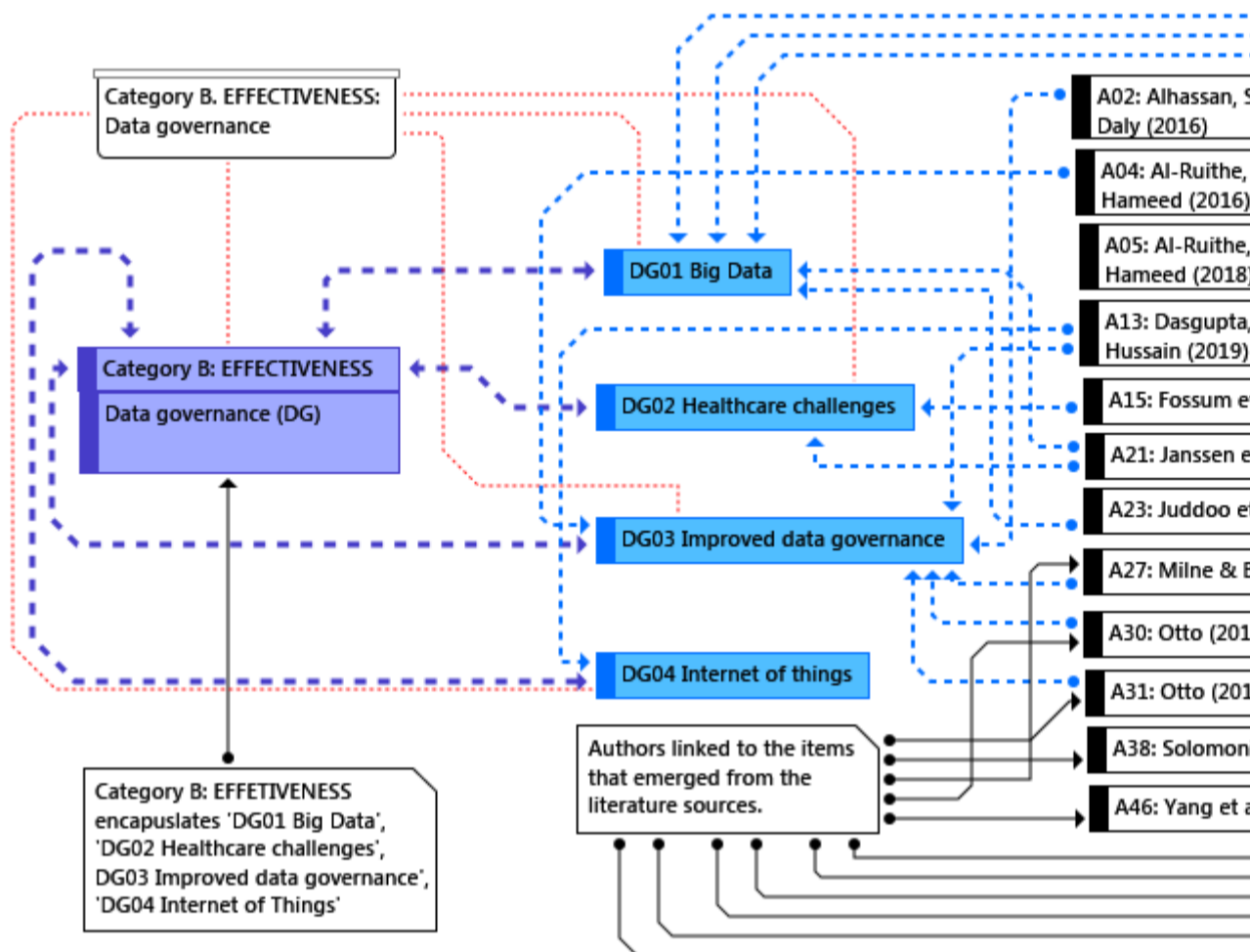


Figure 4-2 Network diagram for Category A: Effectiveness, themes, items and authors

Figure 4-2 Network diagram for Category A: Effectiveness, themes, items and authors

4.4 C. Performance - DG contingency model

The items of data governance contingency model encapsulate: The Contingency and Organizational fit, Data governance, Organizational innovativeness.

4.4.1 Contingency and organizational fit

A contingency is a future circumstance or event, which is possible but unpredictable. Pereira and da Silva (2012) state that organizations need to take into consideration the following contingency factors:

- Strategy;
- Organizational structure and culture;
- Organizational Size;
- Organizational Maturity;
- Trust and Ethical;
- Industry; and
- Regional differences.

Organizations that are high in contingency fit, are low in risk to the deviation from the formation of organization performance, but organizations with the best institutional fit, will hardly decrease their operation (Volberda., van der Weerd, Verwaal, Stienstra & Stienstra, 2012). Institutional fit and contingency bring interdependent and complementary explanations of organization performance.

Organizations that have a 'quasi fit' rather than a perfect contingency fit or optimal institutional fit, will have a better performance with improvements in contingency and/or institutional fit (Volberda et al., 2012). On the other hand, organizations with high contingency fit are barely at risk to deviation from institutional fit in the formation of firm performance. Furthermore, organizations with the best institutional fit will hardly decrease their performance when they attempt to a contingency fit. Maturity, structure, culture and industry, are recognized as the most appropriate contingency factors (Pereira & Silva, 2012).

4.4.2 Data governance (DG)

Today, organizations consider data as a new form of fuel. Data governance is required to carefully govern data and the success of the organization. Furthermore, how to change a suitable DG dealing

with the concerns, has been ignored and therefore, there is scant research on this topic (Lee et al., 2018).

4.4.3 Organizational innovativeness

Organizations require greater levels of innovativeness to be successful (Boso, Story, Cadogan, Micevski & Kadić-Maglajlić, 2013). There is a possibility that greater innovativeness leads to superior organizational performance. Innovativeness refers to a positive attribute of organizations, however; greater innovativeness might not be suitable for all organizations.

Figure 4-3 shows the network diagram for Category E: Performance, theme, items and the authors that contributed to each item.

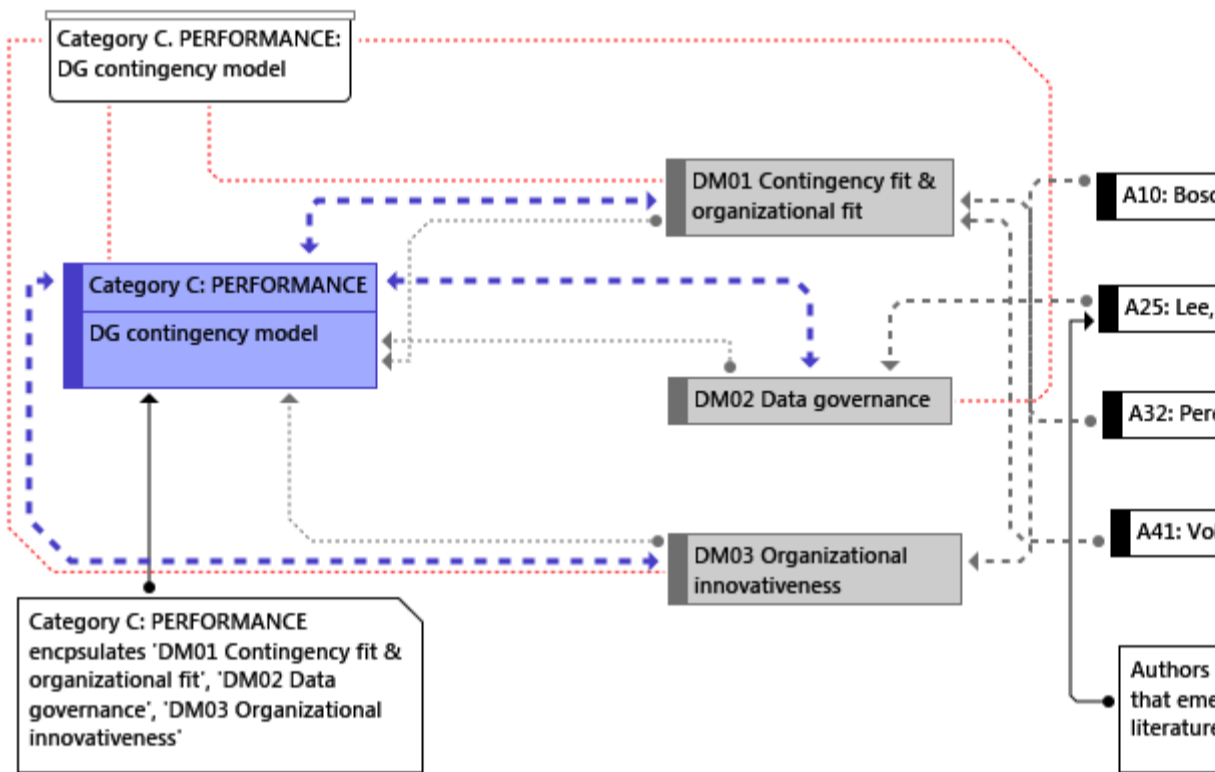


Figure 4-3 Network diagram for Category E: Performance, theme, items and authors

4.5 D. Adoption – Healthcare information systems (HIS)

The items that emerged under healthcare information systems are Digitalization, Healthcare, HIS Adoption, HIS Challenges and Implementation.

4.5.1 Digitalization

Digitalization is the collective concept of differing and interrelated phenomena, which are rearranging traditional market conditions and causing a turbulent and competitive environment (Bomark, 2019). Presti, Testa, Marino and Singer.(2019). Rocha (2011) inform that the emergence of new technologies has developed unexpected and interesting possibilities in healthcare. Researchers and practitioners highlighted the benefits related to technological development in the healthcare field (Jędrzejczyk & Zarzeczna-baran, 2019). Furthermore, various aspects of daily digital technologies co-exist sometimes as conflicting perspectives sometimes in parallel (Hult, Hansson, Svensson & Gellerstedt, 2019).

Bomark (2019) pinpoints that digitization contributed to digital technology adoption. The researcher adds that the expected solution of digitalization is projected to decrease costs and increase efficiency. Hult et al. (2019) point out that digitalization transforms not only healthcare and the work practices, but also the way physicians interact and learn at work. Although the adoption of digitalization has been initiated in healthcare, IS researchers has a limit to findings of digital transformation in healthcare.

4.5.2 Healthcare

Healthcare information systems are divided into two categories: clinical decision support and electronic medical support (Vaganova et al., 2017).The healthcare industry is producing large amounts of patient data (Islam, Hasan, Wang, Germack & Noor-E-Alam, 2018). The proper utilization and collection of electronic health information (EHI) of a patient is the foundation of present healthcare, where electronic medical records (EMRs) function as the transporter (Yang et al., 2015). Electronic healthcare record (EHR) data from various patients are now gathered across different healthcare organizations (Xiao, Choi & Sun, 2018). The growing number of recent publications corroborates the importance of healthcare analytics to build enhanced healthcare systems globally.

4.5.3 HIS adoption

The nature of healthcare information systems, which is influenced by the contingency factors, has transformed over the years (Almunawar & Anshari, 2012). The adoption of EHRs is recognized as a goal of healthcare systems to advance the efficiency of organizations (Carvalho, Rocha & Abreu, 2016). However, healthcare professionals face challenges that affect health information technologies (HIT) adoption and acceptance (Mukono & Tokosi, 2019).

4.5.4 HIS challenges

The deployment of healthcare information systems (HIS) or HITs remains a challenge (Mukono & Tokosi, 2019). Vaganova et al. (2017) reflect that professionals in healthcare organizations face challenges during the implementation of a HIS. These challenges are related to human factors that need suitable management interventions. The authors further highlight that the challenges include HIT customizations, HIT functionality, user-related and a shortage of suitable IT support. Moreover, social sustainability by means of digital engagement platforms is also a challenging topic in healthcare systems (Presti et al., 2019). Furthermore, Cabitza and Locoro (2016) pinpoint that Human Data Interaction (HDI) concerns the way humans generate and utilize data through the interactive systems that can assist to collect and generate data.

4.5.5 Implementation

The deployment of HIT is still a challenge in healthcare organizations (Mukono & Tokosi, 2019). The researchers also point out that healthcare professionals come cross various issues during the implementation of HIT. Lintern and Motavalli (2018) inform that the deployment of automation technologies would help healthcare professionals to enhance the effectiveness and efficiency of healthcare services. Furthermore, the implementation of HITs in healthcare, has assisted the healthcare professionals (Almunawar & Anshari, 2012).

Figure 4-4 illustrates a network diagram for Category A: Transformation, theme and the items that emerged, with the relevant authors that contributed to each item.

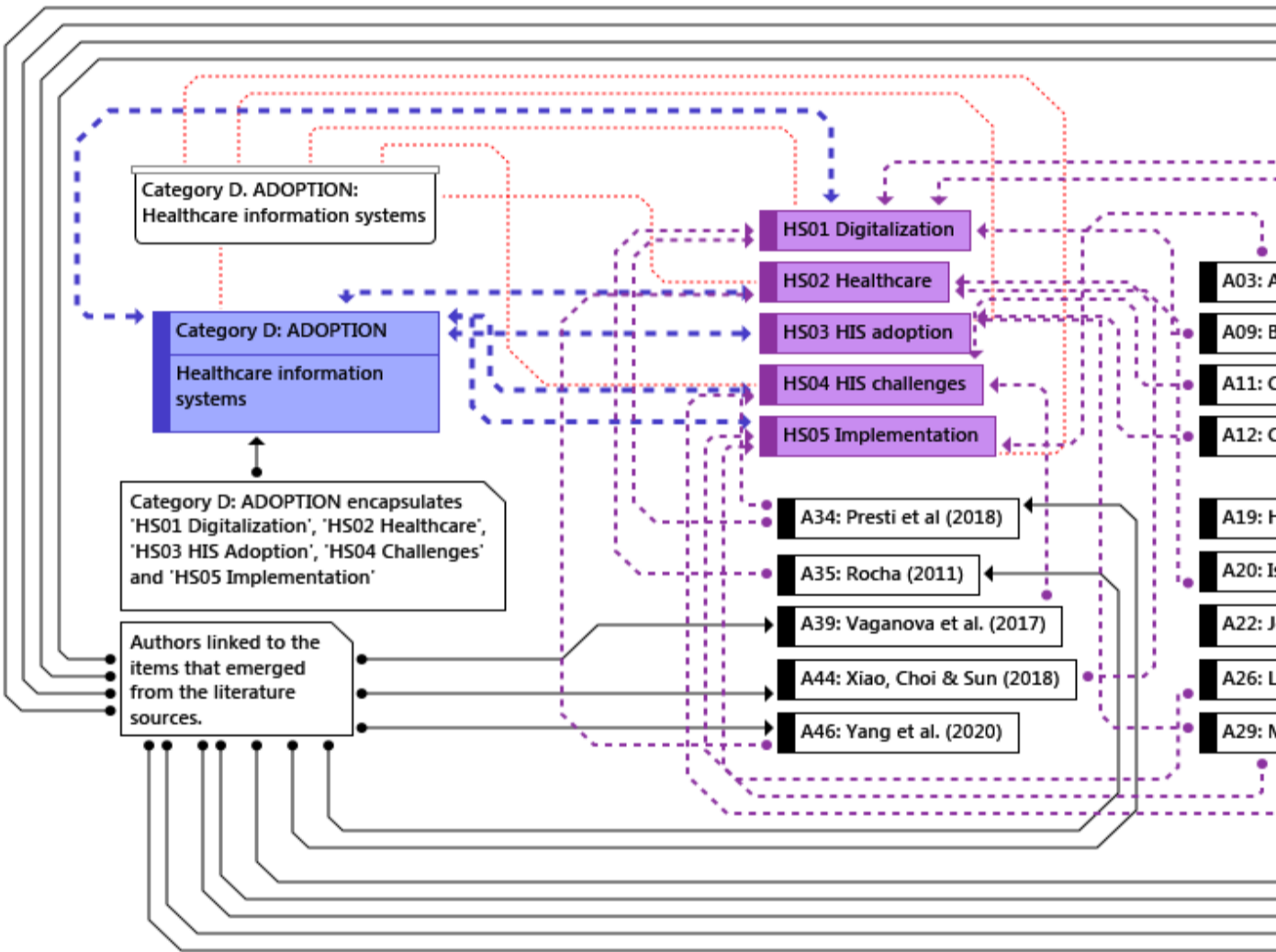


Figure 4-4 Network diagram for Category A: Transformation, theme, items and authors

Figure 4-4 is an example of a relationship between the categories, sub-categories, items and authors. The full list is in Appendix E.1– E.6.

4.6 E. Harmonization – Process harmonization

The sub-items that process harmonization encapsulate: Data challenges, Data harmonization, EHR analysis, and Healthcare transformation.

4.6.1 Data challenges

The shortage of consistent data quality (DQ) definitions, makes it difficult to compare DQ outcomes across multiple data-sharing partners in healthcare (Kahn et al., 2016). Fragmentation in healthcare in the data space is the main challenge for sharing, linking and harmonizing data (Geneviève, Martani, Mallet, Wangmo & Elger, 2019).

4.6.2 Data harmonization

Data harmonization is a key intervention to give strength to the functioning of health systems (Schmidt, Colvin, Hohlfeld & Leon, 2018). It enhances the accessibility, production and usability of standard health information for service management and clinical decision-making.

The development of methods, harmonized data quality (DQ) assessment decision-making terms, and reporting practices can create a mutual understanding (Kahn et al., 2016). Data harmonization is a vital intervention to strengthen a health system's functioning (Schmidt et al., 2018). It has the potential to improve accessibility, production and utilization of routine health information for clinical and service management decision-making.

4.6.3 EHR analysis

Electronic health record (EHR) analysis can support a better understanding to enhance the quality of the healthcare systems (Zhong et al., 2018). However, the low data quality issues of errors and inconsistency-missing values in the data set critically delay the developing of robust machine-training models for data analysis in healthcare.

4.6.4 Healthcare transformation

The digital era caused larger volumes of electronically available data to increase the availability and reuse of EHR data (Kahn et al., 2016). These data have great potential for research and significant improvement in clinical practice. Creating validated data add standardized methodologies for reporting and assessing DQ that is important. The ongoing transformation in healthcare results in systems medicine and personalized care (Blobel, 2017).

Figure 4-5 illustrates a network diagram for Category D: Harmonization, theme, items and authors th

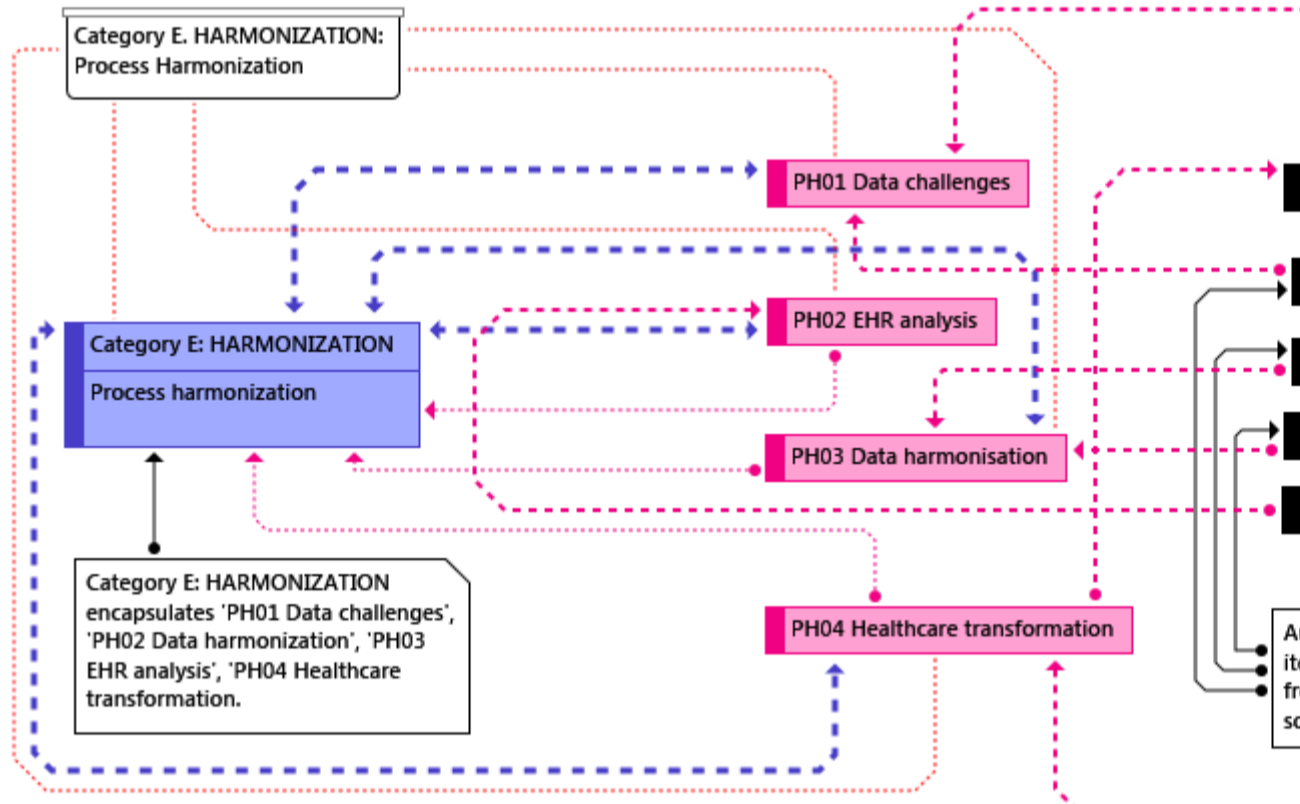


Figure 4-5 Network diagram for Category D: Harmonization, theme, items and

4.7 F. Dynamics - Performance strategy

The items that emerged under adoption include Digital healthcare, EHR Adoption, Improved healthcare services, Organizational performance, and Professional development.

4.7.1 Digital healthcare

The digitization of medical records unlocks many chances for medical practitioners, specifically regarding automated reminders, to avoid medication errors, search capabilities to quickly retrieve and process data for patients, to improve transparency by ensuring both complete and clear records of the patients and improved information sharing across the medical team (Atasoy, Greenwood & Mccullough, 2019). The transition to the digital era improves the quick means to retrieve and process patient data and prevent medication errors through automated reminders. Artificial intelligence (AI) has the ability to influence almost all aspects of healthcare.

4.7.2 EHR adoption

In the past decade the adoption of an electronic health record (EHR) has happened worldwide (Atasoy et al., 2019). The global acceptance of EHRs generate a structure for gathering and analyzing health data. Healthcare organizations and professionals must be ready to adopt these changes (Wiljer & Hakim, 2019). Although the EHR usage has positive results in healthcare, the rate of adoption of these technologies is low (Ajami & Bagheri-Tadi, 2013). Compared to the emergence of new technologies, the adoption of these new technologies in healthcare is far behind. Researchers also have examined the broader effects of electronic medical records adoption. Furthermore, healthcare organizations and professionals must be ready to adopt and advance to these new technologies.

4.7.3 Improved healthcare services

EHR may improve the quality of data, clinical outcomes and patient safety through different mechanisms, the management of information, and may reduce the fragmentation across different providers and care settings (Atasoy et al., 2019). EHR helps healthcare professionals to capture, keep and visualize patient records. It is a means to develop organized and legible recordings and to retrieve medical information (Ajami & Bagheri-Tadi, 2013).

4.7.4 Organizational performance

Managerial capabilities are positively related to the performance of the organization (Vainieri, Ferre', Giorgio & Nuti, 2019). "Information technology (IT) matters to business success because it directly affects the mechanisms through which they create and capture value to earn a profit" (Drnevich & Croson, 2013). The adoption of technology in healthcare improved the accessibility of healthcare information through the electronic healthcare records (Alsharif, Benslimane, Khalifa & Price, 2018).

4.7.5 Professional development

Universal adoption of healthcare can be accelerated through training medical students to depend on electronic medical records (EHRs) and their decision support tools (Ajami & Bagheri-Tadi, 2013). The author added that to have a positive impact on the safety of patients, healthcare professionals need to be able to utilize the EHR systems effectively after the implementation. Healthcare organizations and other organizations must be ready to change and evolve to adopt these new technologies (Wiljer & Hakim, 2019). These technologies include deep learning, expert systems, natural language processing and robotic process automation. Furthermore, the elementary understanding of emergent AI technologies will be necessary for all healthcare practitioners.

4.8 Summary

Chapter 4 constituted data analysis by introducing the chapter and focused on the categories of information and the themes under each category. Furthermore, the chapter explained the six categories of information from the analyzed data as follows:

- Category 1: 'Transformation – Competitive Advantage', which encapsulated five themes, namely, 'Digital transformation', 'Healthcare innovation', 'IT strategy and IT structure', 'Organizational competence' and 'Technology challenges';.
- Category 2: 'Effectiveness – Data governance', which encapsulated 'Big data', 'Healthcare challenges', 'Improved data governance' and 'Internet of things';
- Category 3: Performance – DG contingency model, which contained 'Contingency and Organizational fit', 'Data governance (DG)' and 'Organizational innovativeness';
- Category 4: 'Adoption – Healthcare information systems (HIS)', which encapsulated 'Digitisation', 'Healthcare', 'HIS adoption', 'HIS challenges' and 'Implementation';
- Category 5: 'Harmonization – Process harmonisation', which contained 'Data challenges', 'Data harmonisation' and 'EHR analysis'; and

- Category 6: 'Dynamics – Performance strategy which included 'Digital healthcare', 'EHR adoption', 'Improved healthcare services', 'Organizational performance' and 'Professional development'.

Figure 4-6 on the next page illustrates a network diagram for Category F: Dynamics, theme, items and the authors that contributed to each item. However, subsequently Figure 4-7 proposes the conceptual model of categories and items of the study and it summarizes and concretizes outcomes of Chapter 4 Data Analysis.

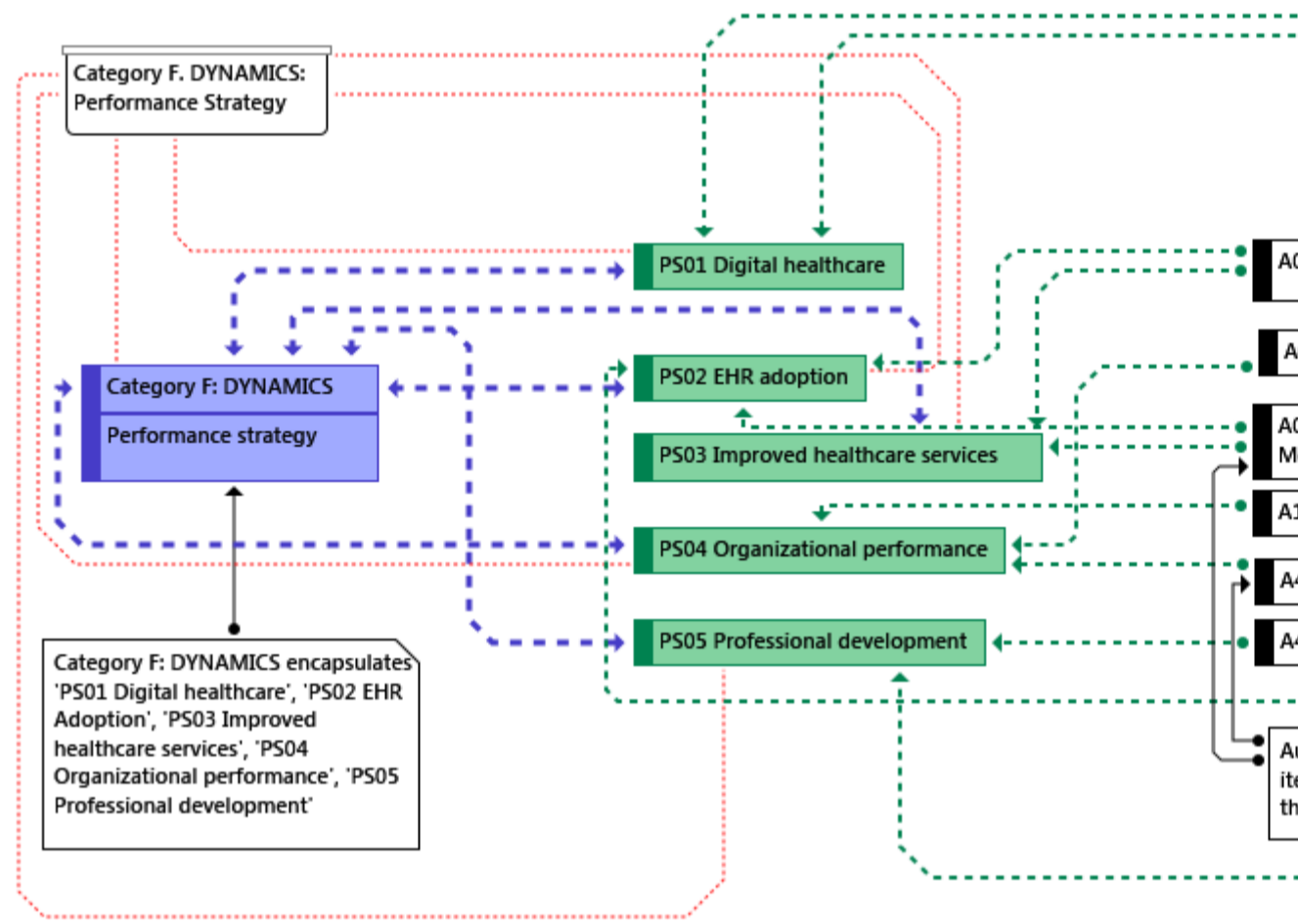


Figure 4-6 Network diagram for Category B: Dynamics, theme, items and a

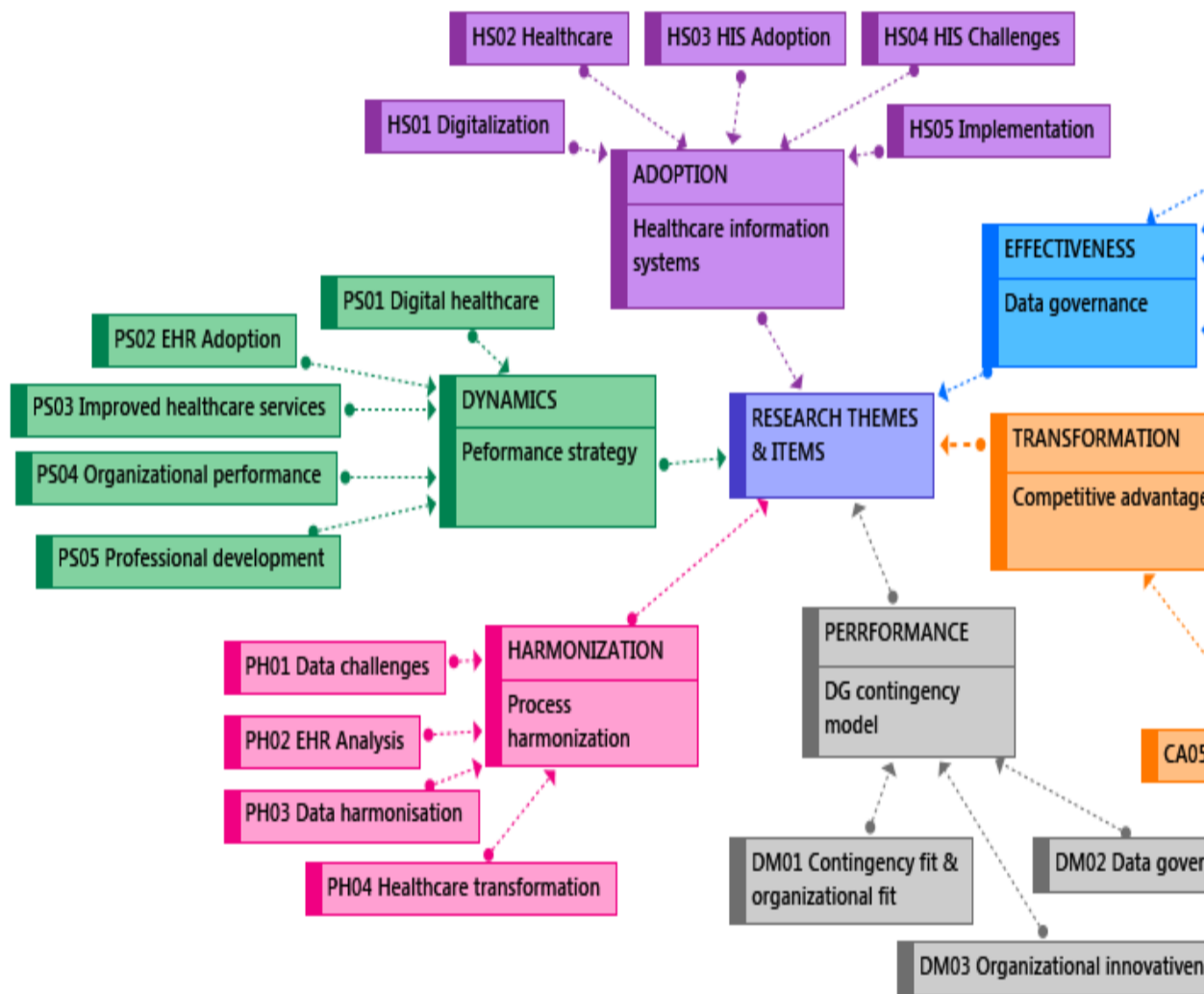


Figure 4-7 Conceptual model of categories and items

5 Chapter 5 Conclusions and Recommendations

This chapter concludes this study by revisiting the aim, rationale and the research questions (Section 5.1), summarizing the main points drawn from this study (Section 5.2). It then focuses on the research themes and findings (Section 5.3), followed by the limitations of the study (Section 5.4), delimitations of the study (Section 5.5), recommendations (Section 5.6) and the implications of the findings (Section 5.7). Furthermore, it discusses the potential direction of future research.

Since this study aimed to explore data governance relative to challenges associated with healthcare information systems by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review, Table 5-1 illustrates a set of guidelines, which inform the improvement to healthcare information systems.

Table 5-1 Guidelines which inform the improvement to performance of healthcare information systems

	Competitive Advantage					Data Governance (DG)										Data governance contingency model				Healthcare Information Systems										Pr										
	Gopal et al., 2019	Gujral et al., 2019	Moreira et al., 2017	Soeidi et al., 2019	Weering & Varsendaal, 2019	Ahassan et al., 2016	Al-Ruihe et al., 2016	Al-Ruihe et al., 2018	Dasgupta et al., 2019	Fossum et al., 2019	Janassen et al., 2020	Juddoo et al., 2018	Milne & Brayne, 2020	Otto, 2011	Otto, 2011b	Solomonides, 2019	Yang et al., 2020	Boso, 2015	Lee et al., 2018	Pereira & de Silva, 2012	Volberda et al., 2012	Almunawar & Anshari, 2012	Bomark, 2019	Cabliza, 2016	Carvalho, 2016	Hult, 2019	Islam, 2018	Jędrzejczyk & Zarzecka-Baran, 2019	Lintem, 2018		Mukono & Tokosi, 2019	Presti, 2019	Rocha, 2011	Veganora, 2017	Xiao, 2018	Yang, 2015	Blobel, 2017			
CA01 Digital transformation	■	■	■					■				■					■					■															■			
CA02 Healthcare innovation		■	■							■									■																					
CA03 IT structure & strategy				■	■																																			
CA04 Organizational competence	■			■						■									■																					
CA05 Technology challenges	■			■	■				■	■	■						■										■											■		
DG01 Big data	■			■						■	■																■											■		
DG02 Healthcare challenges										■																														
DG03 Improved data governance						■	■	■	■				■	■	■	■	■			■							■												■	
DG04 Internet of Things	■							■																																
DM01 Contingency fit & Organizational fit													■	■				■	■	■																	■			
DM02 Data governance model		■				■	■	■		■			■			■			■																					
DM03 Organizational innovativeness																	■		■																					
HS01 Digitalization	■	■		■	■				■										■						■															
HS02 Healthcare	■		■																■				■	■			■	■										■		
HS03 HIS adoption										■									■			■																		
HS04 HIS challenges										■									■			■																		
HS05 Implementation										■									■			■																		
PH01 Data challenges	■											■																												
PH02 EHR analysis																																								
PH03 Data harmonization												■																												
PH04 Healthcare transformation	■			■					■										■								■													
PS01 Digital healthcare	■							■	■	■																	■													
PS02 EHR adoption																																								
PS03 Improved healthcare services								■											■																					
PS04 Organizational performance			■															■		■																				
PS05 Professional development																										■														

5.1 Revisiting the aim, rationale and the research question

This study aims to explore data governance relative to challenges associated with healthcare information systems by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review. The rationale of the study includes the consolidation of pertinent and recent knowledge, producing a set of guidelines, which informs the improvement of performance of healthcare information systems (Table 5-1). The researcher consolidated findings of other researchers and additionally contributed three themes that culminated in six themes. For convenience, the research questions outlined initially as Table 1-3, are repeated below as Table 5-2, revisiting the relationship between proposed research questions and the objectives of this study. This study posed two main research questions (MRQ) and six secondary questions (SQ1, SQ2, SQ3, SQ4, SQ5 and SQ6) to address the scope of the study. The secondary questions serve to answer the main research question.

Table 5-2 Relationship between research questions and research objectives

Research questions	Associated research objectives
MRQ1: How does healthcare information systems influence the possibility of data governance success?	
SQ1: What are the features of HIS?	SO1: To understand the features of HIS
SQ2: What is meant by DG success?	SO2: To acquire information about DG success
SQ3: What influences are noted on DG?	SO3: To understand influence noted on DG
MRQ2: What are the components of a data governance contingency model?	
SQ4: What are the performance strategies that have been explored for improved healthcare?	SO4: To explore the data challenges that affect the healthcare performance strategy
SQ5: What competitive strategies have contributed to data governance success?	SO5: To gain information about the competitive strategies that have contributed to data governance success
SQ6: What process harmonization is currently in place to manage data?	SO6: To identify process harmonization that is currently in place to manage data

Note: MRQ = Main research question; SQ = Secondary question; SO = Secondary objective

5.2 Summary of the main points: MRQ1

The results presented and discussed in this section are according to the main themes identified in the analysis (Chapter 4). The following three sections – Sections 5.2.1 to 5.2.3 – constitute the answering

of the first main research question (MRQ1): *How does healthcare information systems influence the possibility of data governance success?* The answer to this first main research question is achieved via sub questions. *SQ1: What are the features of HIS? SQ2: What is meant by DG success? And SQ3: What influences are noted on data governance?*

The evolution of a synthesized data governance model relates to *MRQ2: What are the components of a data governance contingency model?*

5.2.1 SQ1: What are the features of HIS?

A healthcare information system (HIS) forms a bridge between the information system and healthcare's business process to provide better healthcare services. Several features are unique to HIS but are needed for healthcare performance.

Healthcare automation through the implementation of HIS increased the speed. Speed is one of the constant features of HIS, which enables quick communication between different interlinked departments in healthcare. Easy and quick access to data is another feature of HIS. Healthcare is an industry that is producing big volumes of data for patient treatment plans (Islam et al., 2018), Electronic Medical Records (EMRs) allow the healthcare professionals to have quick and easy access to patient records.

Error free is another feature that arises from HIS, because there is minimum human intervention. HIS enables most of the healthcare processes to run on their own with only mandatory inputs that require human intervention. Thus, HIS ensures that there are minimum errors that result from the healthcare professionals' faults. Due to automated processes in healthcare, HIS produces a feature on reducing supervision. HIS brings forth accountability; healthcare professionals that are working on HIS systems need to put in their credentials (username and password) to login. The implementation of HIS in healthcare reduces costs compared to paper-based systems. The following factors increase the costs of paper-based systems; stationery, lack of storage space, document transportation and editing problems.

5.2.2 SQ2: What is meant by DG success?

Most organizations have realized that the solutions for data management are becoming expensive on their own. Many organizations have realized that the only method to fix the data problem is the

implementation of effective data governance (DG) (Al-ruithe et al., 2016). With the increased adoption and the rise of cloud computing, DG is gaining interest among specialists.

Organizations with successful data governance will enjoy the following:

- Better alignment with data regulations;
- An increase in operational efficiency;
- Revenue will increase;
- Decision-making will improve due to correct data; and
- More satisfaction from the customers.

5.2.3 SQ3: What influences are noted on DG?

The increased volume of data utilized in the healthcare organizations, has a big influence on data governance (DG). The rise of cloud computing, big data and the increased adoption influences DG. Electronic healthcare records (EHRs), a source of big data, provide a large amount of health-associated information about patients. Loss of data threatens the value of data in EHR. Healthcare organizations regard data as a fuel. Big data is noted as a promising solution to overcome the issues around DG. However, a promising way to govern data is DG, which will assist to govern the large amounts of data in EHR.

5.3 Summary of the main points: MRQ2

The second main research question (*MRQ2*) was: *What are the components of a data governance contingency model?* The answer for the MRQ2 is undertaken via the following three sub-questions: *What are the performance strategies that have been explored for improved healthcare? (SQ4) What competitive strategies have contributed to data governance success? (SQ5) What process harmonization is currently in place to manage data? (SQ6)*

These sub-questions are respectively addressed in Sections 5.3.1–5.3.3.

5.3.1 SQ4: What are the performance strategies that have been explored for improved healthcare?

The shortage of reliable data quality (DQ) definitions in healthcare makes it difficult to compare DQ outcomes through various data-sharing partners. Fragmentation in healthcare in the data space is a major issue for data linking, sharing and harmonizing. The worldwide adoption of EHRs develops a

way of collecting and analyzing data in healthcare. The implementation of EHR strategy assists healthcare practitioners to quickly capture, store and visualize patients' records. However, the rate of adopting these new technologies is low compared to the emergence of these new technologies.

5.3.2 SQ5: What competitive strategies have contributed to data governance success?

Healthcare organizations need to change from traditional ways and elevate to new ways in order to increase competitive advantage. Digital transformation in healthcare is the backbone of the healthcare organization in the digital era. The integration of new technologies like machine learning, artificial intelligence and Internet of Things, is the vital component to tackle the data challenges in healthcare to improve competitive advantage. There is a growing need for innovation in healthcare to provide new treatments to patients and to become competitive. Information technology strategy, which refers to processing the information required by healthcare organizations, leads to a sustainable competitive advantage. The combination of IT structure (which enables healthcare organizations to process information) and IT strategy provides a direct effect on the competitive advantage in healthcare. Enterprise risk management, which enables healthcare organizations to determine risks and to have a better chance to identify and manage the risks, shows a positive influence on competitive advantage.

5.3.3 SQ6: What process harmonization is currently in place to manage data?

Data harmonization is a process that intervenes to give strength to health systems functioning, by enhancing the accessibility, production and usability of health information. Harmonized data quality assessment methods, terms, and reporting practices can create mutual understanding.

The research themes and findings (Section 5.4 and Table 5-3) consolidate the findings of the entire study.

5.4 Research themes and findings

Table 5-3 serves to consolidate the preceding findings of this research project. It outlines six relevant themes that emerged:

- Competitive strategy – significant for organizations to exceed the achievement of competitors;
- Data governance – serves as an overall framework, providing evidence and assurance of data quality;
- Data governance contingency model – guides interdependence and independence of organizational units;
- Healthcare information systems – form the foundation of modern digital healthcare;
- Performance strategy – enhances communication between business and IT; and
- Process harmonisation – utilises and produces information for improved decision-making.

Table 5-3 Research themes and findings

Themes	Description	Findings	Source
Competitive strategy	Competitive advantage is the feature that identifies the organization to outdo its competitors.	The skills and competencies from various IT experts and businesses need synchronization. Although digital transformation has begun in many healthcare organizations, few of them have reached maturity. The improvement of technology would lead to greater competitive advantage. Internal sources were explored as being important for the success of organizations.	Gopal et al. (2019), Gujral et al. (2019), Moreira et al. (2017), Saeidi et al. (2019), Wetering & Versendaal (2019)

Themes	Description	Findings	Source
Data governance (DG)	DG is described as an organizational framework for allocating responsibilities and decision-related privileges that allow the management of data as an organizational asset.	Data governance assists organizations to ensure data quality and to maintain the value of data as an organizational asset. Data governance is the cornerstone of the trustworthy artificial intelligence. Successful data governance may answer certain challenges of cloud computing. The entire organization needs to align their goals to data governance. Clarity of data supply chain can be a possible goal of DG.	Alhassan et al. (2016), Al-Ruithe et al. (2016), Al-Ruithe et al. (2018), Dasgupta et al. (2019), Fossum et al. (2019), Janseen et al. (2020), Juddoo et al. (2018), Milne & Brayne (2020), Otto (2011a), Otto (2011b), Solomonides (2019), Yang et al. (2020)
Data Governance contingency model	A contingency is an upcoming event, which is potential but not easily predicted.	Institutional fit and contingency give complementary and interdependent explanations of organizational performance.	Boso et al. (2015), Lee et al. (2018), Pereira & da Silva (2012), Volberda et al. (2012)
Healthcare information systems	A healthcare information system serves as a bridge between information systems and the business processes in healthcare in order to bring better healthcare services (Almunawar & Anshari, 2012).	The proper collection and utilization of EHR is the foundation of the digital healthcare. EHR serves as the main driver of modern healthcare. The effect of technological, social and political factors changed the nature of the healthcare industry eventually. This change led organizations to seek organizational change through digital transformation.	Almunawar & Anshari (2012), Bomark (2019), Cabitza & Locoro (2016), Carvalho et al. (2016), Hult et al., (2019), Islam et al. (2018), Jędrzejczyk & Zarzeczna-Baran (2019), Lintern & Motavalli (2018), Mukono & Tokosi (2019), Presti et al. (2018), Rocha (2011), Vanagova et al. (2017), Xiao et al. (2018), Yang et al. (2015)

Themes	Description	Findings	Source
Performance strategy	Performance strategy is a method that organizations use to help implement their strategy into their organization to achieve all goals.	The strategies for sharing information on goals, organizational structure and overall performance have a significant positive effect on performance. Improve organizational communication between business and IT. Enhance organizational governance by having clear processes for utilizing resources effectively and prioritizing IT projects. Develop human and organizational skills to adopt cultures and accept changes that promote readiness to face unexpected and expected challenges.	Ajami & Bagheri-Tadi (2013), Alsharif et al. (2018), Atasoy et al. (2018), Drnevich & Croson (2013), Vainieri et al. (2019), Wiljjer & Hakim (2019)
Process harmonization	Process harmonization refers to organizing and applying standards for business process to achieve targeted business requirements.	Data improves the accessibility, utilization and production of routine health information for service management and medical decision-making. Reporting practices, harmonized data quality (DQ) assessment methods and terms, can build a common understanding of the limitations and strengths of the EHR data for quality improvement, research and operational analytics.	Blobel (2017), Geneviève et al. (2019), Kahn et al. (2016), Schmidt et al. (2018), Zhong (2018)

5.5 Limitations of the study

Since the study aimed to explore data governance relative to challenges associated with healthcare information systems by reviewing guidelines emerging from academic sources as part of a consolidated systematic literature review, the researcher encountered a number of limitations. This study was limited to the period 2010–2020, thus, relevant research studies that were conducted before this period were excluded, and therefore, important and pertinent information could have been missed. This study was limited to data collected from web search engines and digital databases, and thus could have missed relevant research in university databases and public libraries. A systematic literature review is the only method used to gather data and that helped the researcher to search for titles, keywords, abstracts and phrases.

The findings of this study are restricted and limited to the literature sourced internationally. This study is deliberately and intentionally not extending the model; however, the original model needs an extension. Unfortunately, the nature of this study does not allow the researcher to determine how organizations in healthcare information systems are dealing with data governance. It would have been nearly impossible for the researcher to collect data from the healthcare industry. The researcher had to learn using *ATLAS.ti V8*, and a qualitative data analysis, extracted from the network diagrams. To learn how to perform an SLR was an issue. The study based the findings on international and on local data. The scope of the master's study did not provide for the links of what the researcher has done and for the evaluation of an existing organization. The collection of the literature was extended to international sources and not only restricted to South African publications.

5.6 Delimitations of the study

This study did not explore data governance in a particular organization, but from literature. The study did not explore all the aspects of the lens. The researcher has limited this study to three aspects of the lens: competitive strategy, performance strategy and process harmonization. The researcher decided to explore literature only from 2010–2020. Any articles published prior to 2010 are not included in this study. The researcher did not evaluate a particular healthcare information system and data governance context using the proposed framework of guidelines.

5.7 Recommendations

By considering the above findings, this study highlights important recommendations that could motivate research achievements for data governance in healthcare information systems in South

Africa. This chapter highlights the main findings drawn from this study and presents a summary of the research findings. It revisits the research design and methodology and literature review. Furthermore, it discusses the theoretical, practical and methodological contributions of the study, makes recommendations, discusses future research opportunities, and summarizes the research findings and limitations of the study and closes with the conclusion.

5.8 Implications of the findings

There is a model that can look at six different themes and each theme has implications. There are three types of contributions to this research: theoretical contribution, practical contribution and methodological contribution.

5.8.1 Theoretical contribution

This study contributes theoretically to the body of knowledge by:

- Reviewing challenges and guidelines relating to data governance within the healthcare environment;
- Reviewing features of the DG contingency model and proposing changes to it;
- Contributing to the body of knowledge by reviewing challenges and proposing guidelines relating to DG within a healthcare environment; and
- Highlighting pertinent challenges and guidelines relating to DG in South Africa.

There is limited evidence concerning the findings on HIS success and DG in South Africa, since data governance is still in its infancy.

5.8.2 Practical contribution

This study contributes practically to the body of knowledge through understanding of the healthcare information's systems status.

5.8.3 Methodological contribution

- This study contributes to the body of knowledge methodologically and significantly to systematic literature review techniques; and
- The study reviews features of the DG contingency model and utilizes them directly, contributing to the study and directly contributing to the body of knowledge.

5.9 Directions for future research

The focus of the research determined the status of healthcare research. For future research, the researcher is of the opinion that possible areas should include more focus on HIS organizations. It is important to investigate whether the guidelines that the researcher is presenting are relevant. There is needed research for the future to propose an extended version of the model, because times have changed and are still changing. Future research could incorporate and expand on themes set out in Table 5-3. Additionally, of interest would be the implementation and evaluation of a revised DG model within a South African context. In this way, the guidelines proposed in this study could be evaluated and potentially augmented organically and empirically.

5.10 Reflection

The conducted study was done as a systematic literature review. The findings offer insight into the research done by other researchers on data governance (DG) in healthcare information systems (HIS). The literature searched 142 papers on DG and HIS.

5.11 Summary

Chapter 5 presented conclusions and the recommendations of the study. It revisited the aim, rationale and the research questions. The researcher then summarized the main points for the main research question (MRQ), which was divided into three sub questions (SQ), SQ1, SQ2 and SQ3. Followed by a summary of the main points for MRQ2 with the associated sub questions, SQ4, SQ5 and SQ6. The chapter then discussed the research themes and findings, delimitations of the study, recommendations and the implications of the study, which was divided into theoretical, practical and methodological contribution. Furthermore, the chapter gave directions for future research and summarized a brief reflection of the whole study.

References

- Ahmadi, H., Arji, G., Shahmoradi, L., Safdari, R., Mehrbaakhsh, N. & Alizadeh, M. 2019. The application of internet of things in healthcare : a systematic literature review and classification. *Universal Access in the Information Society*, 18(4): 837–869.
- Ahmed, Y.A., Ahmad, M.N., Ahmad, N. & Zakaria, N.H. 2019. Social media for knowledge-sharing: A systematic literature review. *Telematics and Informatics*, 37: 72–112.
- Ajami, S. & Bagheri-Tadi, T. 2013. Barriers for adopting electronic health records (EHRs) by physicians. *Acta Informatica Medica*, 21(2): 129–134.
- Al-ruithe, M., Benkhelifa, E. & Hameed, K. 2016. A conceptual framework for designing data governance for cloud computing. *Procedia Computer Science*, 94: 160–167. www.sciencedirect.com.
- Al-ruithe, M., Benkhelifa, E. & Hameed, K. 2019. A systematic literature review of data governance and cloud data governance. *Personal and Ubiquitous Computing*, 23(5): 839–859.
- Al-ruithe, M., Benkhelifa, E. & Hameed, K. 2018. Data governance taxonomy: Cloud versus non-cloud. *Sustainability*, 10(1): 95.
- Alhassan, I., Sammon, D. & Daly, M. 2016. Data governance activities : an analysis of the literature. *Journal of Decision Systems*, 25(sup1): 64–75.
- Alhojailan, M.I. 2012. Thematic analysis: A critical review of its process and evaluation. *West East Journal of Social Sciences*, 1(1): 39–47.
- Almunawar, M.N. & Anshari, M. 2012. Health information systems (HIS): Concept and technology. *arXiv preprint arXiv*, 1203: 3923.
- Alrasheedi, M., Capretz, L.F. & Raza, A. 2015. A systematic review of the critical factors for success of mobile learning in higher education (university students' perspective). *Journal of Educational Computing Research*, 52(2): 257–276.
- Alsharif, S., Benslimane, N., Khalifa, M. & Price, C. 2018. Healthcare IT Strategic Alignment: Challenges and Recommendations. *In ICIMTH*: 207–210.
- Atasoy, H., Greenwood, B.N. & Mccullough, J.S. 2019. The digitization of patient care: a review of the effects of electronic health records on health care quality and utilization. *Annual review of public health*, 40: 487–500.
- Ayyoubzadeh, S.M., R. Niakan Kalhori, S., Shirkhoda, M., Mohammadzadeh, N. & Esmaeili, M. 2020. Supporting colorectal cancer survivors using eHealth: a systematic review and framework suggestion. *Supportive Care in Cancer*, 28(8): 3543–3555.
- Beaulieu-Jones, B.K. & Moore, J.H. 2017. Missing data imputation in the electronic health record using deeply learned autoencoders. *In Pacific Symposium on Biocomputing*: 207–218.

- Blobel, B. 2017. Standardization for Mastering Healthcare Transformation—Challenges and Solutions. *European Journal for Biomedical Informatics*, 13(1): 9–15.
- Boell, S.K. & Cecez-Kecmanovic, D. 2010. Literature reviews and the hermeneutic circle. *Australian Academic & Research Libraries*, 41(2): 129–144.
- Bomark, S. 2019. *RESHAPING PUBLIC SECTOR HEALTHCARE: Creating conditions for digital transformation*. Umeå University.
- Boso, N., Story, V., Cadogan, J., Micevski, M. & Kadić-Maglajlić, S. 2013. Firm innovativeness and export performance: Environmental, networking, and structural contingencies. *Journal of International Marketing*, 21(4): 62–87.
- Braun, V. & Clarke, V. 2006. Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2): 77–101.
- Bryman, A. & Bell, E. 2011. *Business Research Methods*. 3rd ed. Oxford University Press.
- Cabitza, F. & Locoro, A. 2016. Human-data interaction in healthcare: acknowledging use-related chasms to design for a better health information. *In proceedings from the 8th IADIS International Conference on e-Health.*: 1–9.
- Carvalho, J.V., Rocha, Á. & Abreu, A. 2016. Maturity models of healthcare information systems and technologies: a literature review. *Journal of Medical Systems*, 40(6): 131.
- Charmaz, K. 2011. A constructivist grounded Theory analysis of losing and regaining a valued self. *Five ways of doing qualitative analysis: Phenomenological psychology, grounded theory, discourse analysis, narrative research, and intuitive inquiry*: 165–204.
- Cherry, B.K. 2019. How Does the Cross-Sectional Research Method Work?
- Creswell, J.W. 2013. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. 4th ed. Sage.
- Creswell, J.W. 2003. *Research Design: Qualitative, quantitative and mixed Methods Approaches*. 2nd ed. Sage.
- Cronin, P., Ryan, F. & Coughlan, M. 2008. Undertaking a literature review: a step-by-step approach. *British journal of nursing*. *British Journal of Nursing*, 17(1): 38–43.
- Cucari, N. 2019. Qualitative comparative analysis in corporate governance research : a systematic literature review of applications. *Corporate Governance: The International Journal of Business in Society*.
- Dasgupta, A., Gill, A. & Farookh, H. 2019. A Conceptual Framework for Data Governance in IoT-enabled Digital IS Ecosystems. *In DATA*: 209–216.
- Drnevich, P.L. & Croson, D.C. 2013. Information technology and business-level strategy: Toward an integrated theoretical perspective. *MIS Quarterly*, 37(2): 483–509.

- ECRI Institute. 2015. Wrong-Record , Wrong-Data Errors with Health IT Systems. *ECRI Institute PSO*, 7(2): 1–10.
- Fleissner, B., Jasti, K., Ales, J. & Thomas, R. 2014. The importance of data governance in healthcare. : 1–11. http://encorehealthresources.com/wp-content/uploads/2014/10/The-Importance-of-Data-Governance_FINAL-Oct-2014.pdf.
- Fossum, K., Fossum, S.M., Hanseth, O. & Sanner, T.A. 2019. ADAPTIVE NETWORKED GOVERNANCE OF E-HEALTH STANDARDS: THE CASE OF A REGIONAL HEALTH INFORMATION INFRASTRUCTURE IN NORWAY. In *European Conference on Information Systems (ECIS)*. 1–15.
- Friese, S. 2014. Methods And Methodologies For Qualitative Data Analysis. *Methods and methodologies for qualitative data analysis*: 1–10.
- Galmiche, M., Déchelotte, P., Lambert, G. & Tavolacci, M.P. 2019. Prevalence of eating disorders over the 2000–2018 period: a systematic literature review. *The American journal of clinical nutrition*, 109(5): 1402–1413.
- Geneviève, L.D., Martani, A., Mallet, M.C., Wangmo, T. & Elger, B.S. 2019. Factors influencing harmonized health data collection , sharing and linkage in Denmark and Switzerland: A systematic review. *PloS one*, 14(12): 1–44.
- Gopal, G., Suter-Crazzolaro, C., Toldo, L. & Eberhardt, W. 2019. Digital transformation in healthcare—architectures of present and future information technologies. *Clinical Chemistry and Laboratory Medicine (CCLM)*, 57(3): 328–335.
- Grandia, L. 2017. Healthcare information systems: a look at the past, present, and future. *Health Catalyst*: 1–6.
- Gray, D.E. 2013. *Doing research in the real world*. 3rd ed. Sage.
- Gujral, G., Shivarama, J. & Mariappan, M. 2019. ARTIFICIAL INTELLIGENCE (AI) AND DATA SCIENCE FOR DEVELOPING INTELLIGENT HEALTH INFORMATICS SYSTEMS. In *Proceedings of the Ntional Conference on AI in HI & VR, SHSS-TISS Mumbai*.
- Hanson, J.L., Balmer, D.F. & Giardino, A.P. 2011. Qualitative research methods for medical educators. *Academic pediatrics*, 11(5): 375–386.
- Harpur, P.A. 2018. *A framework for ad hoc mobile technology-enhanced learning in a higher education context*. Doctoral dissertation, Cape Peninsula University of Technology.
- Hasan, M. 2019. *Barriers and Success Factors for Implementation and Adoption of Healthcare Information Systems in Developing Countries: A Systematic Literature Review*. Doctoral dissertation, University of Oulu.
- Heidingsfelder, J. & Beckmann, M. 2020. A governance puzzle to be solved? A systematic literature review of fragmented sustainability governance. *Management Review Quarterly*, 70(3): 355–390.

- Hemed, M. & Tanzania, G.F.M.E.R. 2015. Cross-sectional studies. *Training Course in Sexual and Reproductive Health Research Geneva*, 12.
- Heymans, A., Breadsell, J., Morrison, G.M., Byrne, J.J. & Eon, C. 2019. Ecological urban planning and design: A systematic literature review. *Sustainability*, 11(13): 3723.
- Holden, M.T. & Lynch, P. 2004. Choosing the appropriate methodology: Understanding research philosophy. *The marketing review*, 4(4): 397–409.
- Huizing, A. 2007. The value of a rose: rising above objectivism and subjectivism. *Working Papers on Information Systems*, 7(11): 25.
- Hult, H.V., Hansson, A., Svensson, L. & Gellerstedt, M. 2019. Flipped healthcare for better or worse. *Health informatics journal*, 25(3): 587–597.
- Inayat, I., Salim, S.S., Marczak, S., Daneva, M. & Shamshirband, S. 2014. A systematic literature review on agile requirements engineering practices and challenges. *Computers in human behavior*, 51: 915–929.
- Institute for Work & Health. 2015. Cross-sectional vs. longitudinal studies. <https://www.iwh.on.ca/what-researchers-mean-by/cross-sectional-vs-longitudinal-studies>.
- Ishigure, Y. 2011. Trends, Standardization, and Interoperability of Healthcare Information. *NTT Technical Review, NTT Service Integration Laboratories*, 9(4): 1–6.
- Islam, M.S., Hasan, M.M., Wang, X., Germack, H.D. & Noor-E-Alam, M. 2018. A systematic review on healthcare analytics: application and theoretical perspective of data mining. *In Healthcare*, 6(2): 54.
- Janssen, M., Brous, P., Estevez, E., Barbosa, L.S. & Janowski, T. 2020. Data governance: Organizing data for trustworthy Artificial Intelligence. *Government Information Quarterly*, 37(3): 101493.
- Jebreen, I. 2012. Using inductive approach as research strategy in requirements engineering. *International Journal of Computer and Information Technology*, 01(02): 162–173.
- Jędrzejczyk, T. & Zarzeczna-baran, M. 2019. What are the aims of the implementation of e-solutions in healthcare? Review of the relevant practical studies. *European Journal of Translational and Clinical Medicine*, 2(1): 78–84.
- Johnson, R.B. & Christensen, L. 2014. *Educational Research: Quantitative, Qualitative and Mixed Approaches*. 5th ed. Los Angeles: Sage.
- Kahn, M.G., Callahan, T.J., Barnard, J., Bauck, A.E., Brown, J., Davidson, B.N., Estiri, H., Goerg, C., Holve, E., Johnson, S.G. & Liaw, S.T. 2016. A harmonized data quality assessment terminology and framework for the secondary use of electronic health record data. *Egems*, 4(1): 1–18.
- Katz, P. 2015. Preventing, detecting, and responding to data integrity events. <https://rx-360.org/wp-content/uploads/2018/08/Preventing-Detecting-and-Responding-to-Data-Integrity-Events-by-Paula-Katz-2015.pdf>.

- Kesmodel, U.S. 2018. Cross-sectional studies—what are they good for? *Acta obstetricia et gynecologica Scandinavica*, 97(4): 388–393.
- Khan, S.N. 2014. Qualitative research method: Grounded theory. *International Journal of Business and Management*, 9(11): 224–233.
- Kilani, M. Al & Kobziev, V. 2016. An overview of research methodology in information system (IS). *Open Access Library Journal*, 3(11): 1.
- Kim, H.Y. & Cho, J.-S. 2018. Data governance framework for big data implementation with NPS Case Analysis in Korea. *Journal of Business and Retail Management Research*, 12(3): 36–46.
- Kitchenham, B. 2004. *Procedures for performing systematic reviews*. Keele, UK: Keele University.
- Kitchenham, B. & Charters, S. 2007. *Guidelines for performing systematic literature reviews in software engineering*. Keele University and Durham University joint report.
- Kitchenham, B., Pearl Brereton, O., Budgen, D., Turner, M., Bailey, J. & Linkman, S. 2009. Systematic literature reviews in software engineering - A systematic literature review. *Information and Software Technology*, 51(1): 7–15.
- Lapp, T., Karvonen, T., Lwakatare, L.E., Aaltonen, K. & Kuvaja, P. 2018. Toward an improved understanding of agile project governance. *Project Management Journal*, 49(6): 39–63.
- Le, T.H., Arcodia, C., Novais, M.A. & Kralj, A. 2019. What we know and do not know about authenticity in dining experiences: A systematic literature review. *Tourism Management*, 74: 258–275.
- Lee, L., Rawstron, E., Henderson, P., Applewhite, E. & Guy, K. 2018. Data Governance: driving value in healthcare. *KPMG International*. <https://home.kpmg/content/dam/kpmg/co/pdf/2018/07/data-governance-driving-value-in-health.pdf>.
- Lee, S.U., Zhu, L. & Jeffery, R. 2018. A Contingency-Based Approach to Data Governance Design for Platform Ecosystems. In *In PACIS*. 168.
- Lewis, J.K. 2015. Using ATLAS.ti to facilitate data analysis for a systematic review of leadership competencies in the completion of a doctoral dissertation. In *Available at SSRN 2850726*.
- Lintern, G. & Motavalli, A. 2018. Healthcare information systems: the cognitive challenge. *BMC medical informatics and decision making*, 18(1): 1–10.
- Mack, N., Woodsong, C., MacQueen, K.M., Guest, G. & Namey, E. 2005. *Qualitative research methods: A data collector's field guide*. Family Health International.
- Mahlathi P & Dlamini J. 2013. SOUTH AFRICA MINIMUM DATA SETS FOR HUMAN RESOURCES FOR HEALTH AND THE SURGICAL WORKFORCE IN SOUTH AFRICA'S HEALTH SYSTEM.
- March, S.T. & Smith, G.F. 1995. Design and natural science research on information technology. *Decision support systems*, 15(4): 251–266.
- Mehta, N. & Pandit, A. 2018. Concurrence of big data analytics and healthcare: A systematic review.

International journal of medical informatics, 114: 57–65.

- Miles, M.B. & Huberman, M.A. 1994. *Qualitative data analysis: An expanded sourcebook*. 2nd ed. Sage.
- Milne, R. & Brayne, C. 2020. We need to think about data governance for dementia research in a digital era. *Alzheimer's research & therapy*, 12(1): 1–3.
- Moreira, M.R.A., Gherman, M. & Sousa, P.S.A. 2017. Does innovation influence the performance of healthcare organizations? *Innovation*, 19(3): 335–352.
- Mukono, W. & Tokosi, O.T. 2019. Premier Service Medical Investments: Challenges and perceptions of healthcare practitioners in the adoption and implementation of healthcare information technology (HIT). In *In Proceedings of the South African Institute of Computer Scientists and Information Technologists 2019*. South Africa: 1–10.
- Musawir, A. ul, Abd-karim, S.B. & Mohd-danuri, M.S. 2020. Project governance and its role in enabling organizational strategy implementation: A systematic literature review. *International Journal of Project Management*, 38(1): 1–16.
- Myers, M.D. 2009. *Qualitative research in business & management*. London: Sage.
- Noordin, S.A. & Masrek, M.N. 2016. Adopting the quantitative and qualitative methods in the social science research: Justifying the underpinning philosophical orientation. In *In Proceedings of the 28th International Business Information Management Association Conference-Vision 2020: Innovation Management, Development Sustainability, and Competitive Economic Growth*. 3891–3903.
- Okoli, C. 2015. A guide to conducting a standalone systematic literature review. *Communications of the Association for Information Systems*, 37(1): 43.
- Otto, B. 2011a. A morphology of the organisation of data governance. *ECIS 2011 Proceedings*: 272.
- Otto, B. 2011b. Organizing data governance: Findings from the telecommunications industry and consequences for large service providers. *Communications of the Association for Information Systems*, 29(1): 3.
- Panian, Z. 2010. Some practical experiences in data governance. *World Academy of Science, Engineering and Technology*, 62(1): 939–946.
- Parabhoi, L., Seth, A.K. & Pathy, S.K. 2017. Citation management software tools: A comparison with special reference to Zotero and Mendeley. *Journal of Advances in Library and Information Science*, 6(3): 288–293.
- Pardo, C., Pino, F., Garcia, F. & Piattini, M. 2012. Identifying methods and techniques for the harmonization of multiple process reference models. *Dyna*, 79(172): 85–93.
- Pereira, R. & Silva, M.M. 2012. A literature review: Guidelines and contingency factors for IT governance. In *In European, Mediterranean & Middle Eastern Conference on Information Systems*. Germany: 342–360.

- Piper, R.J. 2013. How to write a systematic literature review: a guide for medical students. *National AMR, Fostering Medical Research*, 1: 1–8.
- Pisano, V. & Hitt, M.A. 2015. What is competitive strategy? Origins and developments of a relevant research area in strategic management. *Handbook of Research on Competitive Strategy*: 18–44.
- Presti, L. Lo, Testa, M., Marino, V. & Singer, P. 2019. Engagement in healthcare systems: adopting digital tools for a sustainable approach. *Sustainability*, 11(1): 220.
- Rajasekar, S., Philominathan, P. & Chinnathambi, V. 2006. Research methodology. : 1–53.
- Rindfleisch, A., Malter, A.J., Ganesan, S. & Moorman, C. 2008. Cross-sectional versus longitudinal survey research: Concepts, findings, and guidelines. *Journal of marketing research*, 45(3): 261–279.
- Robinson, P. & Lowe, J. 2015. Literature reviews vs systematic reviews. *Australian and New Zealand Journal of Public Health*, 39(2): 103.
- Rocha, A. 2011. Evolution of information systems and technologies maturity in healthcare. *International Journal of Healthcare Information Systems and Informatics (IJHISI)*, 6(2): 26–36.
- Russom, P. 2012. *Seven reasons why master data management needs data governance*.
- Ryan, G. 2010. *Guidance notes on planning a systematic review*. Galway: James Hardiman Library, National University of Ireland Galway.
- Sadoughi, F., Khodaveisi, T. & Ahmadi, H. 2019. The used theories for the adoption of electronic health record: a systematic literature review. *Health and Technology*, 9(4): 383–400.
- Saeidi, P., Saeidi, S.P., Sofian, S., Saeidi, P.S., Nilashi, M. & Mardani, A. 2019. The impact of enterprise risk management on competitive advantage by moderating role of information technology. *Computer Standards & Interfaces*, 63: 67–82.
- Saunders, M., Lewis, P. & Thornhill, A. 2007. *Research Method for Business Students*. 4th ed. England: Essex: Prentice Hall: Financial Times.
- Saunders, M., Lewis, P. & Thornhill, A. 2019. *Understanding research philosophy and approaches to theory development*. 8th ed. New York: Pearson Education Limited.
- Schmidt, B., Colvin, C.J., Hohlfeld, A. & Leon, N. 2018. Defining and conceptualising data harmonisation : a scoping review protocol. *Systematic reviews*, 7(1): 1–6.
- Siddaway, A. 2014. What is a systematic literature review and how do I do one. *University of Stirling*, 1(1): 1–3.
- Siviy, J., Kirwan, P., Marino, L. & Morley, J. 2008. *The value of harmonizing multiple improvement technologies: a process improvement professional's view*.
- Solomonides, A. 2019. Research Data Governance, Roles, and Infrastructure. *In Clinical Research*

Informatics: 291–310.

South African Human Rights Commission. 2009. *Public Inquiry : Access to Health Care Services*.

Staples, M. & Niazi, M. 2007. Experiences using systematic review guidelines. *Journal of Systems and Software*, 80(9): 1425–1437.

Thomas, D.R. 2003. *A general inductive approach for qualitative data analysis*. University of Auckland.

Thondoo, M., Rojas-rueda, D., Gupta, J., de Vries, D.H. & Nieuwenhuijsen, M.J. 2019. Systematic literature review of health impact assessments in low and middle-income countries. *International journal of environmental research and public health*, 16(11): 2018.

Trienekens, J.J.M., Romero, H.L. & Cuenca, L. 2016. Assessment of Factors Influencing Business Process Harmonization. *ICEIS 2016*: 103–110.

Vaganova, E., Ishchuk, T., Zemtsov, A. & Zhdanov, D. 2017. Health Information Systems: Background and Trends of Development Worldwide and in Russia. In *HEALTHINF*: 424–428.

Vainieri, M., Ferre´, F., Giorgio, G. & Nuti, S. 2019. Explaining performance in health care : How and when top management competencies make the difference. *Health care management review*, 44(4): 306–317.

Vänskä, A. 2013. *Designing data governance model: case study*. Aalto University.

Visser, R., Bhana, R. & Monticelli, F. 2012. *The national health care facilities baseline audit national summary report*. Durban.

Volberda, H.W., van der Weerd, N., Verwaal, E., Stienstra, M. & Verdu, A.J. 2012. Contingency fit, institutional fit, and firm performance: A metafit approach to organization–environment relationships. *Organization Science*, 23(4): 1040–1054.

Wager, E. & Wiffen, P.J. 2011. Ethical issues in preparing and publishing systematic reviews. *Journal of Evidence-Based Medicine*, 4(2): 130–134.

Wang, Y., Han, J.H. & Beynon-Davies, P. 2019. Understanding blockchain technology for future supply chains: a systematic literature review and research agenda. *Supply Chain Management: An International Journal*, 24(1): 62–84.

Weber, K., Otto, B. & Österle, H. 2009. One size does not fit all---a contingency approach to data governance. *Journal of Data and Information Quality (JDIQ)*, 1(1): 1–27.

Webster, J. & Watson, R.T. 2002. Analyzing the past to prepare for the future: Writing a literature review. *MIS quarterly*, 26(2): xiii–xxiii.

Weill, P. & Ross, J. 2005. A Matrixed Approach to Designing IT Governance. *MIT Sloan management review*, 46(2): 26.

Wende, K. & Otto, B. 2007. A contingency approach to data governance. In *12th International*

Conference on Information Quality (ICIQ-07).

- Wetering, R. van de & Versendaal, J. 2020. Flexible collaboration infrastructures and healthcare information exchange in hospitals: an empirical resource-based perspective. *International Journal of Networking and Virtual Organisations*, 23(2): 171–188.
- Wiljer, D. & Hakim, Z. 2019. Developing an artificial intelligence-enabled health care practice: rewiring health care professions for better care. *Journal of medical imaging and radiation sciences*, 50(4): S8–S14.
- Van Wyk, B. 2012. *Research design and methods Part I*. University of Western Cape.
- Xiao, C., Choi, E. & Sun, J. 2018. Opportunities and challenges in developing deep learning models using electronic health records data: a systematic review. *Journal of the American Medical Informatics Association*, 25(10): 1419–1428.
- Yang, J.J., Li, J., Mulder, J., Wang, Y., Chen, S., Wu, H., Wang, Q. & Pan, H. 2015. Emerging information technologies for enhanced healthcare. *Computers in industry*, 69: 3–11.
- Yang, L., Li, J., Elisa, N., Prickett, T. & Chao, F. 2019. Towards Big data Governance in Cybersecurity. *Data-Enabled Discovery and Applications*, 3(1): 1–12.
- Yang, Z., Dehmer, M., Yli-Harja, O. & Emmert-Streib, F. 2020. Combining deep learning with token selection for patient phenotyping from electronic health records. *Scientific reports*, 10(1): 1–18.
- Zhang, N. & Yuan, Q. 2016. An overview of data governance. *Economis Paper*, (December): 1–10.
- Zhong, J., Yi, X., Wang, J., Shao, Z., Wang, P. & Lin, S. 2018. Artificial Intelligence Based Data Governance for Chinese Electronic Health Record Analysis. *International Journal of Data Mining & Knowledge Management Process*, 8(3): 29–41.

Appendix A: Institution Ethical Clearance



P.O. Box 652 • Cape Town 8000 South Africa • Tel: +27 21 469 1012 • Fax +27 21 469 1002
80 Roeland Street, Vredehoek, Cape Town 8001

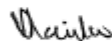
Office of the Research Ethics Committee	Faculty of Informatics and Design
---	-----------------------------------

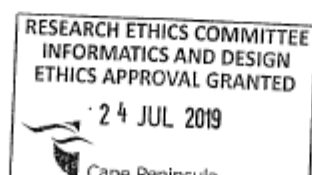
Ethics approval was granted to Mrs Nomputumo Jim, student number 199031096, for research activities related to the MTech: Information Technology at the Faculty of Informatics and Design, Cape Peninsula University of Technology (CPUT).

Title of thesis:	An exploration of data governance in Healthcare Information Systems: A systematic literature review
------------------	---

Comments

Research activities are restricted to those details in the research proposal. Informed consent is not required as the study is a systematic literature review and no human participants are involved.

 Signed: Faculty Research Ethics Committee	<u>24/7/19</u> Date
--	------------------------



Appendix B. Systematic Literature Review

B.1 Search items

Search Keywords
Data governance AND competitive advantage
Data governance AND digitization AND healthcare
Data governance AND healthcare
Data governance AND healthcare information systems
Data governance AND eHealth
Data governance AND electronic health records
Data governance AND electronic medical records
Data governance AND performance strategy
Data governance AND process harmonization
Data governance framework
Improving data governance AND healthcare
Improving data governance AND eHealth

B.2 Academic publications – final selection of articles

ID	Article details - abbreviated title	Author(s)	Origin	CA	DG	DM	HS	PH	PS
DCA1	Digital transformation in healthcare	Gopal et al. (2019)	INT	■	-	-	-	-	-
DCA2	Artificial intelligence and data science for developing intelligent HIS	Gujral et al. (2019)	INT	■	-	-	-	-	-
DCA3	Does Innovation impact the performance of healthcare?	Moreira et al. (2017)	INT	■	-	-	-	-	-
DCA4	The impact of enterprise risk management on competitive advantage	Saeidi et al. (2019)	INT	■	-	-	-	-	-
DCA5	Flexible collaboration infrastructures and healthcare information exchange	Wetering & Versendaal (2019)	INT	■	-	-	-	-	-
DDG1	Data governance activities: an analysis of the literature	Alhassan et al. (2016)	INT	-	■	-	-	-	-
DDG2	A conceptual framework for designing data governance	Al-Ruithe et al. (2016)	INT	-	■	-	-	-	-
DDG3	Data governance taxonomy	Al-Ruithe et al. (2018)	INT	-	■	-	-	-	-
DDG4	A conceptual framework for DG in IoT-enabled digital IS	Dasgupta et al. (2019)	INT	-	■	-	-	-	-
DDG5	Adaptive networked standards of healthcare	Fossum et al. (2019)	INT	-	■	-	-	-	-
DDG6	Data governance – Trustworthiness	Janseen et al. (2020)	INT	-	■	-	-	-	-
DDG7	Data governance in the health industry	Juddoo et al. (2018)	INT	-	■	-	-	-	-
DDG8	We need to think about DG for dementia in a digital era	Milne & Brayne (2020)	INT	-	■	-	-	-	-
DDG9	A morphology of the organization of data governance	Otto (2011a)	INT	-	■	-	-	-	-
DDG10	Organizing data governance	Otto (2011b)		-	■	-	-	-	-
DDG11	Research DG, roles and infrastructure	Solomonides (2019)	INT	-	■	-	-	-	-
DDG12	Combining deep learning with token learning for EHRs	Yang et al. (2020)	INT	-	■	-	-	-	-
DDM1	Firm innovativeness and export performance	Boso et al. (2015)	INT	-	-	■	-	-	-
DDM2	A contingency-based approach DG design	Lee et al. (2018)	INT	-	-	■	-	-	-
DDM3	A review of literature for guidelines and contingency factors for ITG	Pereira & da Silva (2012)	INT	-	-	■	-	-	-
DDM4	Contingency fit – institutional fit and firm performance	Volberda et al. (2012)	INT	-	-	■	-	-	-
DHS1	Healthcare information systems: Concept and technology	Almunawar & Anshari (2012)	INT	-	-	-	■	-	-
DHS2	Reshaping public sector healthcare	Bomark (2019)	INT	-	-	-	■	-	-
DHS3	Human-data interaction in healthcare	Cabitz & Locoro (2016)	INT	-	-	-	■	-	-
DHS4	Maturity models of HIS and technologies	Carvalho et al. (2016)	INT	-	-	-	■	-	-
DHS5	Flipped healthcare for better or worse	Hult et al. (2019)	INT	-	-	-	■	-	-
DHS6	A systematic review on healthcare analytics	Islam et al. (2018)	INT	-	-	-	■	-	-
DHS7	What are the goals of implementing E-solutions in healthcare?	Jędrzejczyk & Zarzeczna-Baran (2019)	INT	-	-	-	■	-	-
DHS8	Healthcare information systems: The cognitive challenge	Lintern & Motavalli (2018)	INT	-	-	-	■	-	-
DHS9	Challenges and perception of healthcare	Mukono & Tokosi (2019)	SA	-	-	-	■	-	-
DHS10	Engagement in healthcare systems: Adopting digital tools	Presti et al. (2018)	INT	-	-	-	■	-	-

ID	Article details - abbreviated title	Author(s)	Origin	CA	DG	DM	HS	PH	PS
DHS11	Evolution of IS and technologies maturity in healthcare	Rocha (2011)	INT	-	-	-	■	-	-
DHS12	HIS: Worldwide background and trends of development	Vanagova et al. (2017)	INT	-	-	-	■	-	-
DHS13	Opportunities and challenges in deep learning using EHR's data	Xiao et al. (2018)	INT	-	-	-	■	-	-
DHS14	Emerging IT for enhanced healthcare	Yang et al. (2015)	INT	-	-	-	■	-	-
DPH1	Standardization for mastering healthcare transformation	Blobel (2017)	INT	-	-	-	-	■	-
DPH2	Factors influencing harmonized health data collection, linkage and sharing	Geneviève et al. (2019)	INT	-	-	-	-	■	-
DPH3	A harmonized DQ assessment in healthcare	Kahn et al. (2016)	INT	-	-	-	-	■	
DPH4	Defining and conceptualizing data harmonization	Schmidt et al. (2018)	SA	-	-	-	-	■	
DPH5	Artificial intelligence-based DG for EHR analysis	Zhong (2018)	INT	-	-	-	-	■	-
DPS1	Barriers for adopting EHRs in healthcare	Ajami & Bagheri-Tadi (2013)	INT	-	-	-	-	-	■
DPS2	Healthcare IT strategic alignment: Recommendations and challenges	Alsharif et al. (2018)	INT	-	-	-	-	-	■
DPS3	The digitization of patient care	Atasoy et al. (2018)	INT	-	-	-	-	-	■
DPS4	Information technology and business level strategy	Drnevich & Croson (2013)	INT	-	-	-	-	-	■
DPS5	Explaining performance in healthcare	Vainieri et al. (2019)	INT	-	-	-	-	-	■
DPS6	Developing and AI-enabled practice in healthcare	Wijjier & Hakim (2019)	INT	-	-	-	-	-	■

B.3 Quality assessment criteria – article details and criteria

ID	Article details - abbreviated title	Author(s)	QAC1	QAC2	QAC3	QAC4	Index
DCA1	Digital transformation in healthcare	Gopal et al. (2019)	1	1	1	1	4
DCA2	Artificial intelligence and data science for developing intelligent HIS	Gujral et al. (2019)	1	1	0.5	1	3.5
DCA3	Does Innovation impact the performance of healthcare?	Moreira et al. (2017)	1	1	0.5	1	3.5
DCA4	The impact of enterprise risk management on competitive advantage	Saeidi et al. (2019)	1	1	1	0.5	3.5
DCA5	Flexible collaboration infrastructures and healthcare information exchange	Wetering & Versendaal (2019)	1	1	0.5	1	3.5
DDG1	Data governance activities: literature analysis	Alhassan et al. (2016)	1	1	1	1	4
DDG2	A conceptual framework for designing data governance	Al-Ruithe et al. (2016)	1	1	1	1	4
DDG3	Data governance taxonomy	Al-Ruithe et al. (2018)	1	1	1	1	4
DDG4	A conceptual framework for data governance	Dasgupta et al. (2019)	1	1	0.5	1	3.5
DDG5	Adaptive networked standards of healthcare	Fossum et al. (2019)	1	0.5	0.5	0.5	2.5
DDG6	Data governance – Trustworthiness	Janseen et al. (2020)	1	1	0.5	1	3.5
DDG7	Data governance in the health industry	Juddoo et al. (2018)	1	1	0,5	0.5	3
DDG8	We need to think about data governance in digital era	Milne & Brayne (2020)	1	1	0.5	1	3.5
DDG9	A morphology of the organization of data governance	Otto (2011a)	1	1	1	1	4
DDG10	Organizing data governance	Otto (2011b)	1	1	1	1	4
DDG11	Research DG, roles and infrastructure	Solomonides (2019)	1	0.5	1	0.5	3
DDG12	Combining deep learning with token learning for EHRs	Yang et al. (2020)	1	1	0.5	0.5	3
DDM1	Firm innovativeness and export performance	Boso et al. (2015)	1	0.5	0.5	0.5	2.5
DDM2	A contingency-based approach to data governance design	Lee et al. (2018)	1	1	1	0.5	3.5
DDM3	A review of literature for guidelines and contingency factors for IT governance	Pereira & da Silva (2012)	1	0.5	05	0.5	2.5
DDM4	Contingency fit – institutional fit and firm performance	Volberda et al. (2012)	1	0.5	0.5	05	2.5
DHS1	Healthcare information systems: Concept and technology	Almunawar & Anshari (2012)	1	0.5	0.5	0.5	2.5
DHS2	Reshaping public sector healthcare	Bomark (2019)	1	0.5	0.5	0.5	2.5
DHS3	Human-data interaction in healthcare	Cabitza & Locoro (2016)	1	0.5	0.5	0.5	2.5
DHS4	Maturity models of HIS and technologies	Carvalho et al. (2016)	1	0.5	0.5	0.5	2.5
DHS5	Flipped healthcare for better or worse	Hult et al. (2019)	1	0.5	0.5	0.5	2.5
DHS6	A systematic review on healthcare analytics	Islam et al. (2018)	1	0.5	0.5	0.5	2.5
DHS7	What are the goals of implementing E-solutions in healthcare?	Jędrzejczyk & Zarzeczna-Baran (2019)	1	0.5	0.5	0.5	2.5
DHS8	Healthcare information systems: The cognitive challenge	Lintern & Motavalli (2018)	1	0,5	0.5	0.5	2.5
DHS9	Challenges and perception of healthcare	Mukono & Tokosi (2019)	1	0.5	0.5	0.5	2.5
DHS10	Engagement in healthcare systems: Adopting digital tools	Presti et al. (2018)	1	0.5	0.5	0.5	2.5
DHS11	Evolution of IS and technologies maturity in healthcare	Rocha (2011)	1	0.5	0.5	0.5	2.5
DHS12	HIS: Worldwide background and trends of development	Vanagova et al. (2017)	1	1	0.5	1	3.5
DHS13	Opportunities and challenges in deep learning using EHR's data	Xiao et al. (2018)	1	1	0.5	0.5	3
DHS14	Emerging IT for enhanced healthcare	Yang et al. (2015)	1	1	0.5	0,5	3

ID	Article details - abbreviated title	Author(s)	QAC1	QAC2	QAC3	QAC4	Index
DPH1	Standardization for mastering healthcare transformation	Blobel (2017)	1	1	0.5	0.5	3
DPH2	Factors influencing harmonized health data collection, linkage and sharing	Geneviève et al. (2019)	1	0.5	0.5	0.5	2.5
DPH3	A harmonized DQ assessment in healthcare	Kahn et al. (2016)	1	0.5	1	0.5	3
DPH4	Defining and conceptualizing data harmonization	Schmidt et al. (2018)	1	0.5	0.5	0.5	2.5
DPH5	Artificial intelligence-based DG for EHR analysis	Zhong (2018)	1	1	0.5	0.5	3
DPS1	Barriers for adopting EHRs in healthcare	Ajami & Bagheri-Tadi (2013)	1	1	0.5	1	3.5
DPS2	Healthcare IT strategic alignment: Recommendations and challenges	Alsharif et al. (2018)	1	1	0.5	1	3.5
DPS3	The digitization of patient care	Atasoy et al. (2018)	1	0.5	0.5	0.5	2.5
DPS4	Information technology and business level strategy	Drnevich & Croson (2013)	1	0.5	0.5	0.5	2.5
DPS5	Explaining performance in healthcare	Vainieri et al. (2019)	1	0.5	0.5	0.5	2.5
DPS6	Developing and AI-enabled practice in healthcare	Wijijer & Hakim (2019)	1	1	0.5	1	3.5
Overall aggregated indices			1	0.8	0.7	0.8	3
			100%	75.7%	69.6%	76.1%	75%

Note: QAC1 = Are aims of the article in line with this study? QAC2 = Does the article focus on issues in DG context? QAC3 = Is there an easily identified framework or set criteria? QAC4 = Based on findings, are they worthy for the synthesis of guidelines for data governance?

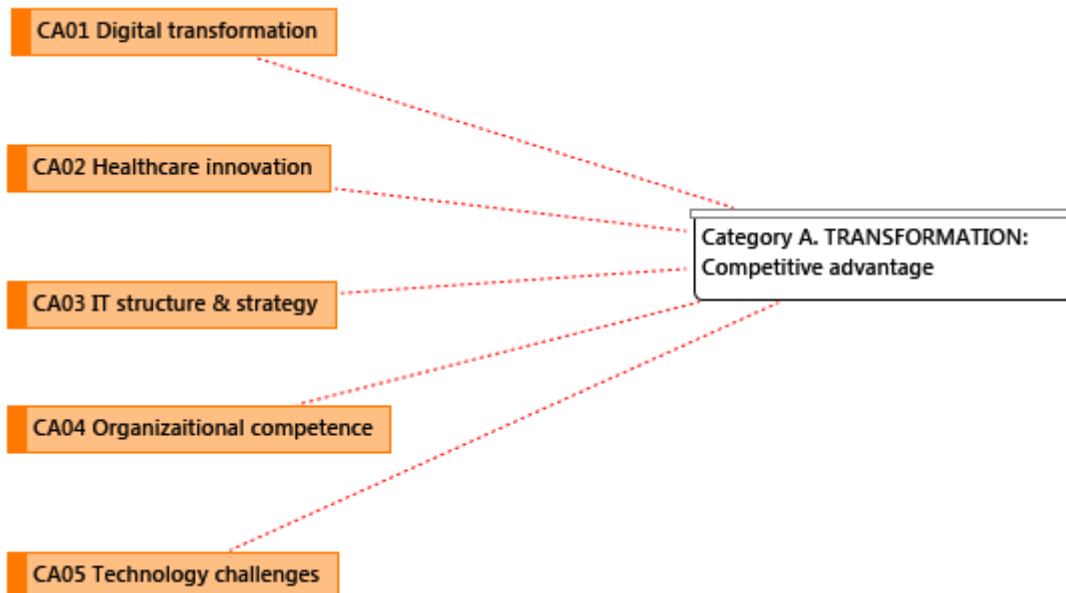
Appendix C: Synthesized Codebook

The final codebook that evolved during the study is provided as Appendix E. It consists of item-based codes with the prefix ‘CA’ for competitive advantage, ‘DM’ for data governance contingency model, ‘DG’ for data governance, ‘HS’ for healthcare information systems, PH’ for process harmonization and ‘PS’ for performance strategy. For example, CA01 represents a code for ‘Digital transformation. The final column suggests the guidelines for best practices associated with each item.

C.1 Category A: Transformation

Code	Items	Guidelines for best practices
CA01	Digital transformation	Adapt to the changing world of digital era
CA02	Healthcare Innovation	Develop a patient-centric approach.
CA03	IT structure & strategy	Build a proper IT strategy and IT structure
CA04	Organizational competence	Respond to the digital trends in healthcare
CA05	Technology challenges	Adopt the latest technologies

Note: Category A. Transformation consists of five codes, CA = Competitive advantage

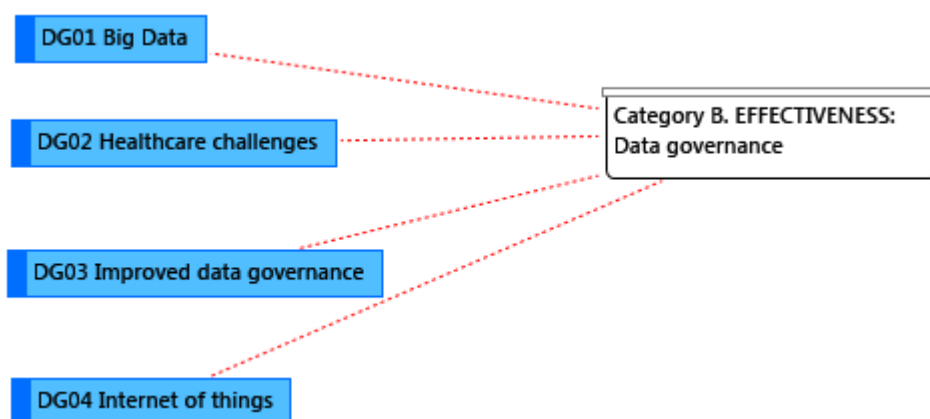


Network diagram for Category A. Transformation, codes and items

C.2 Category B: Effectiveness

Code	Items	Guidelines for best practices
DG01	Big Data	Utilize new technologies for healthcare improvement
DG02	Healthcare challenges	Facilitate professional training to the latest technologies
DG03	Improved data governance	Develop a proper data governance
DG04	Internet of things	Allow the use of internet-able devices of the modern day

Note: Category C. Effectiveness consists of four codes; DG = Data Governance

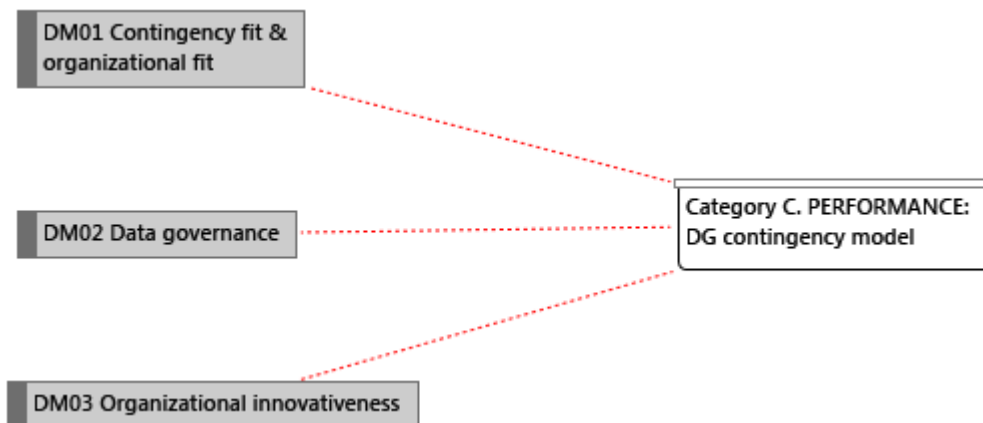


Network diagram for Category B. Effectiveness, codes and items

C.3 Category C: Performance

Code	Items	Guidelines for best practices
DM01	Contingency fit & organizational fit	Maintain the contingency fit within an organization
DM02	Data governance model	Implement a proper data governance model
DM03	Organization innovativeness	Provide improvement, uniqueness and re-invention

Note: Category C. Performance consists of three codes, DM = Data governance contingency model

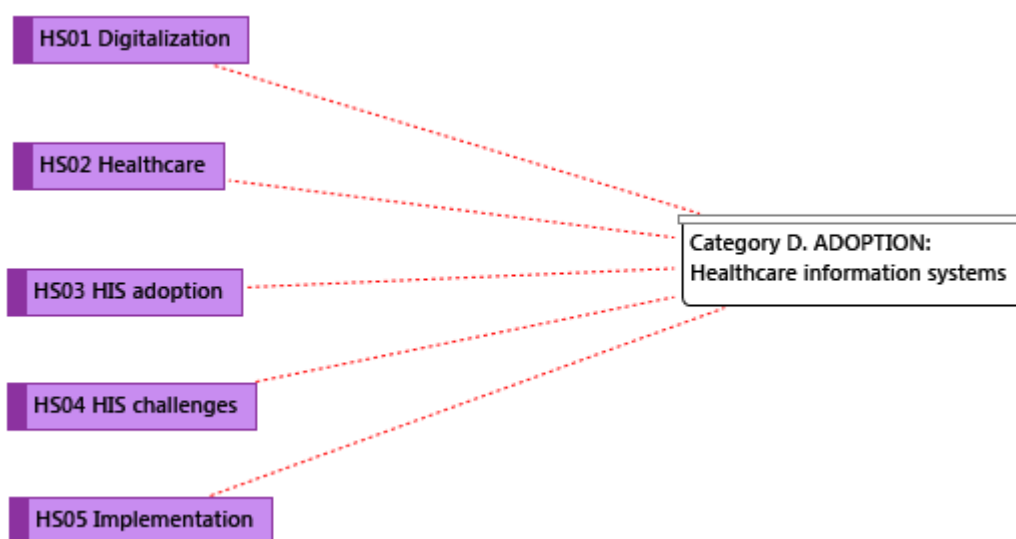


Network diagram for Category C. Performance, codes and items

C.4 Category D: Adoption

Code	Items	Guidelines for best practices
HS01	Digitalization	Facilitate training about the digital systems
HS02	Healthcare	Convert to digital changes for competitive advantage
HS03	HIS Adoption	Permit the use of new technologies
HS04	HIS Challenges	Enable growth to healthcare professionals
HS05	Implementation	Deploy a suitable strategy for deployment

Note: Category D. Adoption consists of five codes, HS = Healthcare information systems

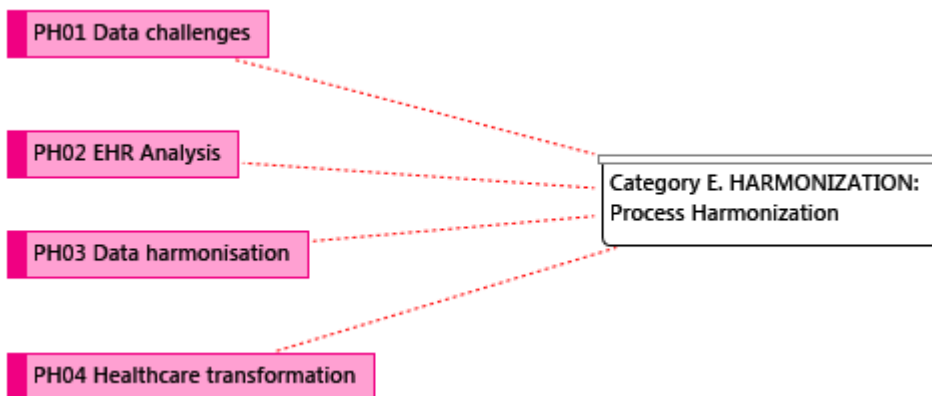


Network diagram for Category D. Adoption, codes and items

C.5 Category E: Harmonization

Code	Items	Guidelines for best practices
PH01	EHR Analysis	Develop robust training machine models for data analysis
PH02	Data challenges	Provide a strategy to handle the data challenges
PH03	Data harmonization	Align healthcare systems processes properly
PH04	Healthcare transformation	Install healthcare intelligent technologies

Note: Category E. Adoption consists of four codes, PH = Process harmonization

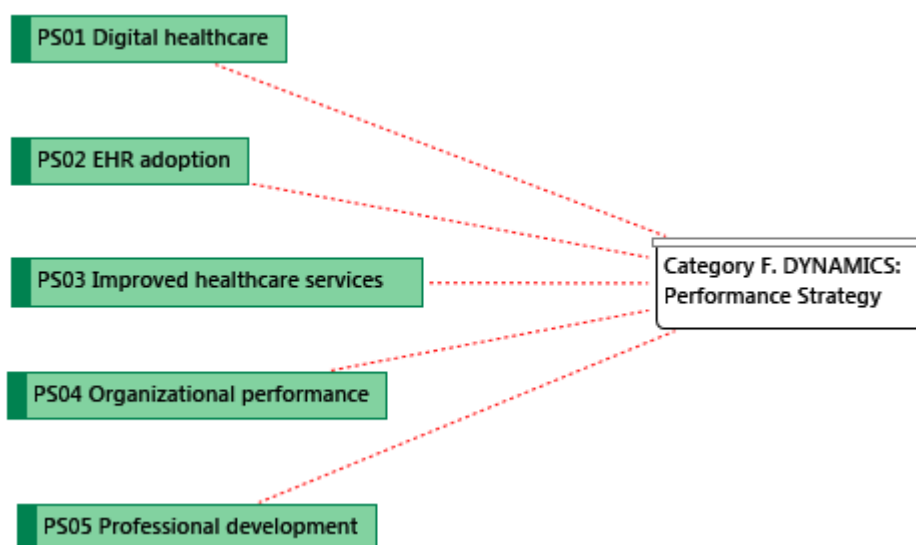


Network diagram for Category D. Harmonization, codes and items

C.6 Category F: Dynamics

Code	Items	Guidelines for best practices
PS01	Adoption	Incorporates the use of digital systems
PS02	Digital healthcare	Utilize digital technologies to achieve healthcare goals
PS03	Improved healthcare services	Incorporates the adoption of digital applications
PS04	Organizational performance	Develop a good competitive advantage strategy
PS05	Professional development	Facilitate upskilling for digital skills and awareness

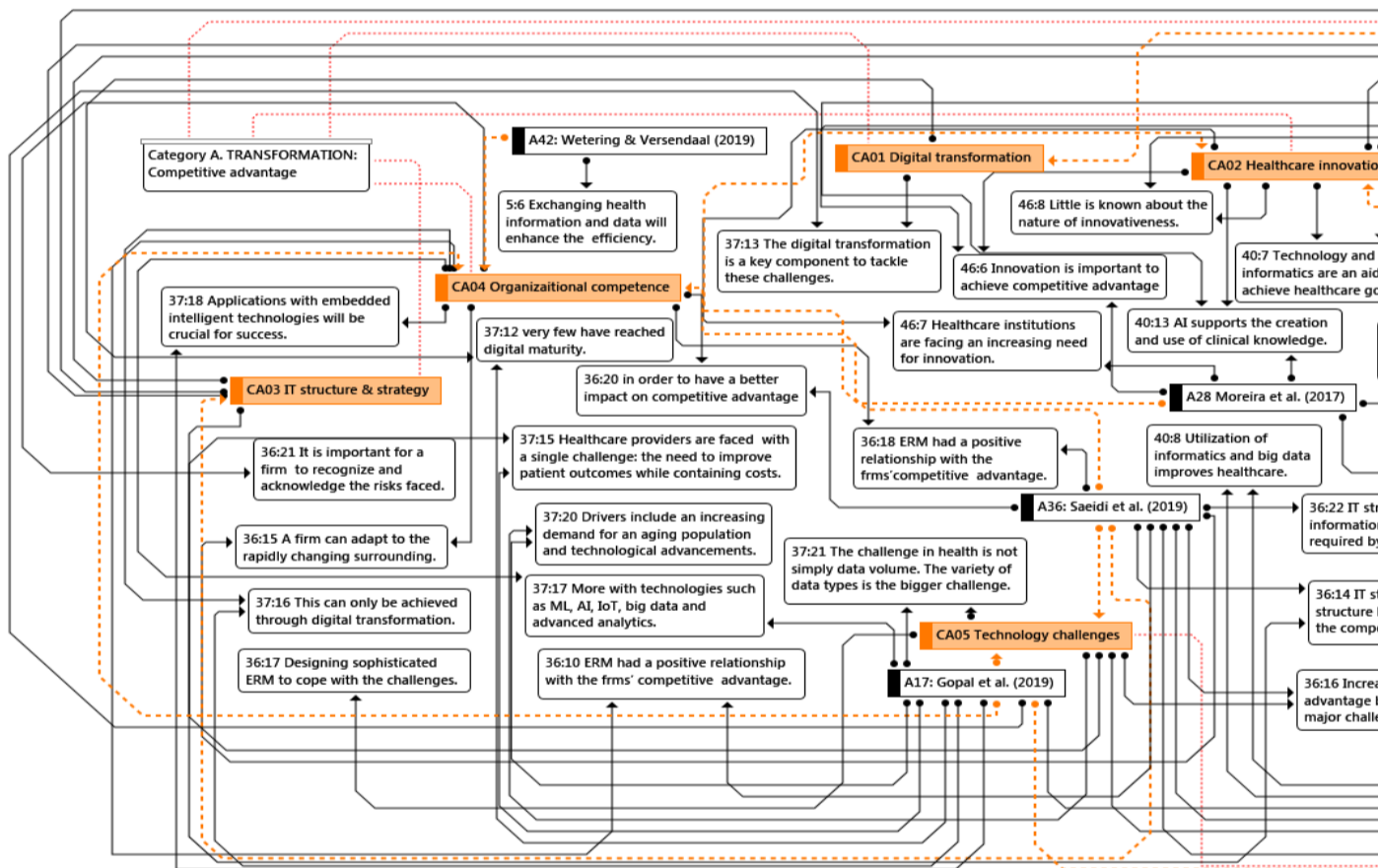
Note: Category F. Dynamics consists of five codes, PS = Performance strategy



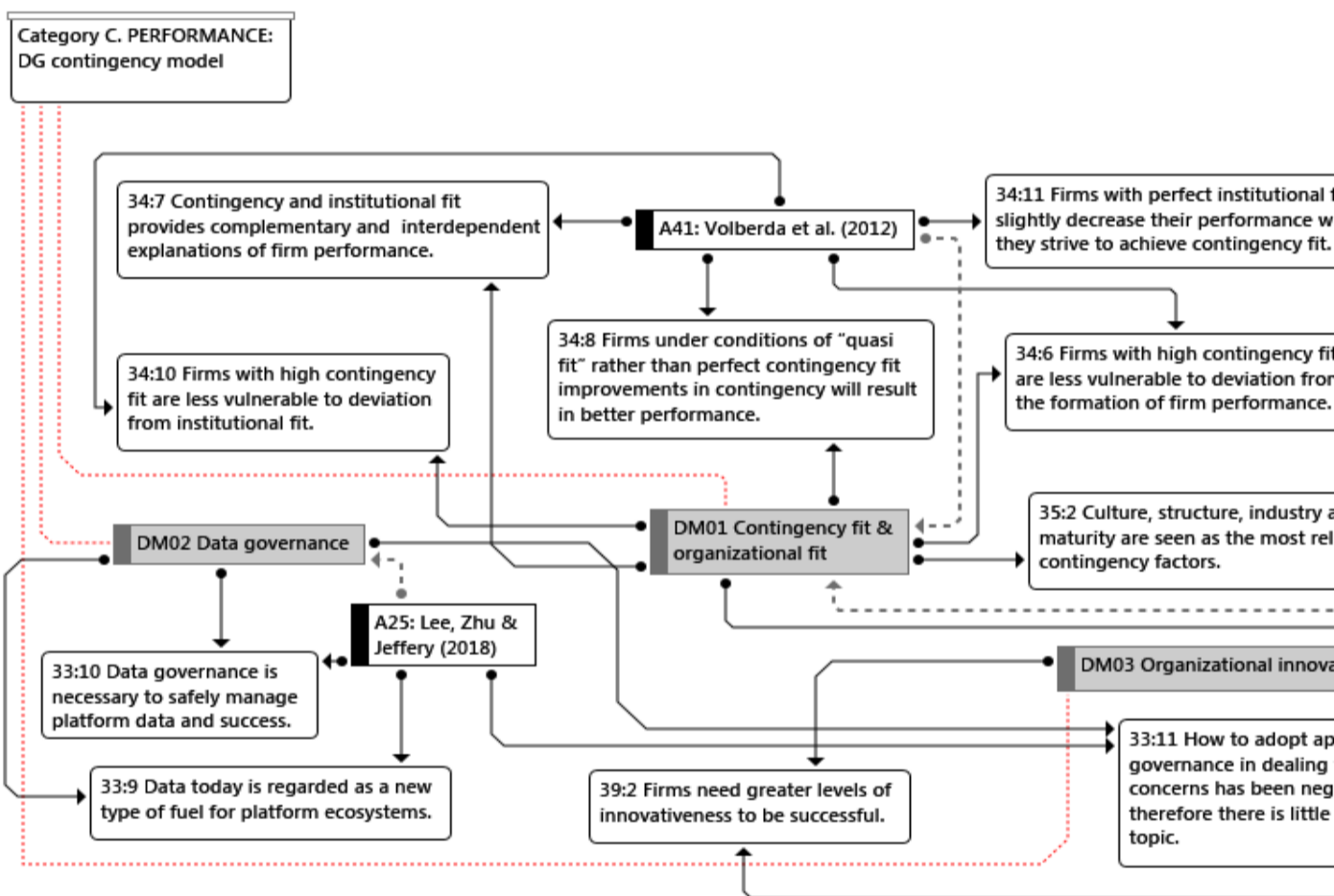
Network diagram for Category F. Dynamics, codes and items

Appendix D: Networks - Code Snippets from the Secondary Data

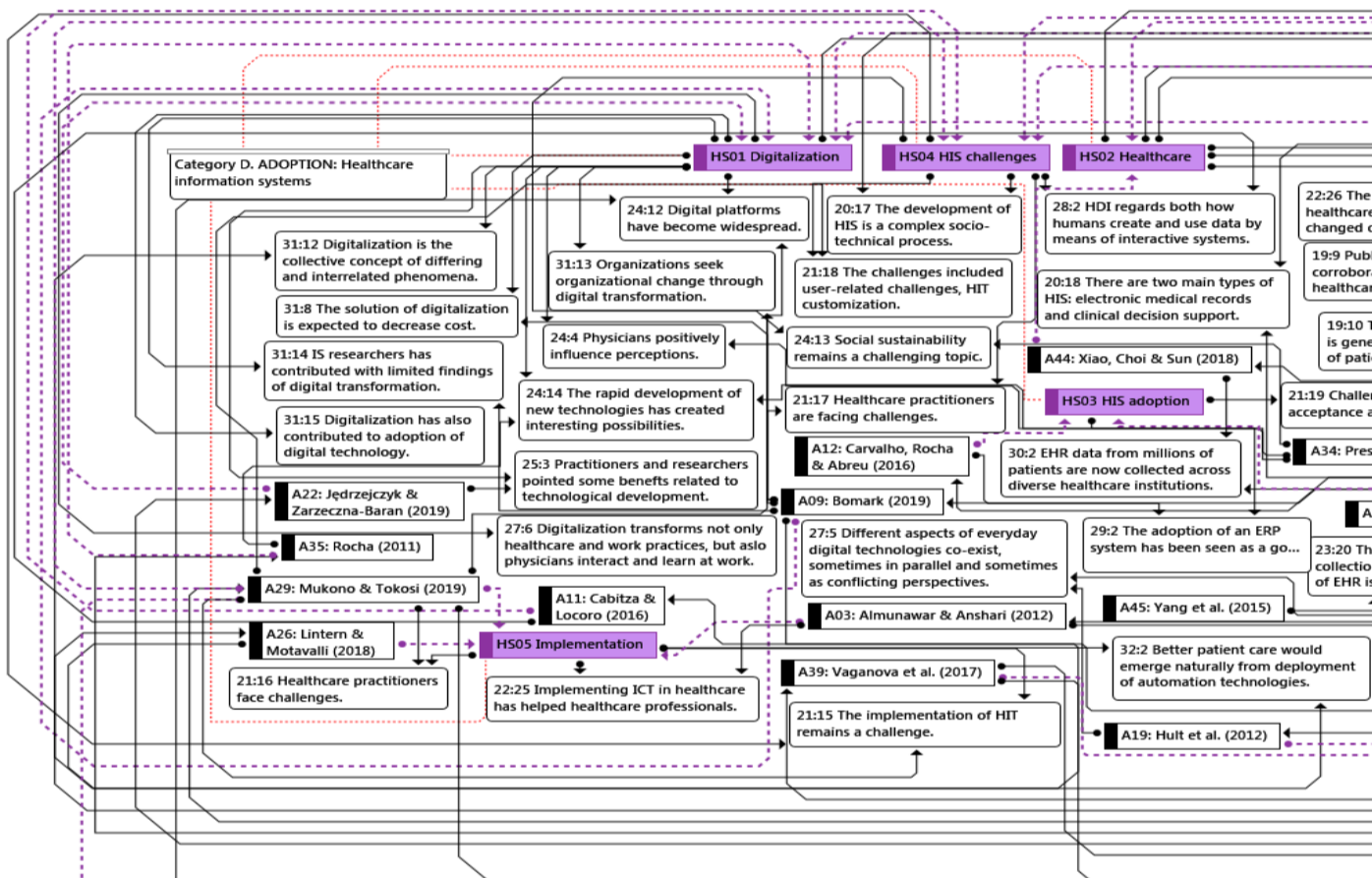
D.1 Category A: Transformation – Competitive advantage network



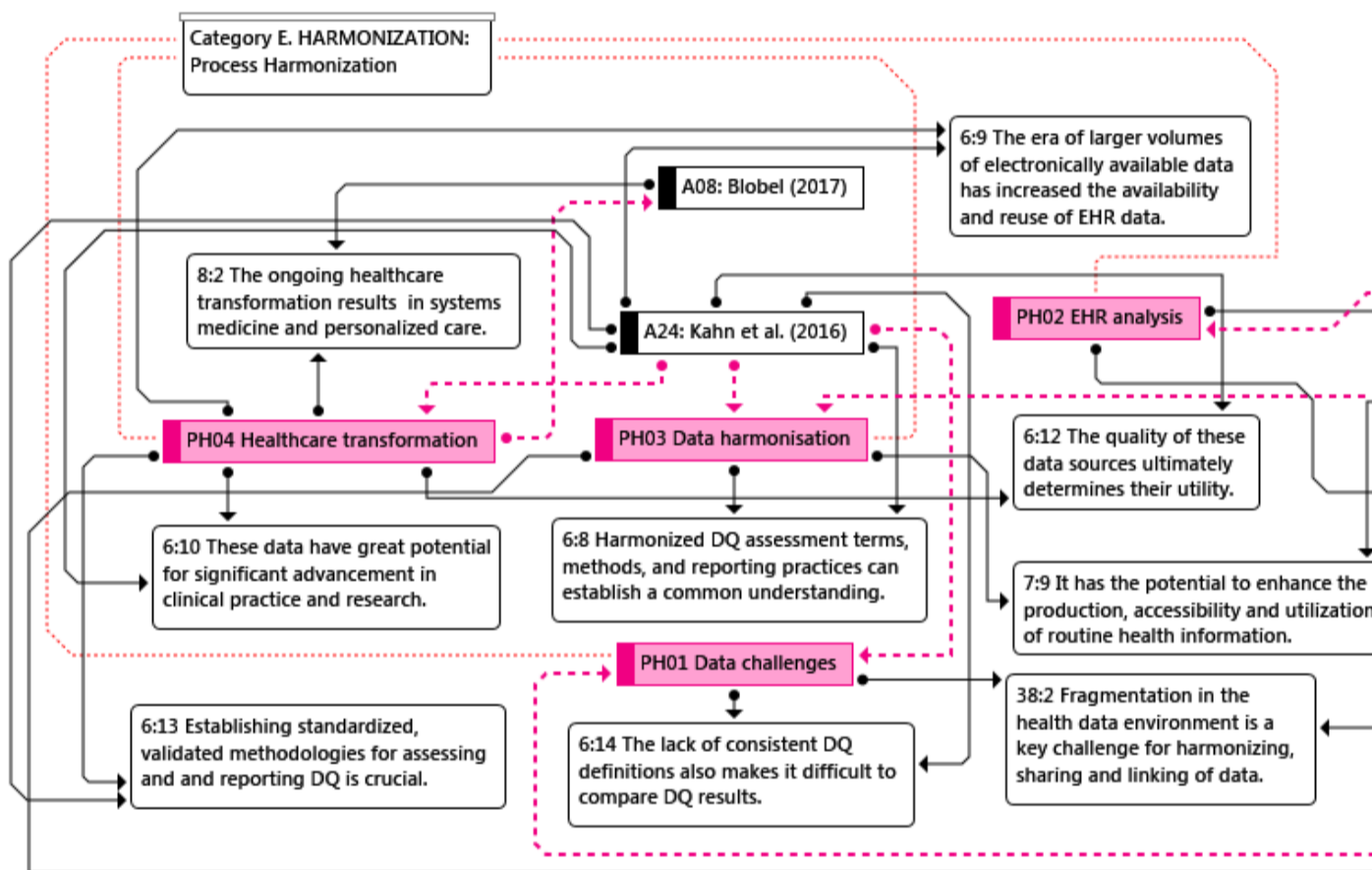
D.3 Category C: Performance – DG Contingency model network



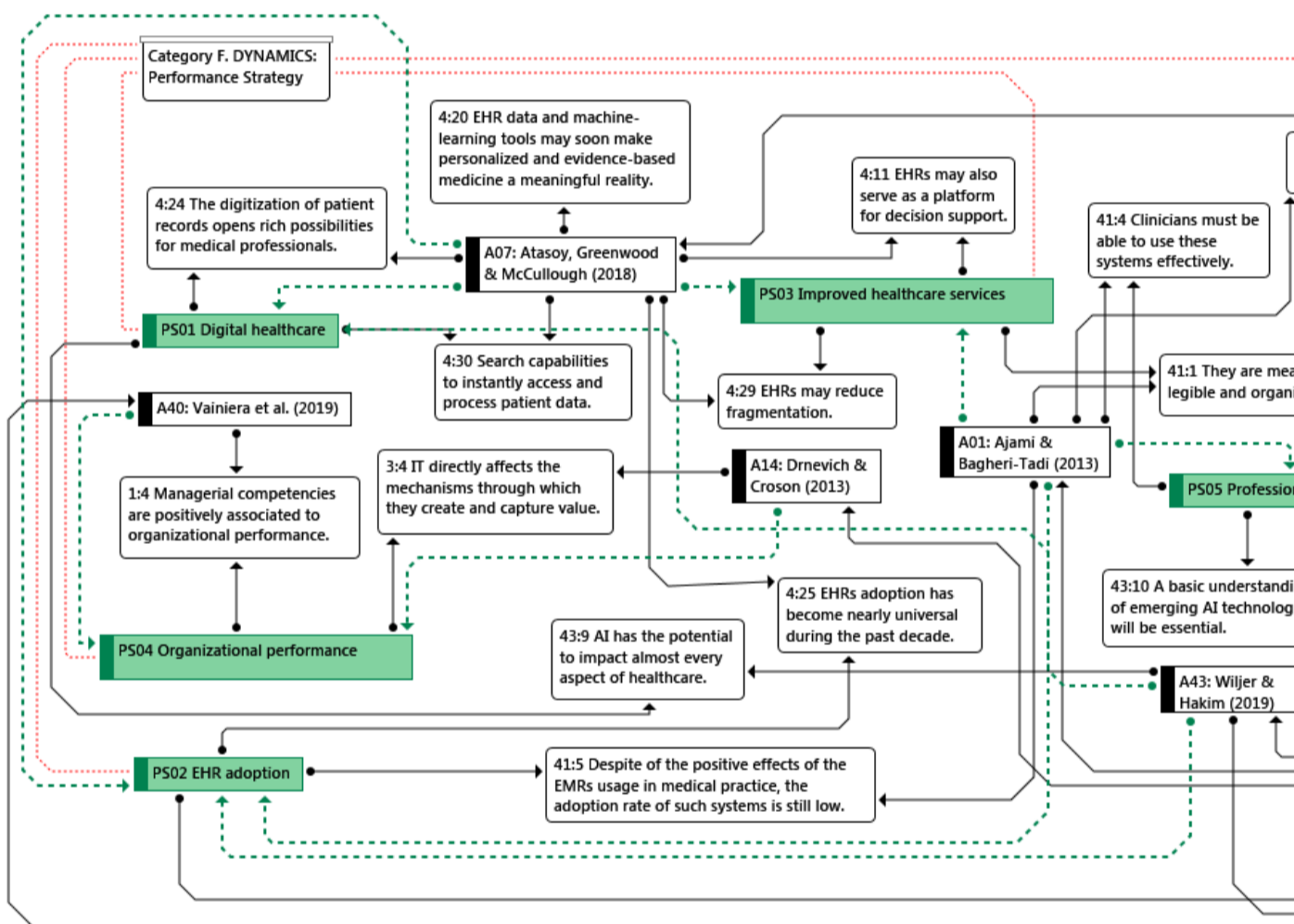
D.4 Category D: Adoption – Healthcare information systems network



D.5 Category E: Harmonization – Process harmonization

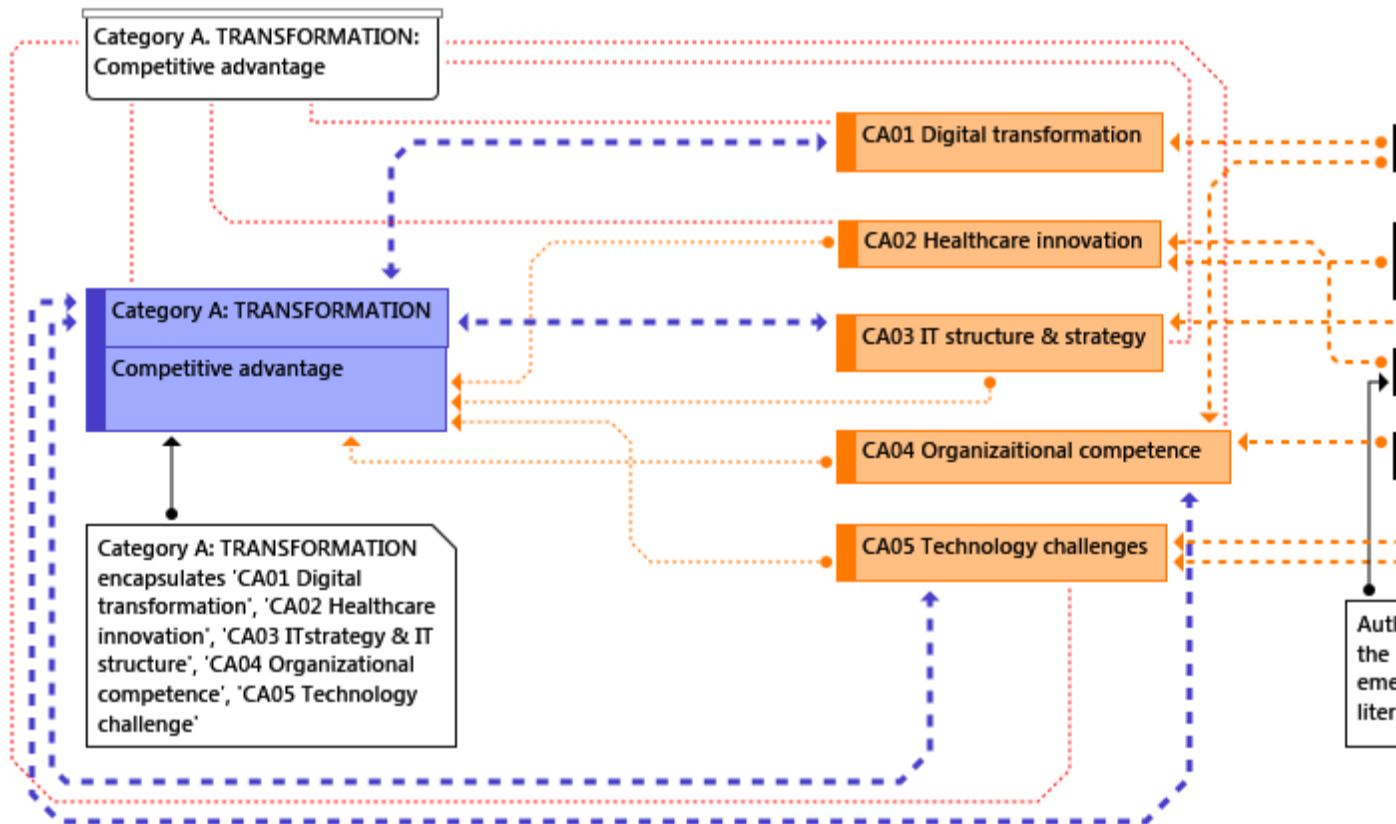


D.6 Category F: Dynamics – Performance strategy network

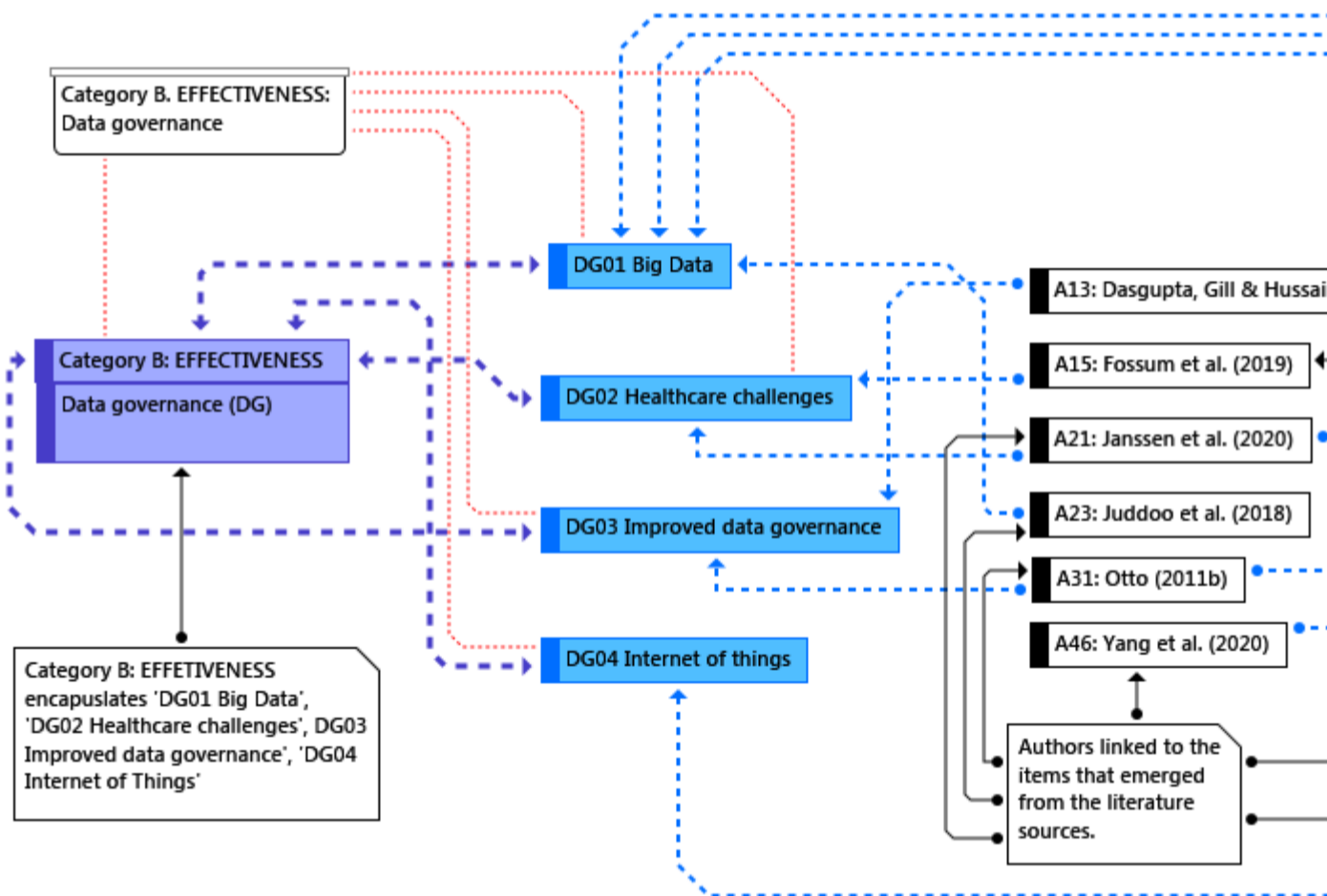


Appendix E: Categories, Items and Authors

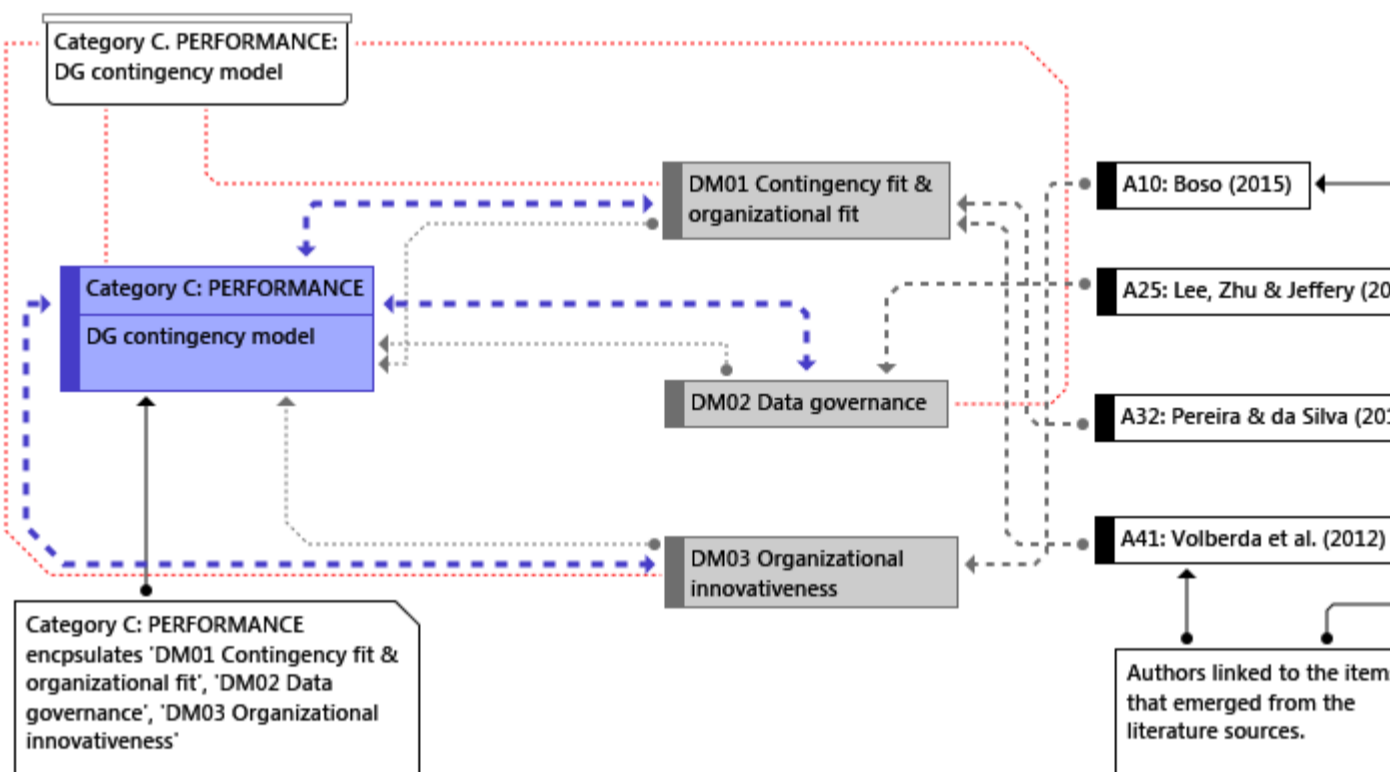
E.1. Category A: Transformation – Link between Category A, items and authors



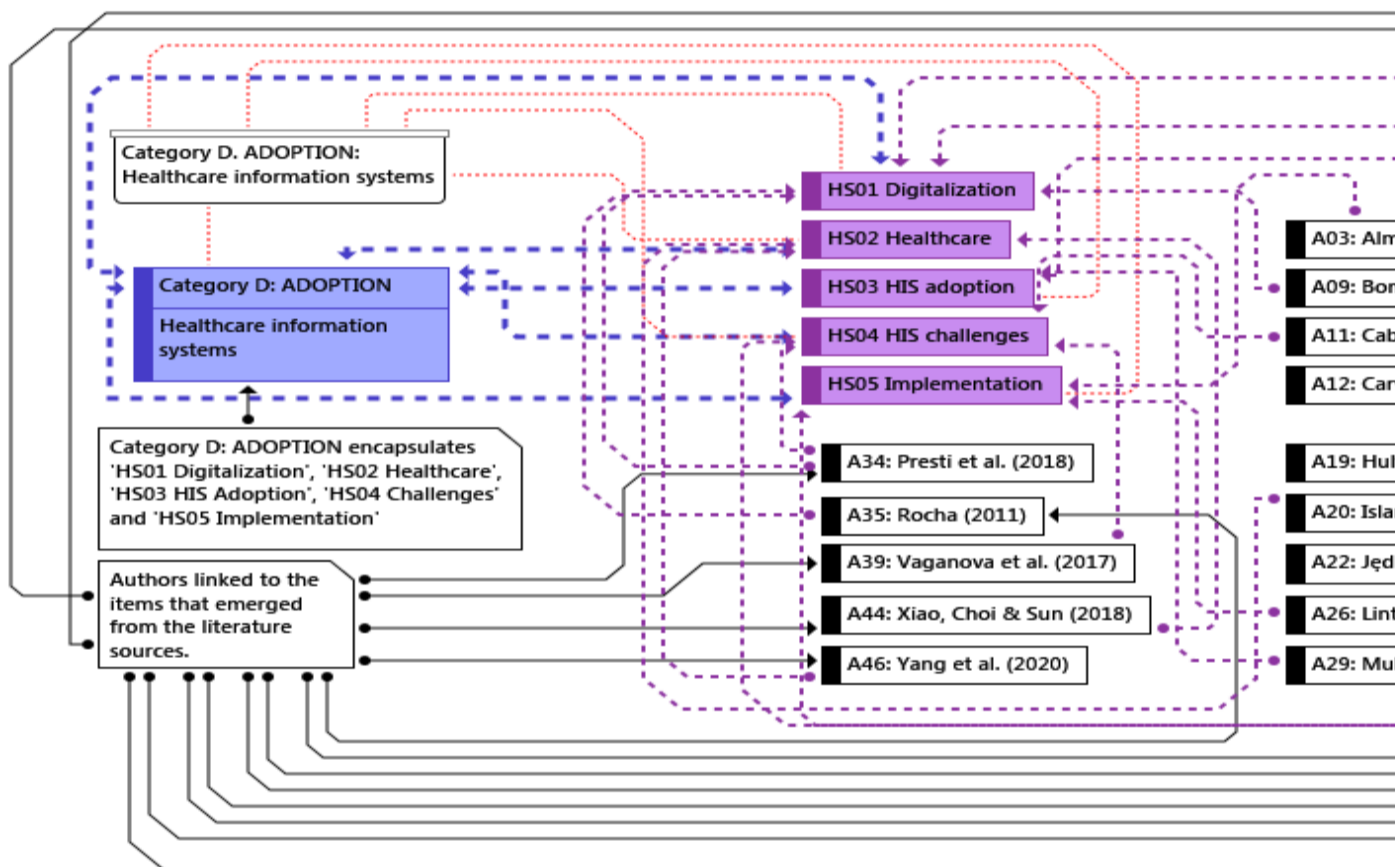
E.2. Category B: Effectiveness – Link between Category A, items and authors



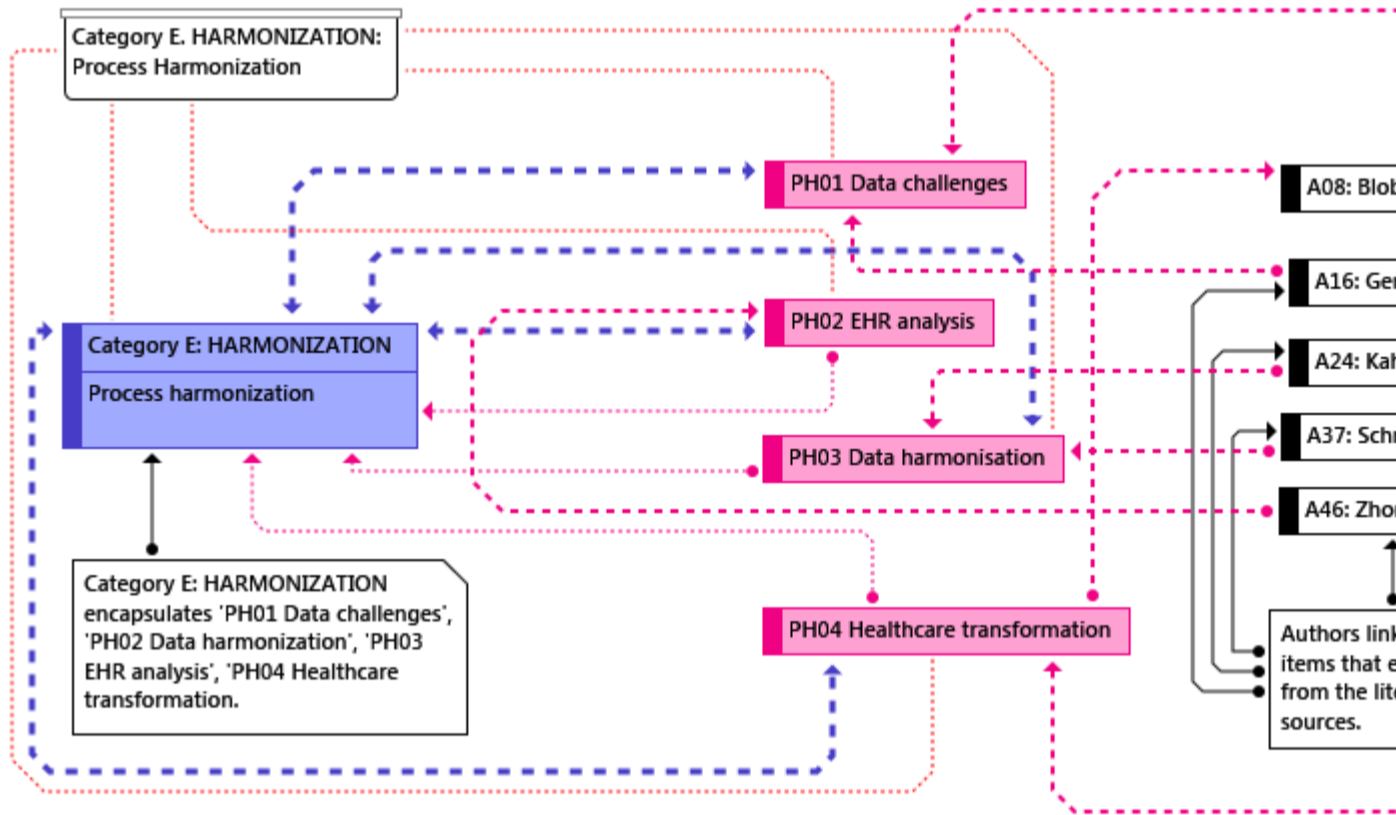
E.3. Category C: DG contingency model - Link between Category C, items and authors



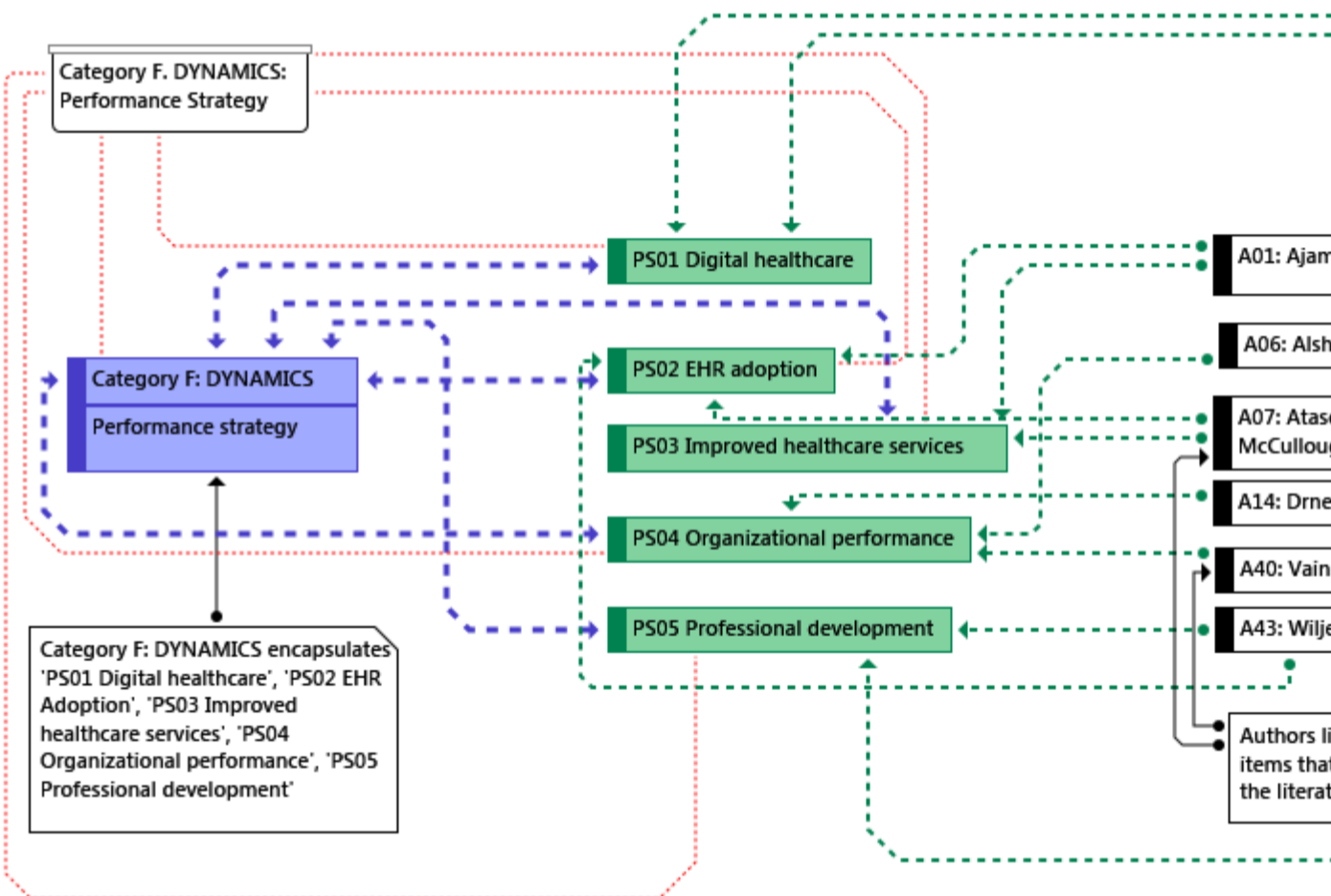
E.4. Category D: Adoption - Link between Category A, items and authors



E.5. Category E: Harmonization - Link between Category F, items and authors



E.6. Category F: Dynamics - Link between Category F, items and authors



Appendix F: Mendeley PDF Files

Mendeley Desktop

File Edit View Tools Help

Add Folders Related Sync Help

We found 16 other PDF files in this folder, would you like to review them for import?

Mendeley Literature Search

My Library

- All Documents
- Recently Added
- Recently Read
- Favorites
- Needs Review
- My Publications
- Unsorted
- Competitive Advantage
- Data Governance

Filter by Authors

- All
- Ales, Joy
- Almunawar, Mohd Nabil
- Anshari, Muhammad
- Beaulieu-Jones, Brett K.
- Boell, Sebastian K.
- Cecez-Kecmanovic, Dubravka
- Chen, Shi
- Cho, June-Suh
- Coughlan, Michael
- Cronin, Patricia
- Cuenca, L
- Desouky, Ali
- Dlamini J
- ECRI Institute
- Elqhamrawy, Sally

All Documents Edit Settings

★	●	📄	Authors	Title	Year	Published In	Added
☆	●	📄	Almunawar, Mohd Nabil; Anshari, Muhammad	Health Information Systems (HIS): Concept and Technology	2012		5/27/19
☆	●	📄	Beaulieu-Jones, Brett K.; Moore, Jason H.	Missing data imputation in the electronic health record using deeply learned autoencoders	2017	Pacific Symposium on Biocomputing	Jun 1
☆	●	📄	Boell, Sebastian K.; Cecez-Kecmanovic, Dubravka	Literature reviews and the hermeneutic circle	2010	Australian Academic and R...	Jun 2
☆	●	📄	Cronin, Patricia; Ryan, Frances; Coughlan, Michael; ...	Undertaking a literature Review: A Step by Step Approach	2008	British Journal of Nursing	10/30/19
☆	●	📄	ECRI Institute	Wrong-Record , Wrong-Data Errors with Health IT Systems	2015	PSO Navigator	Jun 1
☆	●	📄	Fleissner, Bill; Jasti, Kamalak; Ales, Joy; Thom...	The Importance of Data Governance in Healthcare AN ENCORE POINT OF VIEW THE IMPORTANCE OF DATA G...	2014		Jun 1
☆	●	📄	Gough, David; Oliver, Sandy; Thomas, James	Introducing systematic reviews	2012		Jun 2
☆	●	📄	Grandia, Larry	Healthcare Information Systems : A Look at the Past , Present , and Future	2017		5/27/19
☆	●	📄	Grossman, Thomas A	Spreadsheet Engineering: A Research Framework	2002	From the Proceedings of ...	Jun 1
☆	●	📄	Harpur, Patricia-Ann	A FRAMEWORK FOR AD HOC MOBILE TECHNOLOGY- ENHANCED	2018		Jun 2
☆	●	📄	Hassan, Mohsmmed; Desouky, Ali; Elqhamrawy, ...	Security in Smart Cities: Models, Applications, and Challenges	2019	Future Generation Co...	Jun 1
☆	●	📄	HST	The National Health Care Facilities Baseline Audit	2012		1/31/19
☆	●	📄	Katz, Paula	Lapses obscure other problems	2015		10/12/19
☆	●	📄	Kim, Hee Yeong; Cho, June-Suh	Data governance framework for big data implementation with NPS Case Analysis in Korea	2018	Journal of Business and R...	Jun 1
☆	●	📄	Kitchenham, Barbara	Procedures for Performing Systematic Reviews	2004		5/11/19