

Investigating the integration of public and private pharmaceutical supply chains

by

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Declaration

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Abstract

Investigating the integration of public and private pharmaceutical supply chains

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Health supply chains in low and medium-income countries are constantly strained due to a lack of resources and infrastructure, poor management and supply-side shortages. This often results in health care facilities experiencing stockouts, leaving patients without access to certain medicines. It is therefore important to recognise that the efficient functioning of pharmaceutical supply chains is a fundamental priority, as the failure to deliver certain important medicines can result in numerous lives being lost.

These problems have led to the implementation of various approaches by a number of healthcare organisations to address and alleviate the strain experienced by pharmaceutical supply chains. Although these approaches have had a mostly positive impact, the overall results have been disappointing. Therefore, new and innovative approaches are required to improve the supply of medicines.

In order to address the need for better functioning pharmaceutical supply chains and improved medicine supply, this study investigates the potential for the integration of public and private pharmaceutical supply chains. Specifically, the study proposes a framework to assist developing countries to identify opportunities for public-private integration in pharmaceutical supply chains. The purpose of the framework is to: (i) determine a pharmaceutical supply chain's current integration level; (ii) identify opportunities for integration; (iii) determine the risks and benefits of the opportunities; and (iv) prioritise the identified opportunities.

Extensive literature reviews are carried out on three intersecting research fields, namely: public health supply chains, pharmaceuticals and public-private integration. The insights gained during the literature reviews are integrated to develop the framework. The resulting framework consists of a guide containing descriptions of the purpose, how the framework should be used as well as templates that are required during the assessment. In addition, the framework consists of an Excel[®] file that is used for data collection and analysis.

The framework was validated through the use of questionnaires that were completed by four subject matter experts (SMEs) who have experience in the pharmaceutical and health supply chain fields. Feedback from the SMEs indicated that there is a need for such a framework and that the framework is able to identify opportunities for integration in pharmaceutical supply chains. The feedback was also used to improve and refine the framework.

An illustrative case study was carried out by applying the framework to a real world scenario. The case study provides an illustration of how the framework can be applied and the typical outcomes of using the framework to assess supply chains. The case study also enabled the identification of opportunities where the framework can be further improved.

The study makes a contribution by introducing a novel framework that enables decision makers and supply chain managers to assess pharmaceutical supply chains and identify opportunities for beneficial public-private integration.

Uittreksel

Die ondersoeking van die integrasie van openbare en private farmaseutiese voorsieningskettings

(“Investigating the integration of public and private pharmaceutical supply chains”)

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Gesondheidsvoorsieningskettings in lae en medium inkomste lande is voortdurend onder druk as gevolg van 'n gebrek aan hulpbronne en infrastruktuur, toenemende produk volumes en vraag, asook swak bestuur. Farmaseutiese voorsieningskettings is moontlik van die mees belangrike voorsieningskettings omdat die ontoeganklikheid van medisyne tot lewensverlies kan lei. As gevolg van die druk waaronder voorsieningskettings gebuk gaan, ervaar gesondheidsfasiliteite dikwels 'n tekort aan produkte en baie mense het nie toegang tot medisyne nie.

Weens hierdie probleme, het 'n aantal gesondheidsorganisasies verkeie benaderings geïmplimenter om die druk wat farmaseutiese voorsieningskettings ervaar aan te spreek en te verlig. Alhoewel hierdie benaderings meestal 'n positiewe impak maak, is die algehele resultate teleurstellend. Derhalwe is nuwe en innoverende benaderings nodig om die voorsiening van medisyne te verbeter.

Om die behoefte van beter funksionerende farmaseutiese voorsieningskettings aan te spreek, ondersoek hierdie studie die potensiaal vir die integrasie van openbare en private farmaseutiese voorsieningskettings. Die studie stel spesifiek 'n raamwerk voor wat onwikkelende lande help om geleenthede vir openbare-private integrasie in farmaseutiese voorsieningskettings te identifiseer. Die doel van die raamwerk is om: (i) die huidige integrasievlak van 'n farmaseutiese voorsieningsketting te bepaal; (ii) geleenthede vir integrasie te

identifiseer; (iii) die risiko's en voordele van die geleentheid te bepaal; en (iv) die geïdentifiseerde geleentheid te prioritiseer.

Ekstensiewe literatuuroorsigte word op drie deurkruisende navorsingsvelde uitgevoer, naamlik: openbare gesondheidskettings, farmaseutiese medisyne en openbare-private integrasie. Die insigte wat tydens die literatuuroorsigte verkry is, word geïntegreer om die raamwerk te ontwikkel. Die gevolglike raamwerk bestaan uit 'n gids met beskrywings van hoe die raamwerk gebruik moet word, sowel as template wat tydens die assessering benodig word. Daarbenewens bestaan die raamwerk uit 'n Excel[®] spreiblad wat vir data-insameling en analise gebruik word.

Die raamwerk is ge-evalueer deur die gebruik van vraelyste wat deur vier vakkundiges, met ervaring in farmaseutiese en gesondheidsvoorsieningskettingvelde, voltooi is. Terugvoer van die vakkundiges het aangedui dat so 'n raamwerk benodig word en dat die raamwerk in staat is om geleentheid vir integrasie in farmaseutiese voorsieningskettings te identifiseer. Die terugvoer is ook gebruik om die raamwerk te verbeter en te verfyn.

'n Illustratiewe gevallestudie is uitgevoer deur die raamwerk op 'n werklike wêreldsituasie toe te pas. Die gevallestudie gee 'n illustrasie van die moontlike toepassing van die raamwerk en die tipiese uitkomst van die gebruik van die raamwerk wanneer voorsieningskettings ge-assesseer word. Die gevallestudie het ook die identifisering van geleentheid waar die raamwerk verder kan verbeter, moontlik gemaak.

Hierdie studie lewer 'n bydrae deur 'n nuwe raamwerk voor te stel wat dit vir besluitnemers en verskaffingkettingbestuurders moontlik maak om farmaseutiese voorsieningskettings te evalueer en geleentheid te identifiseer vir openbare-private integrasie om sodoende die voorsieningsketting te verbeter.

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Acronyms and Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
CFA	Conceptual Framework Analysis
CMS	Central Medical Store
DGDA	Dalberg Global Development Advisors
DoH	Department of Health
EML	Essential Medicines List
GT	Grounded Theory
HIV	Human Immunodeficiency Virus
IFC	International Finance Corporation
LMIC	Low and Medium Income Country
MIT-Z LIP	Massachusetts Institute of Technology-Zaragoza International Logistics Program
NDoH	National Department of Health
NHI	National Health Insurance
OECD	Organisation for Economic Cooperation and Development
PPP	Public-Private Partnership
SME	Subject Matter Expert
STG	Standard Treatment Guideline
TB	Tuberculosis
UHC	Universal Health Care
UN Commission	United Nations Commission on Life-Saving Commodities for Women and Children, Technical Reference Team
VAP	Value-Added Partnership
VMI	Vendor Managed Inventory
WHO	World Health Organization

Chapter 1

Introduction

This chapter introduces the study context by providing the background and problem statement. The research aim and objectives are then established, after which the scope of the study is discussed. Lastly, an overview of the document layout is provided.

1.1 Background

Well-functioning supply chains are the foundation of a health system (MIT-Z ILP, 2008). According to the World Health Organization (WHO), and as manifested in the health system building blocks framework (WHO, 2010), “a well-functioning health system ensures equitable access to essential medical products, vaccines and technologies of assured quality, safety, efficacy and cost-effectiveness, and their scientifically sound cost-effective use” (WHO, 2010). The goal of public health supply chains is not only to deliver the right product at the right place and time, but also to contribute towards improving a country’s health outcomes and achieve broad development goals (such as reducing poverty and increasing productivity) (John Snow Inc., 2017; Bornbusch *et al.*, 2014). Supply chains are crucial to deliver effective health care across all sectors by enabling the availability and provision of affordable and quality products in areas that are accessible to the population (MIT-Z ILP, 2008). Furthermore, supply chains can be used to track the supply and demand which managers and policymakers can use to ensure the health system has adequate resources (MIT-Z ILP, 2008).

A comparison of product availability between Organisation for Economic Cooperation and Development (OECD) countries and low and medium-income countries (LMICs) emphasise the underperformance of health supply chains in many LMICs. In OECD countries, product availability in pharmacies is over 95 percent, whereas in LMICs, product availability at public health facilities is approximately 38 percent (MIT-Z ILP, 2008). According to the WHO (2007),

health systems across the globe are struggling to deliver satisfactory health care. Moreover, health outcomes across developing countries are unacceptably low (WHO, 2007). The vast number of people who do not have access to quality, effective medicine suffer from illnesses that can be treated or prevented (MSH, 2012). This indicates that there are fundamental problems in such health care systems (MSH, 2012).

One of the key health sector challenges is the inequitable and discriminatory access to essential medicines (WHO, 2011; Matowe, 2015). Often, those who have access to medicines receive the wrong dosage, the wrong medicine or there is insufficient stock for the amount of medicine that is required (MSH, 2012). Health supply chains in LMICs face a number of additional challenges. A large proportion of populations living in LMIC countries are impoverished and at increased risk of contracting diseases (MIT-Z ILP, 2008). According to the WHO (2011), the burden of chronic diseases is rapidly increasing which will pressurise medicine suppliers to find supply strategies that are more efficient and cost-effective. However, developing countries not only have to deal with an increase in chronic diseases, but also an increase of other diseases such as malaria, HIV/AIDS and TB (WHO, 2011). Additionally, changes in the demography (e.g. the distribution and size) and epidemiology of human populations will have an impact on the burden of disease, as well as an impact on how medicines are delivered and consumed (WHO, 2011).

Some of the major health system challenges are the shortage of human resources, resource constraints that hinder recruitment and training of staff, geographically reaching all consumers, limited or no information for forecasting and supply planning, insufficient warehouse space and distribution capacity, poor funding and management, increased complexity and increased number of products (MIT-Z ILP, 2008; Allain *et al.*, 2010; John Snow Inc., 2016; UN Commission, 2015; Caulfield and Hort, 2012; Barillas, 2005). In these situations, improving access to medicines is crucial to protecting the public's health and saving lives (UN Commission, 2015). Tetteh (2009) argues that the improvement of pharmaceutical supply chains should be regarded as a top priority as a result of its affect on the affordability, availability and acceptability of medicines. In addition, Tetteh (2009) states:

“The creation of reliable drug supply chains is critical to ensure continuous provision of affordable quality medicines....”

Lives can be saved, and quality of life improved by improving the performance of health supply chains (UN Commission, 2015). However, in order to provide equitable access to medicines and ensure health supply chains function effectively, efficiently and reliably, actors need to work together (John Snow Inc., 2016).

Various solutions, such as capacity building, supply chain strengthening, public-private engagements and vertical integration have been implemented to improve developing countries' health supply chains (Matowe, 2015; Bornbusch *et al.*, 2014; Bornbusch and Bates, 2013). However, numerous authors argue that these methods may not be sufficient, sustainable and proactive (Matowe, 2015; Allain *et al.*, 2010; Bornbusch *et al.*, 2014; USAID, 2009), and some are only applied to disease-specific programme supply chains (Kaboru, 2012) or aimed at solving a specific problem in the supply chain (USAID, 2010; UNICEF, 2016). Innovative solutions are required, for both current and future health supply chain problems (Bornbusch *et al.*, 2014; International Finance Corporation, 2011; WHO, 2011).

MIT-Z ILP (2008) made the observation that in many OECD countries, even though the public sector is the major provider of health products and services, public health supply chains rely heavily on auxiliary services provided by the private sector. Unlike developed countries, numerous LMICs health supply chains are underperforming and have less assistance from the private sector. This begs the question; could greater private engagement and/or the adoption of private supply chain best practices improve the public health supply chain (MIT-Z ILP, 2008)? According to the International Finance Corporation (2011), the scale of health care challenges has necessitated the reassessment of traditional methods of addressing health care needs. Stakeholders in sub-Saharan Africa have begun to recognise that private sector engagement should be a key aspect of any strategy aiming to improve health care (International Finance Corporation, 2011). Public-private engagement can be mutually synergistic; the public sector can leverage the auxiliary resources to improve health outcomes while the private sector fulfils social responsibility, for which it is under increased pressure (Nishtar, 2004). A number of authors (International Finance Corporation, 2011; UN Commission, 2015; MIT-Z ILP, 2008; Bornbusch *et al.*, 2014; Kaboru, 2012) argue that private sector engagement is essential to improve: (i) access to health care; (ii) efficiency, reliability and effectiveness of supply chains; and (iii) health outcomes of the country. However, supply chain integration should not be considered a panacea as public-private engagement cannot be used to solve all supply chain problems (PATH and WHO, 2013; UN Commission, 2015). Public-private engagements are not easily implemented (USAID, 2010) and the management thereof is difficult (Axelsson and Axelsson, 2006). Barriers to successful implementation include different financial streams, different information systems and databases (Axelsson and Axelsson, 2006), conflict of interests (UN Commission, 2015; Nishtar, 2004) and different governance structures (Nishtar, 2004). However, authors such as Nishtar (2004) argue that public-private engagement may be both imperative and unavoidable and that it is the governments' responsibility to improve health systems. However, according to the IFC World Bank Group (2011), the absence of public resources and the presence of a growing private sector

suggests that governments cannot improve health systems unless there is at least minimal engagement with the private sector. In order to overcome the challenges of public-private engagements, parties need to build mutual trust, foster transparency and commitment, ensure that there are mutual benefits and understand the risks associated with engagement (UN Commission, 2015; Tennyson, 2011). According to the UN Commission (2015), many private sector initiatives have already contributed to solving public health supply chain problems by increasing supply chain efficiency and providing expertise on supply chain best practices. Public health supply chains often operate alongside many other health supply chains (such as the private sector supply chain) which Bornbusch and Bates (2013) call a supply network or system. Bornbusch *et al.* (2014) argue that the multitude of supply chains and actors within the health system could be woven together into an integrated system.

Integration is defined by the Merriam-Webster Dictionary as follows: "...to form, coordinate, or blend into a functioning or unified whole..." (Merriam-Webster Inc., 1966). Supply chain integration involves cross-functional or cross-departmental interactions which are often associated with coordination, cooperation or collaboration (Chen *et al.*, 2009). There is a proliferation of definitions for 'integration' in both the supply chain and public health literature. In the public health domain, the term *integration* can be used for a number of different concepts that sometimes overlap (Contandriopoulos *et al.*, 2003). Examples of these concepts include integrated service delivery (PwC, 2007), integration of care (Contandriopoulos *et al.*, 2003), clinical integration (Miller, 1996; Contandriopoulos *et al.*, 2003), physician integration (Miller, 1996), functional integration (Miller, 1996; Contandriopoulos *et al.*, 2003) and integrated national health system (Reddy *et al.*, 2011; Arbulo *et al.*, 2015).

In the supply chain literature, an integrated supply chain can be defined as: "An association of customers and suppliers who work together to optimize their collective performance in the creation, distribution, and support of an end product" (National Research Council *et al.*, 2000). According to the National Research Council *et al.* (2000), the objective of supply chain integration is "to focus and coordinate the relevant resources of each participant on the needs of the supply chain and to optimize the overall performance of the chain". This integration can also be achieved by a focal company expanding its existing operations into related activities. In this context, it is possible to distinguish between horizontal and vertical integration (Axelsson and Axelsson, 2006). Vertical integration takes place when an organisation assumes control of sequential steps in a supply chain (Axelsson and Axelsson, 2006; Roberts *et al.*, 2010). For example, an organisation could take control of its suppliers (backward vertical integration) or its distributors (forward vertical integration) (Roberts *et al.*, 2010). In these supply chains, information and activities are visible up and down the chain, the number of steps in the process

are fewer and there is greater coordination between the levels of the supply chain (USAID, 2009). On the other hand, horizontal integration occurs when two or more organisations, that are at the same point in the supply chain, merge (Roberts *et al.*, 2010). An example of horizontal integration is when two companies that produce similar products, for example, when two retailers selling similar clothing items, merge.

The term “supply chain integration” has also been used in various ways in public health supply chain literature and practice. The focus has predominantly been on (i) integrating disease or program specific supply chains such as immunisation or TB supply chains (Bornbusch and Bates, 2013; PATH and WHO, 2013; Kaboru, 2012; USAID, 2009); (ii) vertical integration (John Snow Inc., 2012); and (iii) product integration (horizontal integration) where some logistics functions of different commodities are combined (UNICEF, 2016; USAID, 2009). The various forms of public health integration are frequently pictured along a continuum of inter-organisational relationships (Axelsson and Axelsson, 2006). It ranges from organisations that are completely autonomous, through intermediate consolidations to the complete merging of organisations (Axelsson and Axelsson, 2006). The WHO’s *Optimize*¹ project horizontally integrated vaccine supply chains with other health commodity supply chains (PATH and WHO, 2013). According to PATH and WHO (2013), this may result in efficiency and effectiveness improvements as well as economies of scale and improved supply chain performance. According to a framework developed by Axelsson and Axelsson (2006), collaboration can be defined as the combination of a high degree of horizontal integration and a low degree of vertical integration. This type of integration is accomplished via voluntary agreements and the willingness to work together (Axelsson and Axelsson, 2006). According to John Snow Inc. (2016): “creating synergies between the public and private requires a deliberate policy and strategic framework, a mutual understanding of the benefits of private sector engagement, and the capability to tailor solutions to local environments”.

1.2 Problem Statement

Public-private supply chain integration, as well as a combination of horizontal supply chain integration and collaboration, may assist with the improvement of pharmaceutical supply chains by increasing the efficiency and effectiveness, thereby addressing current and impending supply chain challenges. However, before public-private supply chain integration can be implemented, supply chains need to be assessed in order to identify whether there are opportunities for integration. Existing frameworks that aim to identify such opportunities

¹For more information see: http://www.who.int/immunization/programmes_systems/supply_chain/optimize/resources/en/

for public-private engagement and integration in supply chains seem to lack the following: (i) the provision of a step-by-step approach to identify opportunities for public-private engagement; (ii) the inclusion of various forms of public-private engagement; (iii) an assessment of end-to-end in-country public supply chains; and (iv) the aim to improve not only underperforming supply chain areas but also well performing supply chain areas.

In summary:

- (i) Pharmaceuticals is an essential component of the health system.
- (ii) Public health supply chains face a great deal of challenges that affect the health of the population.
- (iii) Numerous solutions have been implemented. However, according to some authors (Matowe, 2015; Allain *et al.*, 2010; Bornbusch *et al.*, 2014; US-AID, 2009), these solutions are not sustainable, sufficient nor proactive.
- (iv) Public-private supply chain integration could improve the effectiveness and efficiency of pharmaceutical supply chains and address supply chain problems.
- (v) There is a lack of frameworks that provide supply chain managers the guidance to identify opportunities for public-private integration and engagement along the supply chain.

Therefore, this research proposes that the integration of public and private pharmaceutical supply chains needs to be investigated in order to support integration where it could address supply chain challenges and lead to improvements in efficiency and effectiveness. In addition, this research proposes the development of a conceptual framework which aims to assist developing countries to evaluate pharmaceutical supply chains in order to: (i) determine the supply chain's current level of integration; (ii) identify where there are opportunities to integrate with the private sector; (iii) determine the impact of the potential engagement in terms of the risks and benefits; and (iv) prioritise areas where opportunities of integration have been identified.

1.3 Research Aim

The aim of this research is to develop a framework to analyse public pharmaceutical supply chains in order to identify, evaluate and prioritise possible opportunities for synergies between the public and private sectors that may improve the efficiency and effectiveness of public pharmaceutical supply chains.

1.4 Research Objectives

The following objectives were identified as requirements for developing such a framework, thus supporting the above stated research aim.

1. Review literature pertaining to public health supply chains, pharmaceuticals and public-private integration in order to contextualise the problem with which this research inquiry is concerned, as well as to provide direction for the framework development. Literature that were analysed include:
 - (i) Health supply chain challenges and solutions.
 - (ii) Pharmaceutical supply chains.
 - (iii) Public and private engagement in pharmaceutical supply chains.
 - (iv) Supply chain integration.
 - (v) Existing frameworks and methodologies that have been developed to identify opportunities for public-private integration and engagement.
2. Develop a conceptual framework to evaluate pharmaceutical supply chains to identify opportunities for integration
3. Validate and improve the conceptual framework through engagement with subject-matter experts (SMEs).
4. Perform an illustrative case study by applying the framework to the South African context.
5. Discuss the impact of the research and opportunities for future research.

Section 1.6 outlines the document, along with an indication of the objectives that will be met by each chapter.

1.5 Scope of Study

The following points delineate the scope of the study:

- (i) The scope of this study focuses on three overlapping fields of research, namely: public health supply chains, pharmaceuticals and public-private integration.
- (ii) The supply chain challenges and problems, as discussed in Chapters 1 and 3, that need to be addressed occur in developing countries. Therefore, the framework is created to be able to assess pharmaceutical supply chains from the perspective of developing countries.
- (iii) In this study the private sector refers to the private for-profit sector.

1.6 Document Outline

Table 1.1 shows how the document is structured and what each section contains. Table 1.2 gives an indication of where each objective is addressed in the document.

Table 1.2: An indication of where objectives are met

Objective	Chapter
1. Literature review of relevant topics	3
2. Develop a conceptual framework to evaluate pharmaceutical supply chains	4 & 5
3. Validate the conceptual framework by performing an exploratory case study	6
4. Perform an illustrative case study by applying the framework to the South African context	7

1.7 Chapter 1 Conclusion

This chapter introduces the study context by providing the background context within which the study is formulated, and the problem statement. From the context and problem statement, the research aim and objectives are established and described. Lastly, the scope of the study is discussed and the layout of the document is provided. In this chapter the study proposes the investigation of public-private pharmaceutical supply chain integration. In addition, the study proposes the development of a framework that will enable developing countries to evaluate pharmaceutical supply chains in order to identify opportunities for integration.

Table 1.1: An outline of the document

Chapter	Chapter Content
Chapter 2: Methodology	<ul style="list-style-type: none"> i. Thesis strategy detailing the purpose of the research and the research approach. ii. Proposed steps to develop the conceptual framework.
Chapter 3: Literature Review	<p>Health Supply Chains</p> <ul style="list-style-type: none"> i. Overview of the challenges that public health supply chains are facing. ii. Overview of the methods used to improve public health supply chains and the shortcomings of these methods. <p>Pharmaceutical Supply Chains</p> <ul style="list-style-type: none"> i. Overview of the importance of pharmaceutical supply chains. ii. Overview of PSC structures. iii. Overview of how PSCs function. iv. Overview of how PSCs are managed. <p>Public-Private Engagements in PSCs</p> <ul style="list-style-type: none"> i. Overview of why the public and private sectors should work together. ii. Overview of public-private engagement challenges. iii. Overview of how engagement challenges can be overcome. iv. Overview of the types of public-private engagements. v. Examples of public-private engagements. <p>Supply Chain Integration</p> <ul style="list-style-type: none"> i. Overview of supply chain integration. ii. Definition of supply chain integration. iii. An introduction to public-private supply chain integration.
Chapter 4: Existing Frameworks and Methodologies	<ul style="list-style-type: none"> i. Review of literature to determine what methods have been used to identify opportunities of integration. ii. Determine whether the research aim has been met by other authors. iii. Identify research gaps. iv. Adapt research gaps to framework criteria.
Chapter 5: Preliminary Framework Development	<ul style="list-style-type: none"> i. Overview of the methodology used to develop the framework. ii. The framework criteria are met by selecting the most appropriate solution. iii. The individual steps of the framework are determined. iv. The individual steps are integrated to form the preliminary framework.
Chapter 6: Framework Validation	<ul style="list-style-type: none"> i. Discussion on the internal validation that was carried out. ii. Discussion on the external validation that was carried out.
Chapter 7: Final Framework	<ul style="list-style-type: none"> i. The final framework is presented. ii. Each phase of the framework is discussed.
Chapter 8: Illustrative Case Study	<ul style="list-style-type: none"> i. Overview of the illustrative case study scope. ii. Overview of the case study context. iii. An illustration of how the framework can be applied to identify opportunities for integration. iv. A discussion on the opportunities to further improve the framework as identified during the case study.
Chapter 9: Conclusion & Future Work	<ul style="list-style-type: none"> i. Summary of the research ii. Discussion on how the research objectives are met. iii. Limitations of the research study. iv. Recommendations for future work.

Chapter 2

Research Methodology

The objective of this chapter is to outline the approach that was followed to develop a framework as stated in the research aim and objectives (Sections 1.3 and 1.4). This chapter is divided into two sections: the research design (Section 2.1) provides an overview of the research purpose (Section 2.1.1) and approach (Section 2.1.2). Thereafter, Section 2.2 describes the research strategy, and how the conceptual framework analysis methodology designed by Jabareen (2009) was adapted for the purpose of this dissertation.

2.1 Research Design

The purpose of a research design is “to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible” (De Vaus, 2001). A research design provides a framework for the collection and analysis of data (Bryman and Bell, 2014). The research design is discussed in terms of the research purpose (Section 2.1.1) and the research approach (Section 2.1.2).

2.1.1 Purpose of Research

The purpose of research can be classified into one of three categories (Saunders *et al.*, 2009):

- (i) Exploratory Research: as the name suggests, exploratory research is conducted to explore the identified problem (Singh, 2007). In exploratory research, the researcher asks questions, seeks new insights and assess phenomena from a new perspective (Saunders *et al.*, 2009). Exploratory research is useful when the researcher wants to clarify their understanding of the identified problem (Saunders *et al.*, 2009). There are three dominant ways of conducting exploratory research: reviewing literature, interviewing subject-matter experts and conducting focus group interviews (Saunders *et al.*, 2009).

- (ii) Descriptive Research: descriptive research asks the question ‘what is going on?’ (De Vaus, 2001). The purpose of descriptive research is “to portray an accurate profile of persons, events or situations” (Robson, 2005). It does not attempt to establish causal relationships between variables. Descriptive research encompasses descriptive statistics, such as population censuses, time studies, employment statistics or the frequency of occurrences (Singh, 2007; De Vaus, 2001). Competent descriptions can challenge accepted assumptions about the way things are and can provoke action (De Vaus, 2001).
- (iii) Explanatory Research: The focus of explanatory research is asking ‘why’ questions (De Vaus, 2001). Explanatory research can be described as research that aims to find causal relationships between variables (Saunders *et al.*, 2009). Answering ‘why’ questions requires developing causal answers. Causal explanations maintain that phenomenon X is influenced by factor Y (De Vaus, 2001).

The purpose of this research is exploratory for the following reasons:

1. During the literature review, limited research was found on the integration of pharmaceutical supply chains.
2. Not only has little research been done, but very few frameworks were found that have been developed to facilitate the integration of pharmaceutical supply chains. A number of research gaps were found in Chapter 4 regarding the existing frameworks.
3. Engagement between the public and private sectors is a complex endeavour due to the risks of public-private engagement.

2.1.2 Research Approach

Research approaches can generally be divided into two groups, namely quantitative and qualitative research (Bryman and Bell, 2014).

The main difference between quantitative and qualitative approaches is that quantitative research focuses on the collection and analysis of numerical data, whereas qualitative research focuses on words rather than generating or using numerical data (Saunders *et al.*, 2009; Bryman and Bell, 2014). Another distinction between the two approaches is that quantitative research is generally deductive, which means the emphasis is on testing theories. Qualitative research, on the other hand, is inductive where the emphasis is on generating theories rather than proving theories (Bryman and Bell, 2014).

The research approach of this dissertation is qualitative; the development and validation of the framework involved the use of non-numeric methods, which are generally inductive in nature.

2.2 Research Strategy

The research strategy describes the logical sequence of steps that were followed during the research process. An overview of grounded theory and Jabareen's (2009) conceptual framework analysis (CFA) methodology is provided in Section 2.2.1. In addition, Section 2.2.2 discusses how the CFA methodology was adapted for the purpose of this dissertation.

2.2.1 Grounded Theory

Grounded theory (GT) is a methodology that was introduced by Glaser and Strauss (1967). It was subsequently adapted in the literature for the purposes of building theory from data (Corbin and Strauss, 1990; Strauss and Corbin, 1994; Whitehead, 2013; Corbin and Strauss, 2012). GT can be described as “theory that was derived from data, systematically gathered and analysed through the research process” (Strauss and Corbin, 1998). Similar to other qualitative research methods, GT involves the collection of data from sources such as interviews, documents, books and observations (Corbin and Strauss, 1990). “The procedures of grounded theory are designed to develop a well integrated set of concepts that provide a thorough theoretical explanation of social phenomena under study” (Corbin and Strauss, 1990). GT has been modified over the years, with multiple versions now existing (Whitehead, 2013). The CFA method proposed by Jabareen (2009) was used as a guide for this thesis' research strategy. The CFA method is used to build conceptual frameworks based on the GT method (Jabareen, 2009). Reasons for choosing GT and CFA include the following:

- (i) GT enables researchers to capture complex contexts (Bryman and Bell, 2014).
- (ii) It facilitates the linking of theory with practice (Bryman and Bell, 2014).
- (iii) GT strategies allow researchers to identify gaps in their research during early research stages (Charmaz, 2006).
- (iv) Data is analysed systematically (Hussein *et al.*, 2014).
- (v) GT and CFA are based on an inductive approach (Jabareen, 2009; Glaser and Strauss, 1967; Randall and Mello, 2012).
- (vi) GT is an appropriate method to research supply chain management because “it uses a holistic and process-oriented method to determine the rules, processes, and strategies upon which supply chains operate” (Randall and Mello, 2012).
- (vii) The success of the GT approach has led to an increase in research where GT is used to explain supply chain phenomena (Randall and Mello, 2012)

The definition of the term ‘conceptual framework’ is unclear and imprecise (Jabareen, 2009). Jabareen (2009) defines a conceptual framework as “a network, or ‘a plane’ of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena”. The conceptual framework analysis steps suggested by Jabareen (2009) can be summarised as follows:

1. Map the selected data sources: an extensive review of multidisciplinary literature should be done regarding the phenomena in question.
2. Read and categorise the data extensively: the literature identified in step 1 is read and categorised according to importance and discipline.
3. Identify and name concepts: the literature is reread to allow the researcher to ‘discover’ concepts.
4. Deconstruct and categorise the concepts: each concept is deconstructed into its main attributes and characteristics.
5. Integrate the concepts: similar concepts are grouped together to form a new concept.
6. Synthesise and re-synthesise: concepts are iteratively synthesised and re-synthesised into a conceptual framework until the framework is well-defined.
7. Validate the conceptual framework: the conceptual framework is validated by ‘outsiders’, i.e. other academics or practitioners.
8. Rethink the conceptual framework: the conceptual framework may be revised according to new literature or comments.

The CFA methodology was used as a guide in developing the framework in this research. As a result slight adjustments were made to the methodology which are further discussed in Section 2.2.2.

2.2.2 Methodology

An adapted version of the CFA methodology was used for this dissertation. Figure 2.1 provides an illustration of the research methodology which is adapted from Jabareen (2009). Each phase of the research methodology is further discussed below.

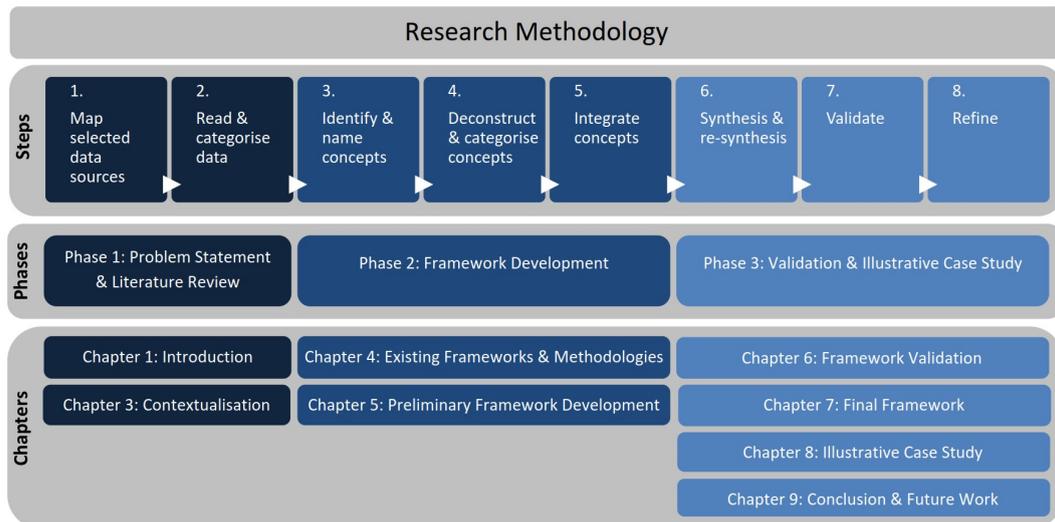


Figure 2.1: An overview of the research methodology

2.2.2.1 Phase 1: Problem Statement and Contextualisation

During Phase 1 of the methodology, information was gathered and read in order to formulate a clear definition and understanding of the problem at hand and to identify the research objectives. This includes both a preliminary and comprehensive literature review of the identified fields of research which are essential to finding a solution to the research problem.

Chapter 1: Background to the research problem is provided through a preliminary literature review. In addition, the research aim, research objectives and the scope of the study is discussed. The preliminary literature review and research objectives help to determine what fields of research should be focused on to obtain a good foundation of knowledge so that the research aim can be achieved.

Chapter 3: Three fields of research were identified during the preliminary literature review in Chapter 1, which are indicated by the blue shaded areas of Figure 2.2. An extensive literature review was carried out on these fields of research to provide further background information and form a deeper understanding of the problem at hand. Literature was gathered through Google Scholar, Scopus, the Stellenbosch University library database and official websites of health and supply chain organisations such as the WHO, USAID, JSI Inc. and MSH.

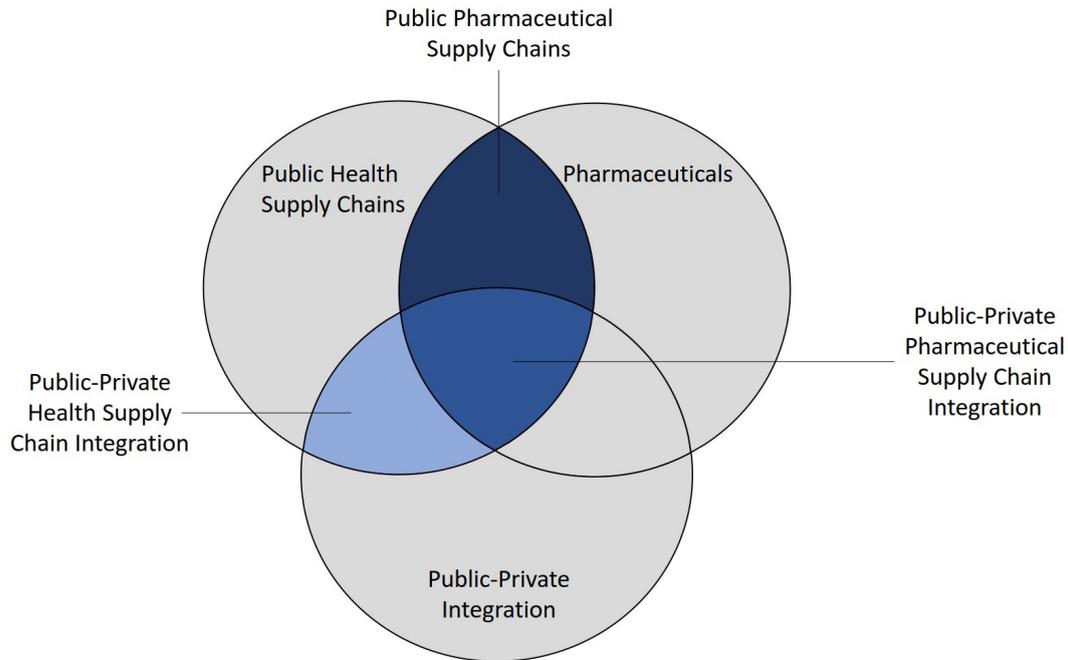


Figure 2.2: Overlapping fields of research

2.2.2.2 Phase 2: Framework Development

In Phase 2 of the methodology, criteria are identified that the framework should meet. These criteria form the main attributes of the framework. The solutions to the criteria are then deconstructed into smaller steps. Various methods for each step is investigated in order to determine which are the most appropriate for the framework. Lastly, the selected methods and solutions to the criteria are integrated to form the preliminary framework.

Chapter 4: A literature review is carried out on existing frameworks and methodologies that aim to identify opportunities for public-private engagement in health supply chains in order to:

1. Determine what methods have been used to identify opportunities for public-private health supply chain integration or public-private engagement.
2. Determine whether the aim of this dissertation has already been achieved by another author.
3. Identify the research gaps of the frameworks.
4. Adapt the identified research gaps to framework criteria.

Four different frameworks and methodologies, that aim to identify opportunities for public-private engagement, were identified for the review. From the review, the following criteria were derived from research gaps:

1. A clear step-by-step approach is needed to identify opportunities for public-private pharmaceutical supply chain integration.
2. The framework should include various forms of public-private engagements.
3. The framework should assess the end-to-end in-country public pharmaceutical supply chain for integration opportunities.
4. The framework should aim to improve any supply chain area, not just underperforming areas.

Chapter 5: The preliminary framework is developed by first meeting the criteria from Chapter 4. The various possible solutions that may meet the criteria are investigated, after which the best solution is chosen for each criteria. The most important criteria is identifying an appropriate approach for the framework. In Section 5.2.1 the DRIVE approach is identified as the most appropriate approach to develop the framework. This section provides a review of the methods that have been used for each step of the DRIVE approach as well as a discussion of the relevance of the methods to the framework. Finally, the most appropriate methods are chosen, which are then integrated to form a preliminary framework.

2.2.2.3 Phase 3: Validation & Illustrative Case Study

The aim of Phase 3 of the methodology is to validate and improve the framework by consulting individual subject-matter experts who have knowledge and practical experience in the research field addressed in this study.

Chapter 6: The preliminary framework is validated by four SMEs. The preliminary framework is resynthesised according to the feedback, insights and recommendations made by the SMEs.

Chapter 7: The final framework is presented and discussed.

Chapter 8: An illustrative case study is conducted to illustrate how the framework can be used to identify any opportunities for improvement that it may still have. The identified opportunities can then be used as recommendations for future work.

Chapter 9: The delimitations and limitations of the framework are discussed, and the recommendations and future work are addressed.

2.3 Chapter 2 Conclusion

This chapter discusses the purpose of the research (Section 2.1.1), the research approach (Section 2.1.2) as well as the reasons for using the GT approach

(Section 2.2.1). A short introduction is given on the CFA method by Jabareen (2009), which is adapted and used to execute the three phases of this thesis (Section 2.2.2). The three phases include: Phase 1: Problem Statement and Contextualisation; Phase 2: Framework Development; and Phase 3: Validation & Illustrative Case Study.

Chapter 3

Contextualisation: Public Health Supply Chains, Pharmaceuticals and Public-Private Integration

In this chapter a literature review is carried out on the following subjects: (i) an overview of health supply chains, including the challenges health supply chains face in developing countries as well as the methods used to improve health supply chains; (ii) the importance of pharmaceutical supply chains, and the structure, functioning and management of pharmaceutical supply chains; (iii) an overview of public-private engagements in pharmaceutical supply chains; and (iv) a review of supply chain integration, the definition of supply chain integration and an introduction to public-private supply chain integration.

3.1 Health Supply Chains

This section explores the difficulties that health supply chains in developing countries face. In addition, a short overview of the methods used to reduce the effects of these problems are provided along with the shortcomings of these methods.

3.1.1 Current Health Supply Chain Challenges

Health supply chains are a crucial element of a health system and are vital for the consistent and continuous delivery of high quality, affordable health products that are available and accessible to the countries' population (MIT-Z ILP, 2008). However, the majority of developing countries have poorly functioning health supply chains (Allain *et al.*, 2010) which result in poor health outcomes (MIT-Z ILP, 2008), increased costs, stockouts, wastage of products and redundant efforts (UN Commission, 2015). Health supply chains function poorly due to a lack of the required resources to ensure the accessibility,

availability and affordability of health commodities (UN Commission, 2015). Developing countries often lack reliable information systems as well as warehousing and distribution resources (MIT-Z ILP, 2008). Health supply chains need reliable and comprehensive data in order for managers to manage supply chain activities and functions, make decisions and improve the supply chain's efficiency (Matowe, 2015). In addition, the data is used to determine the quantity of products that the population needs and thereby ensuring that each health facility has enough stock available (Matowe, 2015). Due to the lack of adequate data and information systems for supply planning and forecasting (MIT-Z ILP, 2008; Matowe, 2015; UN Commission, 2015), health supply chains in developing countries are often unresponsive (UN Commission, 2015) and inefficient resulting in product stockouts (Matowe, 2015).

Another challenge is the absence of trained staff (Allain *et al.*, 2010). As a result, untrained staff and unqualified staff are required to perform supply chain tasks (Matowe, 2015; Allain *et al.*, 2010) which leads to clinical staff spending more time on completing supply chain tasks rather than helping sick or injured patients (Allain *et al.*, 2010). Furthermore, public health supply chains are under increasing pressure due to escalating volumes of products flowing through these supply chains as well as an escalating demand for health products and services Donato *et al.* (2016); Allain *et al.* (2010); Bornbusch *et al.* (2014). Allain *et al.* (2010) argue that an increase in the demand for health products and services induces further complexity in health supply chains which consequently increases costs. Increased donor funding also contributes to the escalating volume of products in health supply chains (Bornbusch *et al.*, 2014). While public supply chains are trying to manage these increases, civil society and partners demand better performance and cost effectiveness (Bornbusch *et al.*, 2014). Meeting the increasing need for health services and products necessitates the implementation of robust regulatory oversight in order to ensure high quality products are provided (Donato *et al.*, 2016). These factors place additional pressure on both the public and private sector health supply chains (Donato *et al.*, 2016).

The majority of public health systems comprise of numerous vertical supply chains which supply different health programmes (Allain *et al.*, 2010). Each of the vertical supply chains receive different amounts of donor funds and attention (Allain *et al.*, 2010). Some governments create separate supply chains for health programmes so that the supply chain's activities, information and investments are aligned with the health programme's objectives and outcomes (Allain *et al.*, 2010). In order to compensate for the public sector's poor performing supply chains and to implement health reforms, some investors have developed alternative vertical supply chains (Bornbusch *et al.*, 2014). However, very few public sectors can accommodate numerous vertical supply chains (Allain *et al.*, 2010). The existence of numerous vertical

supply chains in health systems have been labelled as inefficient and counter-productive methods to strengthening public health systems (Bornbusch and Bates, 2013) and have been criticised for promoting fragmentation (O’Hanlon *et al.*, 2017). Moreover, the development of these vertical supply chains further increase the health system’s complexity (Allain *et al.*, 2010) and result in duplicated efforts and resources (Village Reach, 2015). International organisations such as USAID (USAID, 2009), PATH (WHO and PATH, 2013), the World Health Organization and VillageReach (Village Reach, 2015) have been involved in initiatives where vertical supply chains are merged with the anticipation that redundancies will decrease and that the efficiency and performance of the supply chain will improve (Allain *et al.*, 2010).

Other problems that contribute to poorly functioning health supply chains include the inability to reach all populations, inadequate and insufficient transport, distribution and warehousing, stockouts and unreliable cold chains (MIT-Z ILP, 2008; UN Commission, 2015; Allain *et al.*, 2010). In essence, the public health supply chains in developing countries often lack the required resources and capacity to provide a continuous supply of health products, especially when the volume and complexity of products keep increasing (MIT-Z ILP, 2008).

3.1.2 Methods Used to Solve Health Supply Chain Challenges

Various international organisations have saved countless lives (International Finance Corporation, 2011) by contributing financially (Allain *et al.*, 2010) and promoting the purchase and distribution of pharmaceuticals, including that of malaria, tuberculosis and HIV (International Finance Corporation, 2011). However, these funds fluctuate, are often allocated to disease-specific programmes and the health programme resources may not be effectively shared, resulting in the underutilisation of resources (Allain *et al.*, 2010). According to International Finance Corporation (2011) donor funds may not be a sufficient and sustainable method to address future health challenges.

A great deal of investment and effort has been dedicated to addressing health supply chain problems in the form of capacity building and supply chain strengthening (Matowe, 2015; Bornbusch *et al.*, 2014). Kaplan (2000) define capacity building as “the development of the ability of individuals and organisations or organisational units to perform functions effectively, efficiently and sustainably”. Capacity building and supply chain strengthening have been successfully implemented in some cases where the efficiency (Matowe, 2015) and the performance of the health supply chain improved, resulting in a greater availability of health products (Bornbusch *et al.*, 2014). Examples of successful

cases include countries such as Rwanda and Zambia where it has been reported that the pharmaceutical supply chains operate efficiently (Matowe, 2015). In addition, the Medical Stores Department of Tanzania was improved to operate at a level that is better than expected (Matowe, 2015). However, Matowe (2015) argues that capacity building has been remarkably unsuccessful at improving the efficiency of health supply chains. Matowe (2015) cites cases such as that of Malawi, where the Central Medical Store (CMS) received technical assistance from the Global Fund for more than two years, yet the CMS continuously still encounters complications and problems. Similarly, Bornbusch *et al.* (2014) argues that the results from capacity building and supply chain strengthening initiatives are tenuous and that decision makers need to question whether the solutions that are currently implemented work as well as they should and whether they will be able to address future challenges. Due to the ineffectiveness of capacity building projects, Matowe (2015) argues that this approach needs to change. However, Matowe (2015) offers no suggestion as how capacity building approaches should change or how this approach can be improved.

According to Bornbusch *et al.* (2014) too many governments lack the expertise to operate supply chains and that the operation of supply chains is therefore not the government's core competency. Governments should rather be responsible for the provision of oversight, guidance and vision such that health supply chains can achieve the necessary results (Bornbusch *et al.*, 2014). In other words, the government's core competency should be a stewardship role (Bornbusch *et al.*, 2014). As a steward it is not the government's responsibility to control facilities directly, but to facilitate the coordination and engagement of various actors such that common goals can be collectively achieved (Bornbusch *et al.*, 2014).

Currently, supply chain integration seems to be the favoured method of improving health systems overall as well as improving health supply chain efficiencies (Bornbusch and Bates, 2013). Within the health sector the term "supply chain integration" usually refers to two types of integration, namely product integration (USAID, 2011) (also known as horizontal integration (PATH and WHO, 2013)) and vertical integration (Rai *et al.*, 2006). Product integration involves the consolidation of vertical health programme supply chains (USAID, 2011). On the other hand, vertical integration refers to "the integration of information flows, physical flows, and financial flows between a firm and its supply chain partners" (Rai *et al.*, 2006). When referring to supply chain integration in the health supply chain domain, it generally refers to vertical integration. According to John Snow Inc. (2012) and USAID (2011) vertically integrated health supply chains have six attributes, including: (i) agility; (ii) clear role and responsibilities; (iii) aligned objectives; (iv) streamlined processes; (v) collaboration and trust amongst supply chain actors; and (vi)

visibility of information. Although product integration does improve supply chain efficiency and reduces complexity and redundancy, it does not however improve the availability of health products (USAID, 2009; John Snow Inc., 2012). Integrating supply chains improves customer service and supply chain performance, and reduces cost (USAID, 2009). In opposition to USAID (2009), van Olmen *et al.* (2010) argue that merging vertical supply chains creates weak links in the supply chain in areas such as distribution, stock management and ordering systems. Ultimately, van Olmen *et al.* (2010) argue that the weak links will weaken the entire supply chain.

Even though product and supply chain integration have improved numerous health supply chains as discussed in case studies by John Snow Inc. (2012), USAID (2011) and WHO and PATH (2013), several questions remain unanswered. For instance, will vertical supply chain integration be able to address future health supply chain problems, taking into account that the volume and number of health commodities is increasing (Donato *et al.*, 2016; Allain *et al.*, 2010; Bornbusch *et al.*, 2014), demographics, such as population growth, are changing (WHO, 2011), the demand for health services are increasing (Allain *et al.*, 2010) and the burden of disease is increasing (WHO, 2011)? By examining the documents that are supplied by supply chain integration advocates, such as WHO, PATH, USAID and JSI, it is unclear what resources developing countries would require to implement supply chain integration. Naturally, the resources required for supply chain integration will differ from country to country (USAID, 2011), however by investigating the case studies by John Snow Inc. (2012), USAID (2011) and WHO and PATH (2013) it seems as though substantial physical and financial resources are needed for the implementation of supply chain integration. This raises the question of how developing countries can obtain the required resources to implement product or vertical supply chain integration when there is a lack of resources; whether developing countries should rely on NGOs and how health supply chains can be further improved if integration has already been implemented.

Bornbusch and Bates (2013) argue that private sector research indicates that multiplicity is currently the favoured method to improve supply chain efficiencies. Bornbusch and Bates (2013) defines multiplicity as “structuring a supply system to take advantage of multiple supply chains or segments to reduce risk and maintain supply”. Multiplicity has, to an extent, been applied to health supply chains through the use of public-private initiatives which involves the public sector utilising the strengths of the private sector (MIT-Z ILP, 2008; UN Commission, 2015). Looking at existing literature, it is apparent that public-private initiatives do not aim to improve an entire health supply chain as Bornbusch and Bates (2013) suggest. Currently, public-private initiatives aim to resolve specific supply chain areas that are underperforming or are problematic (USAID, 2010; UNICEF, 2016). Public-private initiatives

are also predominantly carried out in vertical disease-specific supply chains due to increased donor funding for disease-specific programmes (Kaboru, 2012). In order to ensure the availability of products and address current and future health supply challenges, more efficient supply chain strategies need to be implemented (WHO, 2011). In other words, reformists and decision makers need to establish new and innovative supply systems (WHO, 2011) and adopt new models and frameworks (Allain *et al.*, 2010).

3.2 Pharmaceutical Supply Chains

In order to narrow the scope, this thesis will focus on pharmaceutical supply chains for the reasons discussed in Section 3.2.1. After the reasons for focusing on pharmaceutical supply chains have been discussed, an overview is provided on the structure of pharmaceutical supply chains, followed by the functions of pharmaceutical supply chains and the management of pharmaceutical supply chains.

3.2.1 The Importance of Pharmaceutical Supply Chains

Tanzania is one of the countries that was seriously affected by the HIV and AIDS pandemic (Kamuzora, 2011). According to the United Nations Programme on AIDS (UNAIDS) statistics, roughly 200 000 people were enrolled to receive treatment from December 2009 (Kamuzora, 2011). Therefore, ensuring that a continuous supply of ARVs is delivered to the right facilities, in the right quantities is crucial to successfully treating patients and the success of the programme (Kamuzora, 2011). Pharmaceuticals are a fundamental component of the health system. The inaccessibility thereof could indicate failure on the part of the health sector and the government (Barillas, 2005). Medicines are essential for a well functioning health system for the following reasons (MSH, 2012): (i) medicine improves population health and saves lives; (ii) medicines advocate participation and trust in the health system; (iii) medicines are expensive; (iv) medicines are unlike other products; and (v) definite improvements can be made in the supply and use of medicines.

The ability of a health system to successfully respond to health problems largely depends on the availability of pharmaceuticals (Barillas, 2005). Matowe (2015) argues that the accessibility of medicines should be linked to pharmaceutical supply chain management systems because it facilitates efficient distribution, procurement and use of medicines. In addition to the wastage of scarce resources, the occurrence of failures in pharmaceutical supply chains can result in stockouts that could have life-threatening consequences (WHO, 2006). In 2004 it was estimated that approximately 2 billion people did not have access to essential medicines on a regular basis, in addition it was argued that 10 mil-

lion lives could be saved annually by addressing the lack of access to medicines (WHO, 2004; Strengthening Pharmaceutical Systems (SPS), 2011). According to Clark and Barraclough (2010) the improvement of supply management can drastically improve the availability of pharmaceuticals. Tetteh (2009) argues that the improvement of pharmaceutical supply chains should be considered a top priority due to the effect it has on the acceptability, affordability and availability of medicines.

3.2.2 Pharmaceutical Supply Chain Structure

The goal of any health supply chain is to improve a population's health outcomes (John Snow Inc., 2017). In the case of pharmaceutical supply chains this is achieved by ensuring that all activities are seamlessly linked to create a network that delivers the right pharmaceuticals in the right quantities and conditions, to the right facilities at the right time, for the lowest possible cost (John Snow Inc., 2017; WHO, 2011). In the majority of LMICs, public and private organisations exist side-by-side as distribution channels for pharmaceuticals with a number of flows between the two (WHO, 2011). Health supply chains consist of levels, functions and partners (John Snow Inc., 2012). Activities are carried out at multiple levels, including national, regional, central, district and facility level (John Snow Inc., 2012). This is due to the fact that health facilities and retail pharmacies do not have a lot of space to keep stock (WHO, 2011). Therefore, supplies are periodically received from wholesalers in the private sector and regional or district warehouses in the public sector (WHO, 2011). This results in multiple levels of warehouses and distribution between manufacturers and patients (WHO, 2011). Functions are the activities performed at individual links of an interconnected supply chain such as procurement, storage, product selection and distribution. Although pharmaceutical supply chains are organised slightly differently in various countries, Figure 3.1 illustrates the general structure of pharmaceutical supply chains (WHO, 2011; MSH, 2012).

The number of entities at each supply chain level, the governance, ownership and function of each entity varies significantly from country to country (WHO, 2011). The optimal number of levels is dependant on the size of the population, geographical factors, demand variability and the availability of human resources, transport and storage space (WHO, 2011).

3.2.2.1 Public Sector Supply Chains

In LMICs, the predominant supply chain structure in the public sector has a central medical store (CMS) that is used as the primary storage and distribution facility (WHO, 2011). Regional stores (RS) and district stores (DS) act as second and third level storage and distribution facilities, depending on the country's geography and number of health facilities (WHO, 2011). In addition

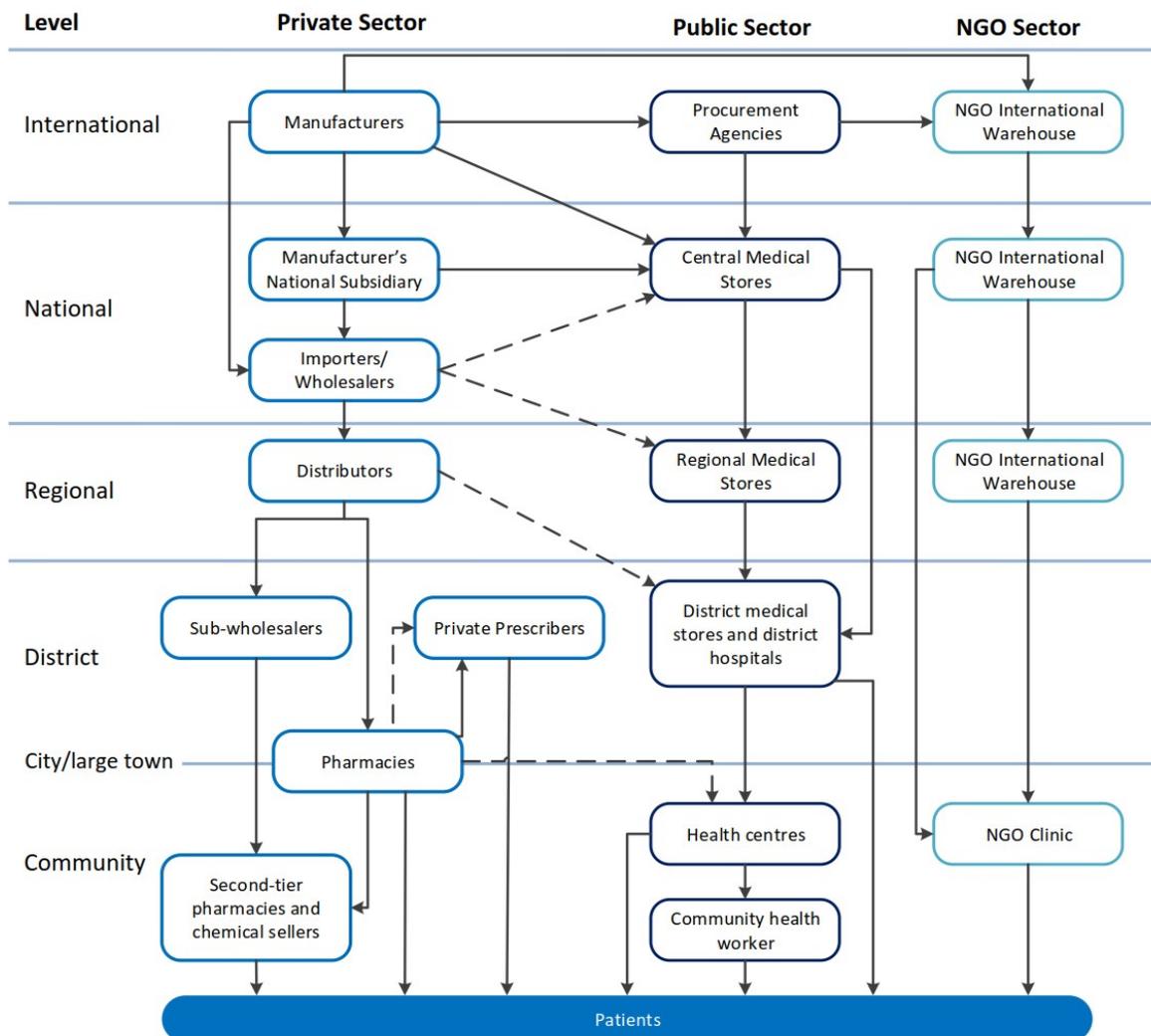


Figure 3.1: Pharmaceutical supply chains. Reprinted from World Medicines Situation 2011, 3rd edition, Yadav,P., Tata,H., Babaley,M., Storage and Supply Chain Management, page 4, Copyright (2011), URL: <http://apps.who.int/medicinedocs/documents/s20054en/s20054en.pdf>, Date accessed: 04 May 2018.

to the central, regional and district stores, some countries have other primary and secondary storage and distribution facilities as well that are used for programme-specific vertical health supply chains (WHO, 2011). These extra storage and distribution facilities increase the complexity of the supply system making the coordination and management of pharmaceutical procurement and distribution increasingly difficult (WHO, 2011). Figure 3.2 illustrates the different structures public health supply chains can have, where CMS refers to central medical store, RS to regional store and DS to district-level store.

There are two major approaches to distributing stock from higher supply chain levels to lower supply chain levels, namely push systems and pull systems (WHO, 2011).

Push system: Higher level stores, such as the CMS, determine the quantities of stock will be distributed to lower level facilities (WHO, 2011; MSH, 2012). At the beginning of a planning period a delivery plan is created and stock is delivered according to the delivery plan. Lower level facility managers are expected to provide stock and consumption data to higher level facilities so that stock can be allocated to lower level facilities (MSH, 2012). Push systems are also known as ration or allocation systems (MSH, 2012).

Pull system: In a pull system, lower level facilities determine the types and quantities of stock that are required and ordered from higher level facilities or stores (WHO, 2011; MSH, 2012). Higher level facilities could be public warehouses or private sector suppliers (MSH, 2012). Managers are expected to estimate the demand, determine the buffer stock and submit requisitions to higher level facilities for their own facilities (MSH, 2012). Pull systems are also known as independent demand or requisition systems (MSH, 2012).

Some countries use a combination of pull and push systems. In these types of mixed systems primary health medicines are routinely supplied in a kit, whereas regional and district hospitals determine their own stock requirements (MSH, 2012). Push and pull systems are preferred under different circumstances (as described below), however the choice is largely determined by the country's quantification capacity at each level and the maturity of the supply chain (MSH, 2012).

Circumstances under which push systems are preferred (MSH, 2012):

- (i) Staff at lower level facilities are not proficient at inventory control.
- (ii) Demand tremendously exceeds supply, making rationing imperative.
- (iii) A limited number of products are being handled.
- (iv) When disaster relief is required or when short term supply is required.

Distribution model	Country example	Key advantages	Key disadvantages
<p>CMS to Health Facility</p>	Kenya	<p>Better visibility of consumption data at CMS</p> <p>Lower total stock in the system</p> <p>Less reliance on district or regional store stock planning capacity</p>	<p>Higher transport costs</p> <p>Lower frequency of delivery</p> <p>Many health facilities not reachable using formal transport</p>
<p>CMS to DS to Health Facility</p>	The Congo, Rwanda, Zambia	<p>Stock positioned closer to health facilities</p> <p>Relies on DS stock planning capacity</p>	<p>Lower visibility of consumption data at CMS</p> <p>Greater risks of pilferage and theft due to large stocks at DS</p>
<p>CMS to RS to Health Facility</p>	Burundi, Cameroon, Chad, The Gambia, Ghana	<p>Few RS easier to manage than a larger number of DS</p>	<p>Lead time from RS to health facilities can be long</p>
<p>CMS to RS to DS to Health Facility</p>	Burkina Faso, Democratic Republic of Congo, Mali, Senegal	<p>Except for DRC, RS is a branch of CMS, thus better visibility of consumption data at CMS level</p> <p>Stock positioned closer to health facilities</p> <p>Relies on district or regional store stock planning capacity</p> <p>More frequent deliveries</p>	<p>More total stock in the system</p>
<p>CMS to DS to Health Facility with DS as pass-through</p>	United Republic of Tanzania	<p>Combines the primary transport cost benefits of DS model with the other benefits of the direct to health facility model</p>	<p>Relies on health facilities estimating their needs and placing orders to the CMS</p>

Figure 3.2: Various examples of public health supply chain structures used to distribute essential medicines. Reprinted from World Medicines Situation 2011, 3rd edition, Yadav,P., Tata,H., Babaley,M., Storage and Supply Chain Management, page 8, Copyright (2011), URL: <http://apps.who.int/medicinedocs/documents/s20054en/s20054en.pdf>, Date accessed: 04 May 2018.

Circumstances under which pull systems are preferred (MSH, 2012):

- (i) Staff at lower level facilities are proficient at managing inventory and determining requirements.
- (ii) Suppliers or higher level facilities have sufficient supplies to meet the needs of lower level facilities.
- (iii) A large number of products are handled.
- (iv) Staff at lower level facilities are often supervised and their performance is monitored.
- (v) Good data is available to staff who make decisions.

The structure of the supply chain also determines the resupply interval, since the resupply interval is influenced by the storage capacity of facilities at each level of the supply chain (MSH, 2012). The resupply interval in turn determines how often deliveries are made, for example annually, monthly, weekly, etc (MSH, 2012). If stock is delivered weekly, stock levels will be low and the probability of stockouts will decline, however transport costs will increase drastically (MSH, 2012). If stock is delivered annually, stock levels and storage costs will increase and transport costs will decrease (MSH, 2012).

3.2.2.2 Private Sector Supply Chains

In the private sector stock is distributed to lower level facilities via a network of wholesalers, importers and pharmacies (WHO, 2011). Wholesalers serve two functions, namely distribution and storage. This allows retail pharmacies to be restocked frequently to meet the daily requirements and decreases the overall stock levels that pharmacies need to carry (WHO, 2011). The number of wholesalers in a country depends on government regulation, the market size and political economics (WHO, 2011). Three methods of distribution are used to get stock from wholesalers to pharmacies, namely: distribution by private couriers, by wholesaler vehicles or customers pick-up stock at the wholesaler (WHO, 2011). Sometimes wholesalers make use of public transport, such as mini-buses, to deliver to customers who are further away. Pharmacists located in rural areas travel to urban areas to fetch stock from wholesalers or sub-wholesalers (WHO, 2011). Although the private sector has effective distribution that ensures product availability, distribution costs can be extremely high. NGOs also serve as important sources of supply, however this varies substantially between countries (WHO, 2011).

3.2.2.3 Vertical Supply Chains

The public sector often has health programs that focus on specific health interventions such as controlling TB, which may have their own vertical supply

chain that operates separately from the country's pharmaceutical supply chain (MSH, 2012). Vertical programs may seem appealing because of the quick results that are produced and the management of a vertical program is much easier than managing horizontal programs with multiple interventions (MSH, 2012). However, various governments and policy makers believe that vertical programs detract resources from constrained health systems. Sometimes vertical supply chains duplicate or displace a country's existing supply chain. In addition vertical and essential medicines supply chains often do not coordinate with one another, resulting in an excess or deficit of stock (MSH, 2012). Some countries are attempting to integrate vertical and essential medicine programs. Functions such as quality assurance, distribution, procurement and storage can be integrated to save costs, increase distribution efficiency and achieve long-term sustainability, however the outcome depends on the government's commitment to the process (MSH, 2012; WHO, 2011).

3.2.2.4 Public-Private Supply Chain Roles

The structure of pharmaceutical supply chains is influenced by the roles the public and private sectors play in the financing, retail distribution and wholesale distribution of pharmaceuticals (MSH, 2012). There are six approaches in which pharmaceuticals can be supplied, ranging from fully public to fully private (MSH, 2012). Table 3.1 gives a summary of the various approaches which are shortly described below.

Table 3.1: Supply of pharmaceuticals according to role of public and private sectors. Source: MSH (2012)

Financing	Distribution	
	Wholesale	Retail
Public		
Fully public	Public	Public
Private supply to government facilities	Private	
Social health insurance	Private	Private
Private		
Private financing and public supply	Public	Public
State wholesale monopoly	Public	Private
Fully private	Private	Private

Fully public: This supply system is usually characterised by the use of a central medical store (CMS) where a government unit procures, finances and distributes medicines. The state manages, owns and funds the entire supply chain.

Private supply to government facilities: The private sector provides publicly funded pharmaceuticals to health facilities that are operated by the government.

Social health insurance: Public funding is used to reimburse patients or pharmacies for medicines that are provided by the private sector.

Private financing and public supply: Government health facilities dispense medicines that are paid for, either in whole or in part, by patient fees.

State wholesale monopoly: A state monopoly imports, distributes and supplies pharmaceuticals to private pharmacies as well as some government health services.

Fully private: Medicines are bought from private pharmacies and are paid for entirely by patients.

While there are a variety of ways in which the supply of pharmaceuticals are organised, the following five basic approaches are used for public health: central medical stores, autonomous supply agency, direct delivery system, primary distributor system and primarily private system (MSH, 2012). In practice, pharmaceutical supply chains consist of a mixture of these approaches depending on the level of health facilities or the categories of products (MSH, 2012). Some of these approaches are also used in the private sector, however the description by MSH (2012) focuses on the public sector perspective:

Central medical stores: Traditional public supply chain where pharmaceuticals are procured and distributed by central governmental unit.

Autonomous supply agency: In this case the CMS is managed by a pharmaceutical supply agency that is either fully or semi-autonomous.

Direct delivery system: In this system there is no CMS. Suppliers deliver directly to districts and health facilities. The government is not responsible for any storage or distribution of pharmaceuticals.

Primary distributor system: This system also has no CMS. In this case the government contracts one or more distributors that receive pharmaceuticals from the suppliers and then distributes them to health facilities.

Primarily private supply: In some countries, private pharmacies located close to public health facilities are used to provide pharmaceuticals to public sector patients.

According to UN Commission (2015) there are specific functions of the supply chain that are more appropriate for the public sector or private sector, however there are overlapping functions that could be carried out by either sector. The functions can be divided as indicated in Figure 3.3.

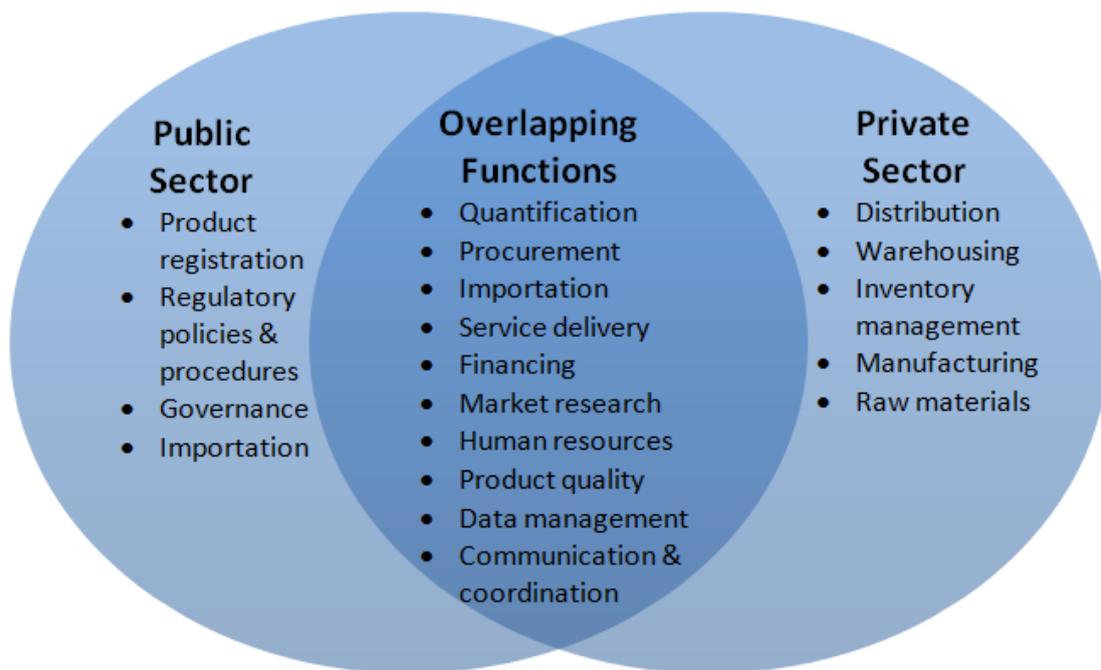


Figure 3.3: Supply chain functions that are most suited for each sector. Source: UN Commission (2015).

3.2.3 Supply Chain Functions

Supply chain functions are the activities that, when combined, constitute the supply chain (John Snow Inc., 2017). Health supply chain functions are defined differently by various authors in the health and pharmaceutical supply chain literature. MSH (2012) and John Snow Inc. (2017) provide the most comprehensive information on the supply chain functions, therefore the most prominent supply chain functions are shortly discussed below in Section 3.2.3.1 through 3.2.3.5 using these two author's work.

3.2.3.1 Product selection

John Snow Inc. (2017) define product selection as "...the process by which health programs, as a whole, select, evaluate and ultimately procure the products that will be used and consumed in service delivery". The list of medicines produced during product selections is known as the essential medicines list (EML) (MSH, 2012). The WHO defines essential medicines as those medicines that satisfy the health needs of the majority of the population. Limiting the number of medicines that can be used in the public sector leads to a more manageable supply chain, improved medicines supply, increased rational pre-

scriptions and lower costs (John Snow Inc., 2017; MSH, 2012).

The EML is developed by first creating a list of common diseases and health problems that occur in the country (MSH, 2012). Based on the list of health problems and disease patterns, the essential medicines, training, supply and medicine us for each level of care can be determined and compiled into a national EML as shown in figure 3.4 (John Snow Inc., 2017; MSH, 2012). The selection of essential medicines is limited to the public sector. The preferred method of selecting medicines for the public sector is through a selection committee as this minimises the potential influence of private interests on the selection process (MSH, 2012). Ideally, members of the selection committee should not have any connections with pharmaceutical manufacturers or distributors (MSH, 2012). The selection of essential medicines should be based on (i) the significance of the medicine to disease patterns; (ii) the safety and efficacy of the medicine; (iii) the performance of medicines under various circumstances; (iv) quality; (v) appropriate cost-benefit ratios; (vi) favourable pharmacokinetic properties; (vii) likelihood that medicines can be manufactured locally and (viii) the availability of medicines as single compounds (MSH, 2012).

3.2.3.2 Quantification

John Snow Inc. (2017) defines quantification as “the process of estimating the quantities and costs of the products required for a specific health program (or service), and determining when the products should be delivered to ensure an uninterrupted supply for the program”. However this definition not only applies to program quantification but also to the quantification used in national pharmaceutical supply chains (MSH, 2012). Figure 3.5 gives an illustration of the quantification process. Contextual factors are used in order to estimate the required quantities. Examples of contextual factors include the capacity of human resources, available funds, storage capacity and service delivery capacity (MSH, 2012). Quantification is an iterative process (usually bianually) where quantification data needs to be reviewed, updated and recalculated to reflect current actual consumption, service delivery and changes in policies (John Snow Inc., 2017). The quantification of pharmaceutical needs can be done using one method or a combination of four methods (MSH, 2012). The four main methods include (MSH, 2012):

Consumption method: The consumption method uses data from pharmaceutical consumption records to forecast future needs of pharmaceuticals. Data are sourced from facility stock and consumptions surveys, LMIS reports and reports of pharmaceutical products dispensed to patients (John Snow Inc., 2017). The consumption method is the most accurate method, however the

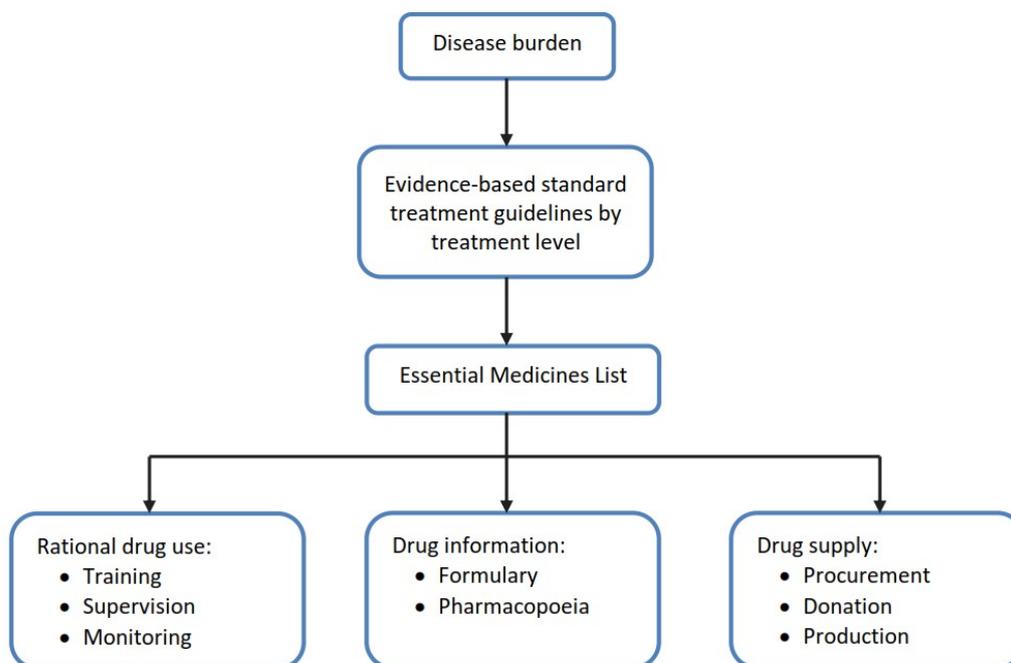


Figure 3.4: Essential medicines selection process. Reprinted from World Medicines Situation 2011, 3rd edition, van den Ham,R., Bero,L., Laing,R., Selection of Essential Medicines, page 3, Copyright (2011), URL: <http://apps.who.int/medicinedocs/documents/s20054en/s20054en.pdf>, Date accessed: 04 May 2018.

reliability of the method depends on the quality of data and the stability of the supply system (MSH, 2012).

Morbidity method: The morbidity method calculates the theoretical amount of pharmaceuticals needed to treat specific illnesses. Standard treatment guidelines and reliable data on morbidity, patient attendance and epidemiology is required to forecast pharmaceutical needs (MSH, 2012; John Snow Inc., 2017). This method is considered the most complex method and takes a considerable amount of time to execute. Even so, the method is beneficial for new programs as well as for justifying a budget request (MSH, 2012).

Proxy consumption method: The proxy consumption method is used when no reliable data on consumption or morbidity is available. In such cases data, such as disease incidence, pharmaceutical expenditures, demand or medicine use, is used to extrapolate consumption rates and determine supply system needs.

Service-level projection of budget requirements: This method is only used when budgetary requirements are needed; it is not used to forecast the

required pharmaceutical quantities. The cost of the average medicine per patient attendance is used to forecast medicine costs in various types of health facilities.

3.2.3.3 Procurement

MSH (2012) define procurement as “the process of purchasing supplies directly from national or multinational private or public suppliers; purchasing through global agencies and procurement mechanisms or regional procurement systems; or purchasing from international procurement agents”. The procurement cycle, as illustrated in figure 3.6, shows the activities and decisions that determine the quantities of pharmaceuticals received, the quality of the pharmaceuticals and the price paid (MSH, 2012).

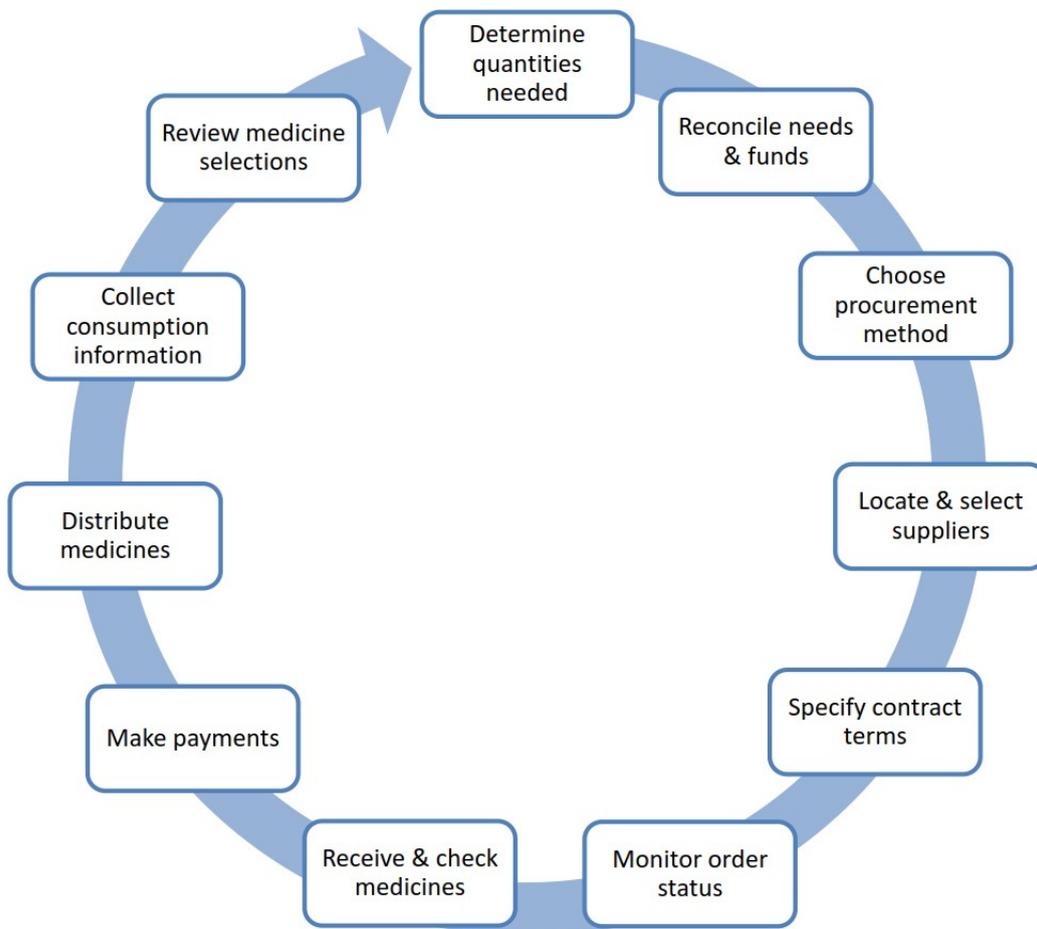


Figure 3.6: The procurement cycle. Source: MSH (2012)

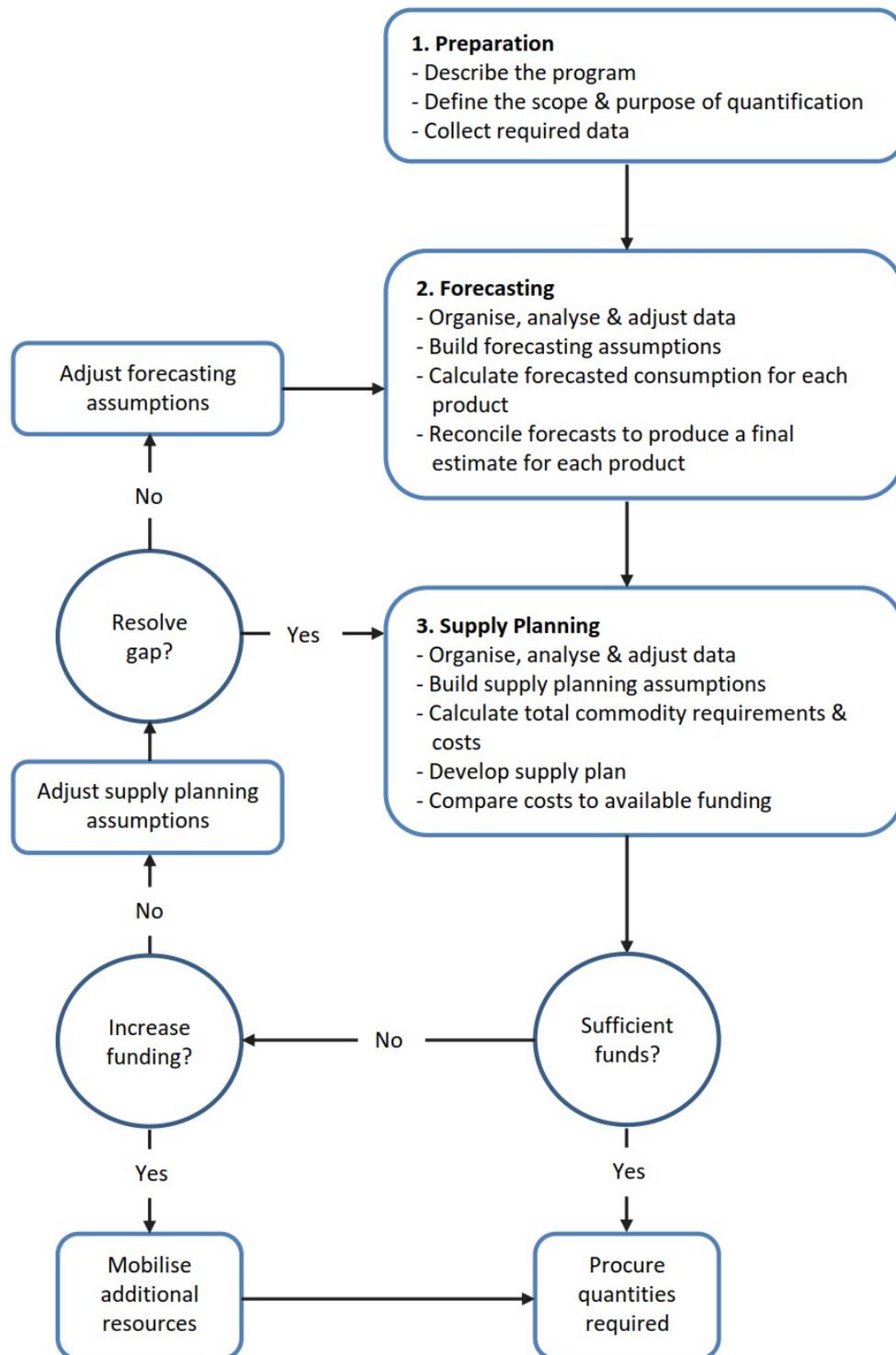


Figure 3.5: An illustration of the process of quantifying health commodities. Adapted from John Snow Inc. (2017)

Various procurement models are used in developing countries to procure pharmaceuticals and other health commodities (WHO, 2011). The following models are the most commonly used procurement models (WHO, 2011):

Centralised procurement: On a national level, this procurement model is traditionally used in the public sector. In this model the ministry of health has a government procurement unit or a government procurement agency (for example a central medical store) that is responsible for procuring pharmaceuticals locally and internationally.

Parastatal organisation: In this model procurement is also centralised, however a parastatal organisation (also known as an autonomous supply agency) is responsible for the procurement. The organisation is partially or wholly owned or governed by the government. As the name suggests, the organisation is granted autonomy to establish its own regulations regarding financing and procurement.

Decentralised procurement: Decentralised procurement involves the delegation of procurement responsibilities from the national level to a lower level (for example the regional, district or municipal level). Governments in a number of countries have decided to decentralise national procurement in an attempt to better meet local requirements.

Procurement agents: Procurement agents are used when governments have limited procurement capacity or funders have specific requirements. Examples of procurement agents include the United Nations agencies and the International Dispensary Association (IDA)

Procurement models can use several procurement methods, depending on the type and amount of products that need to be procured (John Snow Inc., 2017; WHO, 2011). Procurement methods include:

Open tender: A formal process where suppliers, either local or international, are invited to submit quotes based on the terms and conditions, scope and specifications of the tender invite (MSH, 2012; John Snow Inc., 2017).

Restricted tender: Restricted tenders are similar to open tenders, however suppliers must first be approved by going through a pre-qualification process. During this process supplier's performance, manufacturing practices and financial viability are assessed. Any suppliers can apply for the pre-qualification process (MSH, 2012).

Competitive negotiation: In this method buyers approach a number of suppliers for price quotes and may sometimes negotiate with suppliers to procure at a specific price. The public sector is typically prohibited from negotiating with suppliers, therefore competitive negotiations are mainly used in the private sector (MSH, 2012).

International or local shopping: This method of procurement works the same as competitive negotiation, with the exception that negotiation is prohibited (MSH, 2012).

Direct procurement: Direct procurement, or sole-source procurement (John Snow Inc., 2017), involves product procurement from a single supplier. Direct procurement usually occurs when a specific product can only be supplied by one source (John Snow Inc., 2017), which can make this method the most expensive. However, lower prices can be negotiated (MSH, 2012).

Limited-competitive bidding: In this method only a few pre-selected suppliers are given a tender invitation. This occurs when rules and regulations are in place that limit the procurement of specific products to a few suppliers (John Snow Inc., 2017).

In some countries e-procurement and reverse auction have been introduced as new procurement methods, however these methods are not generally used to procure pharmaceuticals (MSH, 2012). According to MSH (2012) the procurement process needs to:

- (i) Manage supplier-buyer relationships ethically and transparently.
- (ii) Acquire the correct products in the required quantities.
- (iii) Secure the lowest cost price.
- (iv) Ensure pharmaceutical quality assurance.
- (v) Ensure deliveries are made on-time to prevent stock-outs.
- (vi) Ensure that suppliers are reliable
- (vii) Choose the purchasing schedule, safety stock levels and order quantities in such way as to minimise the purchasing cost at each level of the health system.
- (viii) Accomplish these objectives as efficiently as possible.

3.2.3.4 Warehousing and Inventory Management

Products are stored at every facility along the supply chain (John Snow Inc., 2017). Ensuring product integrity and safety throughout the supply chain extending to the dispensary, requires good warehousing practices at every facility (John Snow Inc., 2017). Warehousing activities should be coordinated so that products can be managed in an efficient manner and so that order fulfillment and distribution can be carried out promptly (John Snow Inc., 2017). Warehousing activities include:

1. Inspection of incoming deliveries
2. Putting away delivered products
3. Visual inspection of product quality
4. Order fulfillment
5. Picking and packing of products
6. Shipping

The aim of inventory management is to provide a continuous supply of pharmaceuticals while minimising inventory holding costs and managing procurement (MSH, 2012). The inventory strategy determines how the inventory will be maintained to achieve the aim (John Snow Inc., 2017). However, before the inventory strategy can be defined the following characteristics of the supply chain need to be known (John Snow Inc., 2017):

1. The network structure and each supply chain level's role.
2. The characteristics and volume of products that flow through the supply chain.
3. The costs, budget and available resources.
4. The variability of demand and desired service levels.
5. Available tools and technology.
6. The company's relationship with suppliers, as well as suppliers' performance and capacity.

Since the aim is to provide an uninterrupted supply of pharmaceuticals, some stock will have to be held in inventory (MSH, 2012). Deciding which products to hold in inventory should be based on the consumption of the products as well as the value of the products to the public's health (MSH, 2012). Two methods can be used to determine which products should be kept in stock, namely: VEN classification or the ABC classification (MSH, 2012; John Snow Inc., 2017). VEN classifies products into three groups according to how critical the products are and the possible risk of a stock-out (John Snow Inc., 2017). The groups are: vital, essential and non-essential (MSH, 2012) or vital, essential and necessary (John Snow Inc., 2017). The VEN method is useful when there is a shortage of funds to purchase all the required products (John Snow Inc., 2017). The ABC method on the other hand, classifies products according to the pharmaceuticals' value and volume of consumption (MSH, 2012). Category A products are high-volume products, usually represent about 10-20 percent of products and 75-80 percent of expenditure.

Category B products represent 10-20 percent of products and 10-15 percent of expenditures. Lastly category C products are low-volume products that represent 60-80 percent of products and 5-10 percent of the expenditures (MSH, 2012). Decisions regarding when to order, what quantities to order and how to maintain stock levels is determined by an inventory control system (John Snow Inc., 2017). Inventory management may sound simple, however in many cases poor inventory management can lead to financial wastage, stock shortages or excessive stock which can result in the decline of quality health care (MSH, 2012).

3.2.3.5 Distribution

Distribution involves the movement of products from the central warehouse to the final health facilities where the products are dispensed to patients (John Snow Inc., 2017). Similarly to inventory management, the main objective of distribution is to maintain a continuous supply of pharmaceuticals while making sure that resources are used effectively (MSH, 2012). In general, two main distribution models are used: the direct distribution model and the distribution network model (John Snow Inc., 2017). In the direct model, products are delivered directly from central distribution centres to service delivery points (John Snow Inc., 2017). In distribution network model products are distributed to health facilities as well as provincial and regional distribution centres (John Snow Inc., 2017). Distribution systems have four basic characteristics, namely: the degree of centralisation, population and geographic coverage, and the number of levels in the health system (MSH, 2012). The degree of centralisation can be divided into central distribution and decentralised distribution (MSH, 2012). Central distribution is coordinated at national central medical stores (CMS) and products are distributed to regional and provincial warehousing where they are further distributed to health facilities (MSH, 2012). In decentralised distribution, lower-level facilities, such as district or regional facilities, are responsible for distributing products according to their specific needs (MSH, 2012). The activities performed during distribution form a cycle, as shown in Figure 3.7, which starts when suppliers or manufacturers dispatch the products and ends when consumption data is sent back to the procurement unit (MSH, 2012).

3.2.4 Pharmaceutical Supply Chain Management

In order to function properly, a health system requires a supply chain management system that is maintained, designed and operated effectively (John Snow Inc., 2017). The Council of Supply Chain Management Professionals define supply chain management as follows: “Supply chain management encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities. Import-

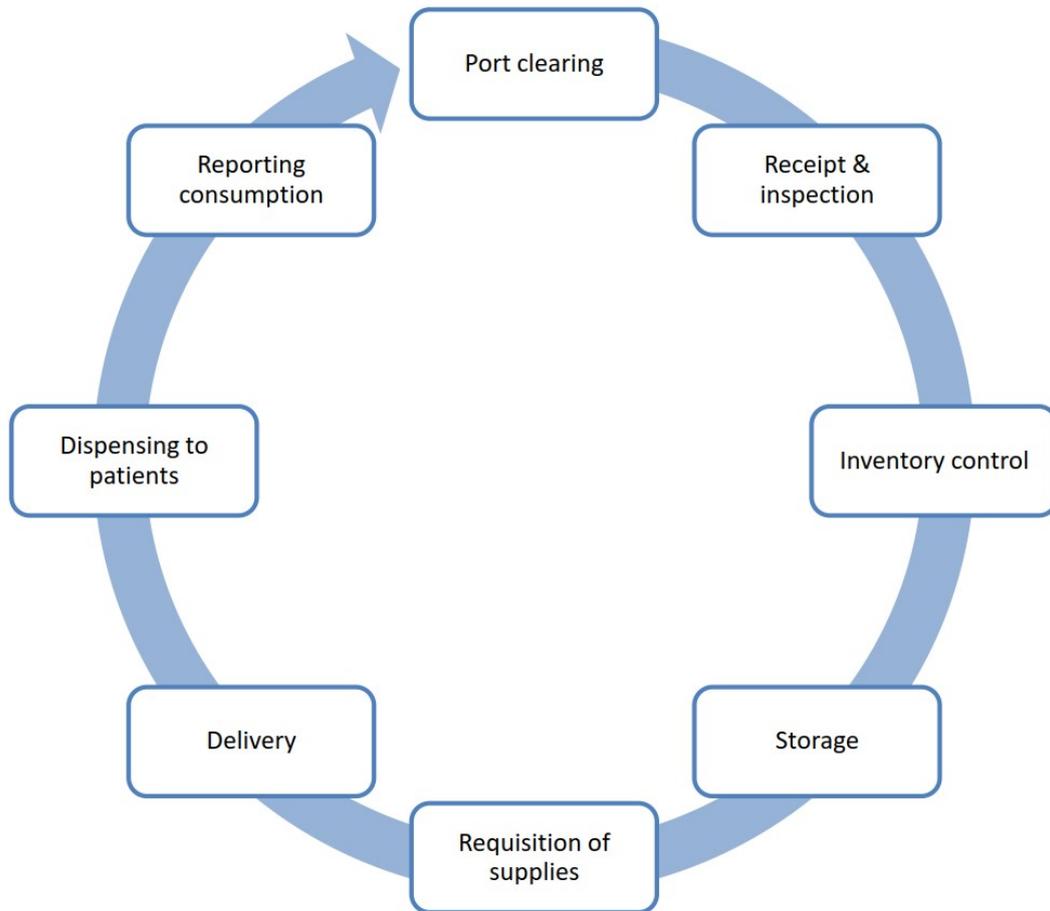


Figure 3.7: The distribution cycle. Source: MSH (2012)

tantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third party service providers, and customers. In essence, supply chain management integrates supply and demand management within and across companies” (CSCMP, 2013). According to the logistics cycle framework by John Snow Inc. (2017), health supply chains consist of operational components that are supported by management functions such as logistics management information systems (LMS), supply chain workforces, financing, performance management and risk management. Similarly, the pharmaceutical supply management framework consists of four basic functions which are supported by management support systems, including planning and administration, organisation and management, information management and human resource management (MSH, 2012). These management support systems hold the pharmaceutical management framework together (MSH, 2012). John Snow Inc. (2017) and MSH (2012) are the main sources that give a good overall and in-depth explanation of how health and pharmaceutical supply chains are managed. For this reason a short description of each

support management component is given from each author.

3.2.4.1 The Logistics Cycle

As illustrated in Figure 3.8 the management functions of the logistics cycle include: LMIS, supply chain workforce, financing, performance management and risk management (John Snow Inc., 2017).

LMIS: Supply chain workers collect and analyse information about each supply chain activity to help make decisions and coordinate future activities. Logistics information management systems are used to collect data, about the supply and consumption of health products, as well as ordering and restocking supplies. Data collected in the supply chain is used to inform decision making regarding the activities that occur in the supply chain.

Workforce: The workforce is the most essential resource of the supply chain. In order for the supply chain to operate effectively a competent workforce is required that can carry out the necessary supply chain functions. Managers should improve the performance of staff by supervising activities and providing opportunities for continuous learning and development.

Financing: Financial management and allocation affects all aspects of the supply chain, including procurement quantities, storage space as well the number of staff and vehicles. Financial management is very important because it influences the availability of products and the efficiency of the supply chain. Supply chain managers need to have a plan in place to ensure there is enough finances and funding to procure the required products, to maintain the operation of the supply chain and to monitor costs and funding to ascertain the viability of current operations.

Performance management: Performance monitoring and management is essential to determine the supply chain's effectiveness and efficiency. Performance data gives supply chain managers an indication whether policies or procedures need to be adjusted.

Risk management: Risk management is the process of identifying and mitigating causes of disturbances and dysfunction in the supply chain. This allows supply chain managers to plan and manage areas of the supply chain that require their attention the most.

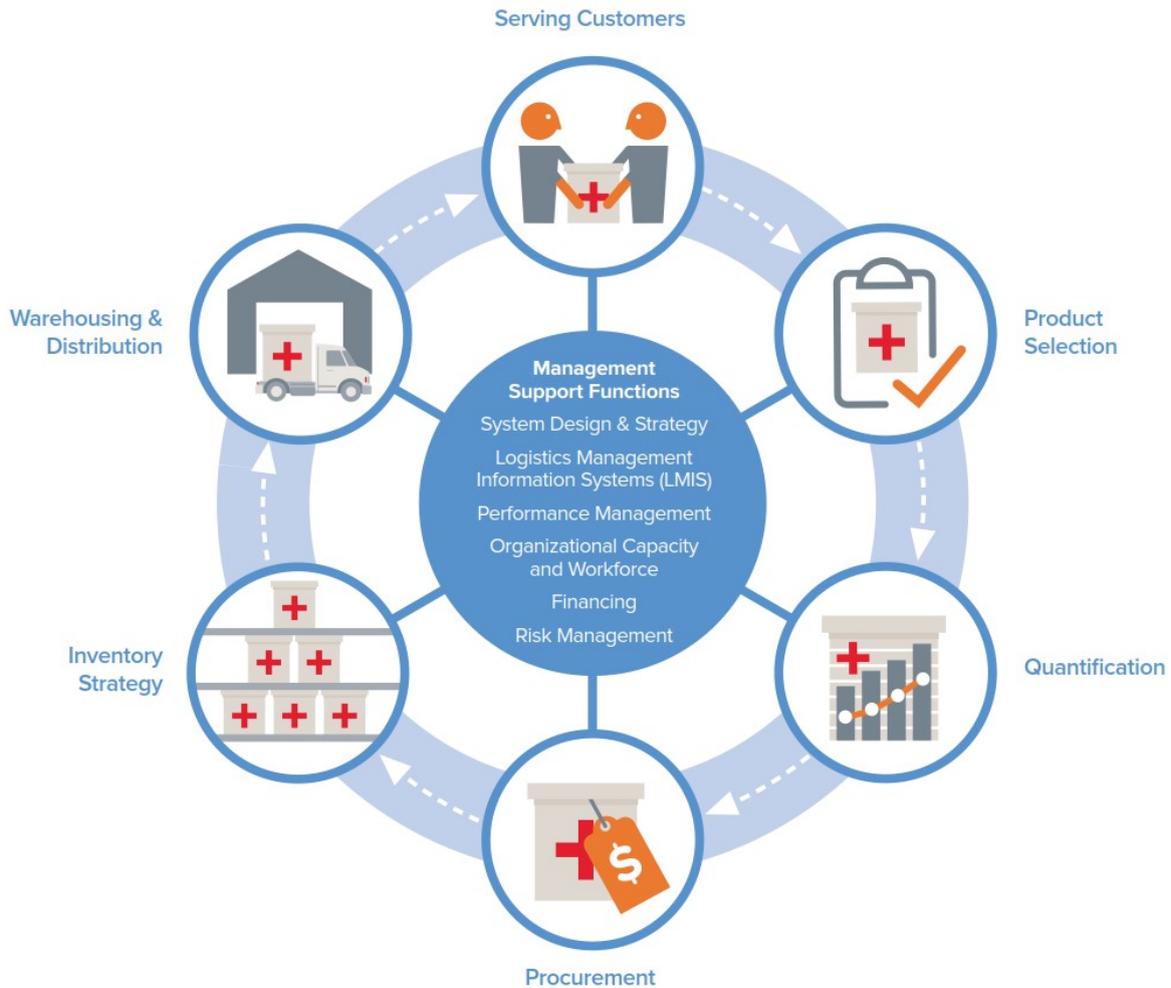


Figure 3.8: The logistics cycle. Source: John Snow Inc. (2017)

3.2.4.2 Pharmaceutical Supply Management Framework

The management support systems of the pharmaceutical supply management framework (shown in Figure 3.9) include planning and administration, organisation and management, information management and human resource management.

Planning and administration: Planning and administration includes the management of pharmaceutical programs; planning for pharmaceutical management where planning involves the analysis of the current situation and needs, establishing goals setting objectives and determining strategies and resources required to achieve expected results; determining whether pharmaceuticals and services should be contracted; financial planning and management which includes analysing and controlling expenditures; and planning and building storage facilities.

Organisation and management: Organisation and management involves security management at health facilities as well as the management of medical stores, hospital pharmacies, health facilities, laboratories and medical supplies

Information management: Information management includes the monitoring and evaluation of the pharmaceutical system; management information systems which are used to collect, process, report and use collected data to make informed decisions; and the management of computer hardware and software.

Human resources management: Human resources are essential for the planning, management and delivery of health services. The aim of human resource management is to cultivate and maintain a sufficient number of skilled workers who provide quality pharmaceutical care. This is achieved through the management and capacity development of human resources as well as designing and implementing training programs to maintain worker's competence, to teach workers how to respond to changing circumstances and implement new approaches and technologies.

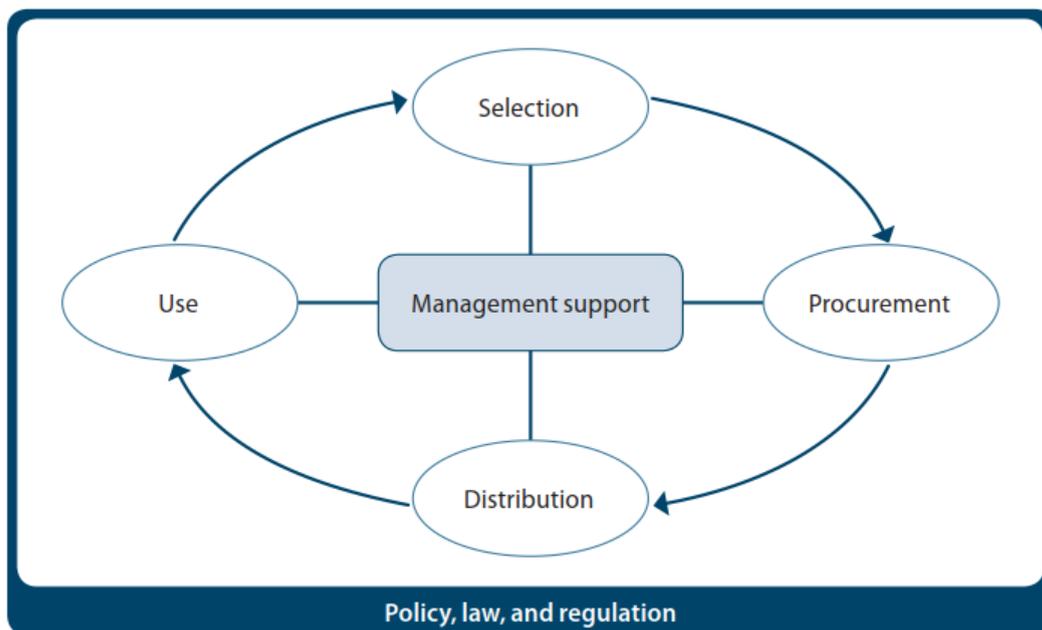


Figure 3.9: Pharmaceutical supply management framework. Source: MSH (2012)

3.3 Public-Private Engagements in Pharmaceutical Supply Chains

Abushaikha (2014) describes ‘relationships’ in supply chains as a “term that encompasses different degrees of interaction across the supply chain”. According to Maloni and Benton (1997) relationships are formed to improve the financial and operational performance of supply chain participants by reducing costs and inventories as well as increasing shared information. A variety of terms have been used to describe the interactions between supply chain participants; examples include coordination, cooperation, collaboration, integration and partnerships (Chen *et al.*, 2009; Abushaikha, 2014). In the context of public and private sector relationships, UN Commission (2015) define private sector engagement as "the deliberate, systematic collaboration of the government and the private sector to move national health priorities forward, beyond individual interventions and programs".

In this section the aim is to gain an understanding of what type of relationships the public and private sectors can have; how relationships can be formed between the two sectors; what impact these relationships have on pharmaceutical supply chains; what type of relationships currently exist in pharmaceutical supply chains; and how the two sectors might be integrated.

3.3.1 Why Work with the Private Sector?

One of the reasons why the public and private sectors should engage is that the private sector is too large to ignore (IFC World Bank Group, 2011). For example, in Sub-Saharan Africa more than 50 percent of the total health expenditure is from the private sector (See Figure 3.10).

In many countries the private sector manages or owns between 40 and 50 percent of the health infrastructure which means the public sector can expand the scope and scale of health services by engaging with the private sector (Harding, 2009; MIT-Z ILP, 2008). Not only does the private sector play a significant role in the health sector, but patients also often prefer the private sector due to its responsiveness, convenience and ease of access (Harding, 2009). Governments are responsible for improving their health systems, however due to the shortage of resources and the magnitude of the private health sector, governments are not able to fulfill this responsibility (IFC World Bank Group, 2011). In order to improve the health system, governments need a minimal level of engagement (IFC World Bank Group, 2011). The private sector fills health delivery gaps by providing health services to the poor when the public sector is unable to meet their needs (Harding, 2009). Contrary to popular belief, the private sector caters for a wide variety of income groups

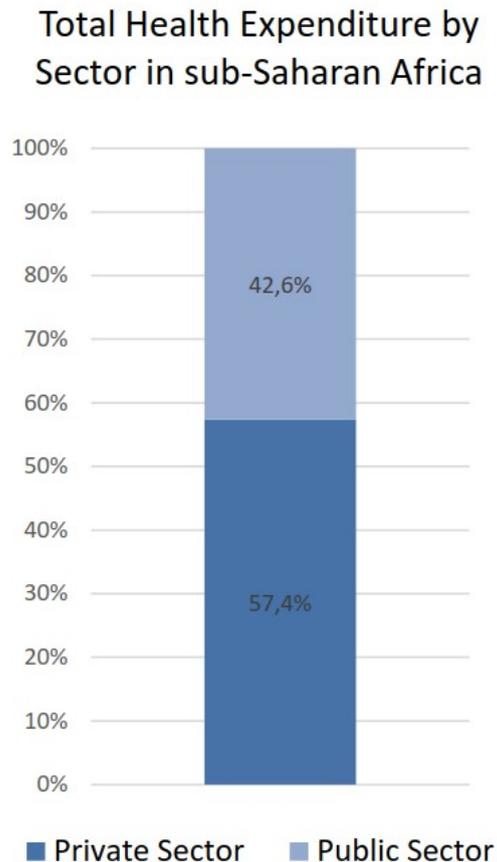


Figure 3.10: Total health expenditure according to sector. Source: World Bank (2014)

and not only the rich (IFC World Bank Group, 2011). Roughly 50 percent of low-income groups receive health care from the private sector in Sub-Saharan Africa (IFC World Bank Group, 2011). UN Commission (2015) lists a number of public-private engagement examples that provide the following health sector benefits: (i) increase the availability of medicines; (ii) ensure the quality of health commodities; (iii) improve the effective use of commodities; and (iv) increase funds and resources for medicines. According to IFC World Bank Group (2011) the slightest level of public-private engagement can make an improvement in the use of resources as well as the quality of health care. Engaging with the private sector can strengthen supply chains, improve supply chain capabilities and performance (John Snow Inc., 2016), and can assist the public sector with overcoming supply chain challenges and increasing the efficiency and effectiveness (MIT-Z ILP, 2008). Other benefits of engagement include (UN Commission, 2015; MIT-Z ILP, 2008):

- (i) Providing access to specialised skills and expertise

- (ii) Promoting operational efficiency
- (iii) Allowing governments to focus on core competencies
- (iv) Providing access to capital investment and innovation
- (v) Sharing risk
- (vi) Adopting private sector best practices
- (vii) Expanding private sector channels

Public-private partnership specific benefits include filling public sector resource gaps; access to health products and efficiencies can be increased across both public and private sectors; partnerships can introduce innovative management and technologies; human resources are increased; and the health sector's capacity to deliver services can increase (O'Hanlon and Jeffers, 2013). However, public-private engagement is not only for the benefit of the public sector.

In some developing countries, such as Tanzania and Ghana, the private sector has saturated the high-income market (O'Hanlon and Jeffers, 2013). Consequently, the private sector now aims to expand its products and services to lower income populations (O'Hanlon and Jeffers, 2013). Engaging with the public sector will allow the private sector to expand its channels to reach these lower income groups (MIT-Z ILP, 2008). In addition, MIT-Z ILP (2008) investigated a number of public-private initiatives and found that some were generating a profit, which signifies that the private sector may generate profit and improve health outcomes through engagement with the public sector. Many authors such as Nishtar (2004), Tennyson (2011), IFC World Bank Group (2011), Prybil *et al.* (2015) and Kula and Fryatt (2014) argue that emerging and current health problems cannot be successfully addressed by each sector individually, but that significant improvements are only possible when the two sectors work together. Although there are many advantages of public-private engagement, it also introduces many challenges that each sector needs to overcome.

3.3.2 Public-Private Engagement Challenges

Although public-private engagement may provide many benefits, there are also challenges that need to be taken into account before considering such engagements. According to Prybil *et al.* (2015) challenges include conceptual and language barriers, establishing and maintaining engagements, constraints such as finances and public policy and demonstrating that the engagement has a positive impact. UN Commission (2015) made a list of challenges each sector faces when taking part in public-private engagements. The challenges that the public sector faces when engaging with the private sector include: (i) conflicts

of interest; (ii) a limited capacity to engage with the private sector due in-experience with contract management which could result in corruption; (iii) regulatory issues; (iv) information sharing issues due to the different sources the public and private sectors receive information from; and (v) external constraints such as the economic and political climate, hidden complexities of donor structures in projects and national agencies and the likelihood that the development and management of public-private engagements will be more expensive than internal government processes.

On the other hand, the private sector faces the following challenges when engaging with the public sector: (i) lack of control since the contractual requirements may stipulate the timing of processes as well as how resources should be allocated and used; (ii) drawn out decision making process by the government due to its structure; (iii) contracting problems due to some government's lack of transparency and standardised tender processes; (iv) delayed payments due to budgetary issues and governmental processes; and (v) information sharing issues due to delayed information sharing and data compilation is not centralised which means that each sector is unaware of what has been contributed. According to Tennyson (2011) such engagement challenges could generate original and unexpected ideas that may actually be beneficial to the engagement. However, strategies are still needed to overcome the challenges of public-private engagement.

3.3.3 Overcoming Public-Private Engagement Challenges

In an effort to overcome engagement challenges, many authors suggest similar factors are necessary for successful public-private engagements. Kula and Fryatt (2014) reviewed 18 public-private interactions in South Africa and identified the following success factors: stewardship, co-ordination, regulation, capacity to support partnership, monitoring and evaluation, high level support and buy-in, harmonization and innovation. According to the review the most important success factor was the government's ability to support partnerships since the private sector could take advantage of the engagement (Kula and Fryatt, 2014). According to Tennyson (2011), three principles are required in order for the two sectors to work together, namely transparency, equity and mutual benefit. Discussing these three principles is a useful starting point before formalising an engagement (Tennyson, 2011).

Similarly, Prybil *et al.* (2015) argues that public-private engagements require trust, effort and commitment from all parties. According to Prybil *et al.* (2015) the following characteristics need to be implemented in order for an engagement to be successful: (i) values, a mission and vision; (ii) a collaborative

culture; (iii) clearly defined goals and objectives; (iv) a durable organisational structure; (v) good leadership; and (vi) regular performance evaluations and continuous improvements (Prybil *et al.*, 2015). One of the success factors of public-private engagement is the quality of the relationship between the two sectors, therefore according to Kula and Fryatt (2014) fostering a good relationship is crucial to developing trust. In addition, it is important for both sectors to understand the other sector's motivations and to identify appropriate incentive mechanisms so that both sector's interest are met (Kula and Fryatt, 2014). UN Commission (2015) offer the following recommendations for overcoming public-private engagement challenges:

- (i) Start with a realistic vision of what can be achieved
- (ii) Build partnerships based on mutual trust
- (iii) Foster transparency from all partners
- (iv) Demonstrate commitment to private sector engagement
- (v) Learn from other sectors
- (vi) Advocate for change

Although public-private engagement could benefit the health supply chain and health system, it does not mean that it is the solution to all supply chain challenges (UN Commission, 2015). Public-private engagement requires time, commitment, measurable goals and aligned objectives (UN Commission, 2015).

3.3.4 Types of Engagements

Public-private engagements can take many forms; each form of engagement can have different levels of collaboration, length of commitments and sharing of financial risk (UN Commission, 2015). Authors identify and classify public-private engagements differently according to their interpretation of what differentiates and characterises specific engagements (John Snow Inc., 2016; UN Commission, 2015; USAID, 2010; Whyte and Olivier, 2016). Some engagement forms are widely recognised and accepted throughout the literature such as outsourcing, partnerships and the adoption of private sector practices (UN Commission, 2015; John Snow Inc., 2016; USAID, 2010). Due to the lack of literature on public-private pharmaceutical supply chain engagements, authors' different forms of public-private health supply chain engagements are shortly discussed. This will give a better understanding of engagements within health supply chains.

John Snow Inc. (2016) reviewed public-private engagements from more than 30 LMIC and found that there are four main models of engagement, namely:

adapting and learning; collaboration; stewardship; and contracting. As the name suggests, adapting and learning involves the adaptation of private sector supply chain tools and practices which help to improve supply chain performance (John Snow Inc., 2016). Examples include information technology and warehouse configuration solutions, supply chain modelling software that streamline routes and supply chain designs, and the implementation of private sector best practice standards (John Snow Inc., 2016). Collaboration involves multiple sectors (private, public and NGO) sharing the responsibility of protecting the public good. This type of engagement necessitates considerable relationship building and trust (John Snow Inc., 2016). The public sector is responsible for providing stewardship to ensure that health products are available and accessible to all. This includes enforcing regulations, being responsible for the efficacy and safety of health products and ensuring that the performance of stakeholders are satisfactory. Supply chain managers who are stewards of supply chains are responsible for offering oversight, vision and guidance (John Snow Inc., 2016).

In many countries the public sector contract the private sector to provide specific services, such as distribution, warehousing or management, within the public supply chain (John Snow Inc., 2016). Some authors (John Snow Inc., 2016) use the terms outsourcing and contracting interchangeably, however USAID (2010) distinguish between the two. According to USAID (2010) contracting entails the customer specifying what the contractor should do and how it must be done. Conversely, during outsourcing the customer specifies the outcome but the contractor uses its expertise to determine how the task will be completed USAID (2010). Whyte and Olivier (2016) identified eight different public-private engagement models in South Africa, including: public-private partnership; social marketing; sector-wide approach; public-private mix; vouchers; contracting; dual practice regulation and financial support. According to the review social marketing, contracting and global public-private partnerships were the most prevalent models respectively (Whyte and Olivier, 2016). Although the review found many instances of public-private engagement, the focus of the review was on health service delivery and financing engagement models and not health or pharmaceutical supply chain engagement models (Whyte and Olivier, 2016).

UN Commission (2015) differentiates public-private health supply chain engagements according to the formality and complexity of the engagements. The first level of engagement is known as public-private interaction which is usually informal and focuses on communication between the sectors. The second is called public-private dialogue which focuses on cooperation and can include both formal and informal engagements. The last level of engagement is public-private agreement which involves contractual engagements that focus on the collaboration of the public and private sectors (UN Commission, 2015). UN Commission (2015) identified eight different forms of engagements that fall

within the three levels of engagements (i.e. interaction, dialogue and agreement), which consist of: outsourcing, technical assistance, corporate social responsibility, advocacy and coordination, financing, partnerships, local manufacturing and innovations. Similar to the adapting and learning definition provided by John Snow Inc. (2016), technical assistance refers to engagements where the public sector learns from private sector examples and successful improvement strategies (UN Commission, 2015). This can be applied in supply chain areas such as quantification, procurement, inventory management, warehousing, human resource training and management, and capacity building. Innovation and advocacy engagements are similar to technical assistance in the sense that private sector approach are implemented in the public sector.

Private sector organisations are continually introducing new innovations, such as new products, innovative improvements, redesign or reverse innovation, in order to remain competitive. These innovations can be applied to the public supply chain to improve the efficiency (UN Commission, 2015). Advocative engagements involve the adaptation of the private sector's approaches to coordination, advocacy and information sharing. Examples of advocative engagements could include market surveys, advocacy on collaboration or policy support. Advocacy and coordination can increase transparency and the inclusivity of stakeholders during policy debates and improve access to information UN Commission (2015). Companies that take part in corporate social responsibility provide the public sector an opportunity for engagement without the possibility of a conflict of interest. Examples of this type of engagement include donations, access to human resources or the provision of contributions during times of abnormal demand (UN Commission, 2015). The public sector can engage in long term financial planning with the private sector in order to accomplish supply chain objectives. Engagements through financing can reduce supplier risk and introduce the possibility of performance based financing (UN Commission, 2015). Introducing local manufacturing may be an alternative to importing and could reduce costs such as transportation costs. Local manufacturers could increase the diversity of suppliers and therefore improve supply chain security (UN Commission, 2015).

3.3.5 Examples of Public-Private Supply Chain Engagements

The aim of this section is to investigate existing public-private supply chain engagements and to determine what impact these engagements have had on the supply chains. Some examples are not specific to pharmaceuticals and include other health commodities, however the same principles can be applied to pharmaceutical supply chains.

3.3.5.1 Commodity Coordinating Committees

Every supply chain function depends on the coordination of key participants to provide crucial assistance and support (SIAPS, 2014). The coordination of key participants can be achieved by creating commodity coordinating committees (CCCs) (SIAPS, 2014). CCCs are committees or groups that work together to improve the availability of health supply chain commodities as well as promote efficient, effective and sustainable supply chain systems and service delivery. The multidisciplinary committees include representatives from the public sector, private sector, non-governmental organisations (NGOs) and donor agencies. CCCs have varying attributes depending the scope of work, in other words CCCs can be formal, informal, part of the government or separate from the government. CCCs have successfully been used to improve the availability and access of reproductive health commodities in health supply chains. However, CCCs can be applied to any type of health commodity, including pharmaceuticals. One of the supply chain areas where CCCs have been used in supply chains is the quantification of health commodities where members work together on forecasting and supply planning activities. In addition, the CCCs aim to increase cooperation and collaboration among the diverse stakeholders who are part of the quantification process (SIAPS, 2014).

3.3.5.2 Distribution Partnership

UTi (now known as DSV) is a service logistics and third party logistics (3PL) provider based in South Africa (UN Commission, 2015) UTi has a comprehensive warehousing and distribution network that distributes pharmaceuticals, cold chain products and medical devices for the private sector (UN Commission, 2015). UTi partnered with the public sector to deliver health commodities throughout South Africa. UTi has a unique business model due to the fact that suppliers pay for UTi's operations in exchange for low risk access to South Africa's growing market and handing over distribution management to UTi (UN Commission, 2015). This resulted in a synergistic relationship since the government received the benefits of having an effective distribution network without incurring additional costs and suppliers had a reduced barrier-to-entry in the South African market (UN Commission, 2015).

3.3.5.3 Vendor Managed Inventory

In vendor-managed inventory (VMI) systems the vendor, or supplier, is responsible for managing, maintaining and replenishing the stock for the customer (SIAPS, 2014). This approach is often used in the private sector and very rarely used in the public sector (SIAPS, 2014; John Snow Inc., 2012). The potential benefits of VMI include decreased stock-outs, cost savings, quicker turnaround and a reduction in government's burden of managing orders and transportation which enables the government to focus on managing vendor contracts (SIAPS,

2014). This approach has been applied in Nigeria and Zimbabwe. In Nigeria the National Agency for the Control of AIDS (NACA) sub-contracted private suppliers to deliver health commodities directly to service delivery points (SIAPS, 2014). Similarly, the VMI approach was implemented in Zimbabwean health facilities which led to a streamlined reporting and ordering process and an increased efficiency of commodity and information flow (John Snow Inc., 2012). Personnel were then able to spend more time helping patients instead of counting stock. The implementation of a VMI system resulted in increased stock availability and stock outs of some medicines decreased by 33 percent (John Snow Inc., 2012).

3.3.5.4 Warehouse-in-a-Box™

In 2010, the Tanzanian Medical Stores Department struggled to accommodate the country's expanding health programme due to an increase in the number of health products, limited storage space and poorly managed and constructed storage space (SIAPS, 2014). A proposed solution was to use a kit developed by Imperial Health Sciences, called Warehouse-in-a-Box™ (WiB). Each WiB contains the required infrastructure that a warehouse needs, such as racking and furniture as well as job descriptions, standard operating procedures and training documents. WiBs can be assembled rapidly and used in a variety of settings including urban and rural settings (Imperial Health Sciences, 2014). During implementation personnel receive training in areas such as warehouse management, medicine disposal, quality control and medicine recall (SIAPS, 2014). After implementation audits are carried out in order to improve management skills and warehouse operations (SIAPS, 2014). As a result of acquiring and implementing five WiBs, Tanzania's storage capacity increased by 195% even though the storage surface area only increased by 60%; roughly \$1 million of annual rent is saved by using the WiBs and 55 Medical Stores Department staff were trained (SIAPS, 2014).

3.3.5.5 Medicine Shoppe

Medicine Shoppe is an Indian retail pharmacy chain that has developed a new type of clinic, called Sehat (which means health) that caters for people from low-income areas (MIT-Z ILP, 2008). At each clinic a qualified doctor provides check ups at a nominal cost. If a patient goes for a check up and buys medicine from the store, the patient gets a doctor fee as a refund on the medicines, resulting in a free check up (MIT-Z ILP, 2008). The clinic's doctor only prescribes generic versions of retail drugs which further decreases the costs incurred by the patients. The clinic also employs health workers who visit households in order to identify people who show symptoms of disease and direct them to the nearest clinic (MIT-Z ILP, 2008). The use of these clinics improves low-income communities' access to primary care by making doctor's

consultations and medicines affordable. Partnering with a retail pharmacy allows the public sector to reach poor communities since high real estate costs are a barrier to entry for the public sector (MIT-Z ILP, 2008).

3.3.5.6 SMS for Life

Kenya's public sector often had antimalarial medicine and diagnostic supply stock-outs (SIAPS, 2014). In order to solve the problem the Kenyan government partnered with Novartis Pharma AG and piloted the project SMS for Life. SMS for Life is a mobile application which consists of an SMS management tool as well as a web-based reporting tool which allows health workers to submit and record current stock levels (SIAPS, 2014). During the pilot test the stock of artemether/lumefantrine (AL) and a rapid diagnostic test was tracked. By the end of the pilot test, stock-outs of AL reduced by 38% (SIAPS, 2014).

3.4 Supply Chain Integration

Provided the present context of pharmaceutical and health supply chains as discussed in sections 3.1 and 3.2, it can be argued that more proactive approaches should be taken by decision makers to improve health outcomes and address supply chain challenges. Public-private supply chain integration may be an approach that can further support the improvement of pharmaceutical supply chains. Public-private supply chain integration is an approach that combines elements of both horizontal supply chain integration and horizontal supply chain collaboration. In order to clarify what the term 'public-private supply chain integration' refers to, an overview of supply chain integration is provided (Section 3.4.1), after which horizontal supply chain integration and collaboration are investigated (Sections 3.4.1.1 and 3.4.1.2). Next, the definition of supply chain integration is provided to prevent confusion with other integration terms (Section 3.4.2). Lastly, public-private supply chain integration is introduced in Section 3.5 as a possible solution to further improve pharmaceutical supply chains.

3.4.1 Review of Supply Chain Integration

Integration is defined by the Merriam-Webster Dictionary as follows: "to form, coordinate, or blend into a functioning or unified whole" (Merriam-Webster Inc., 1966). Supply chain integration involves cross-functional or cross-departmental interactions which are often associated with coordination, cooperation or collaboration (Chen *et al.*, 2009). There is a proliferation of definitions for 'integration' in both the supply chain and public health literature. In the public health domain the term integration can be used for a

number of different concepts that sometimes overlap (Contandriopoulos *et al.*, 2003). Examples of these concepts include integrated service delivery (PwC, 2007), integration of care (Contandriopoulos *et al.*, 2003), clinical integration (Miller, 1996; Contandriopoulos *et al.*, 2003), physician integration (Miller, 1996), functional integration (Miller, 1996; Contandriopoulos *et al.*, 2003) and integrated national health system (Reddy *et al.*, 2011; Arbulo *et al.*, 2015).

In the supply chain literature, an integrated supply chain can be defined as follows: “An association of customers and suppliers who work together to optimize their collective performance in the creation, distribution, and support of an end product” (National Research Council *et al.*, 2000). According to the National Research Council *et al.* (2000), the objective of supply chain integration is “to focus and coordinate the relevant resources of each participant on the needs of the supply chain and to optimize the overall performance of the chain”. There are two main forms of supply chain integration: horizontal and vertical integration (Axelsson and Axelsson, 2006). Vertical integration takes place when an organisation assumes control of sequential steps in a supply chain (Axelsson and Axelsson, 2006; Roberts *et al.*, 2010). For example, an organisation could take control of its suppliers (backward vertical integration) or its distributors (forward vertical integration) (Roberts *et al.*, 2010). In these supply chains information and activities are visible up and down the chain, the number of steps in the process are fewer and there is greater coordination between the levels of the supply chain (USAID, 2009). On the other hand, horizontal integration occurs when two or more organisations, that are at the same point in the supply chain, merge (Roberts *et al.*, 2010). An example of horizontal integration is when producers of a product merge. Figure 3.11 gives an illustration of horizontal and vertical supply chain integration.

Supply chain integration has been used in various ways in public health supply chains. The focus has predominantly been on integrating public disease or program specific supply chains such as immunisation or TB supply chains (Bornbusch and Bates, 2013; PATH and WHO, 2013; Kaboru, 2012; USAID, 2009); (ii) vertical integration (John Snow Inc., 2012); and (iii) product integration which involves combining some logistical functions of different commodities (UNICEF, 2016; USAID, 2009). Researchers in India proposed the creation of the ‘Integrated National Health System’ (INHS) in order to achieve the objective of providing universal health care. The aim of an INHS is to strengthen the public health system, promote and improve the effectiveness, equity, efficiency, and accountability at all stages of the health system by integrating the private sector with the national health system (Reddy *et al.*, 2011). In an INHS all providers, including the allopathic systems as well as the public and private sectors, are integrated. The various forms of public health integration are frequently pictured along a continuum of inter-organisational relationships (Axelsson and Axelsson, 2006). It ranges from organisations that

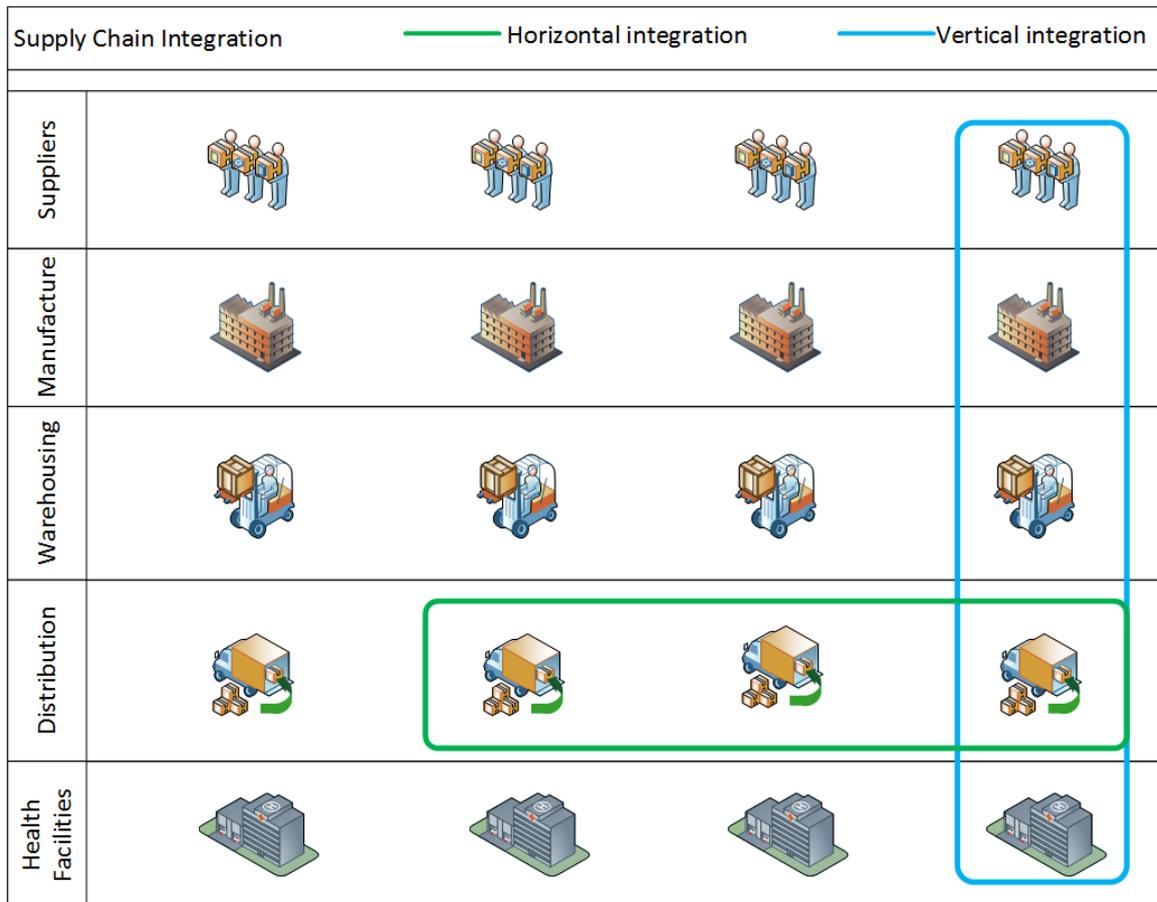


Figure 3.11: Horizontal and vertical supply chain integration

are completely autonomous, through intermediate consolidations to the complete merging of organisations (Axelsson and Axelsson, 2006). The WHO's Optimize project horizontally integrated vaccine supply chains with other health commodity supply chains (PATH and WHO, 2013). According to PATH and WHO (2013) this may result in efficiency and effectiveness improvements as well as economies of scale and improved supply chain performance. According to a framework developed by Axelsson and Axelsson (2006) collaboration can be defined as the combination of a high degree of horizontal integration and a low degree of vertical integration. This type of integration is accomplished via voluntary agreements and the willingness to work together (Axelsson and Axelsson, 2006).

Chen *et al.* (2009) defines process integration as follows: "Process integration refers to the management of various sets of activities that aims at seamlessly linking relevant business processes within and across firms and eliminating duplicate or unnecessary parts of the processes for the purpose of building a better functioning supply chain". Integration involves cross-departmental

or cross-functional interactions which have been described as links or working together. These interactions are commonly attributed to collaboration, cooperation or coordination (Chen *et al.*, 2009). Some authors have proposed their own definitions for integration. According to Papazoglou *et al.* (2000) an integrated value system is formed when multiple firms with a shared target market collectively plan, implement and maintain the flow of information, services and goods, such that the efficiency and value of the value system increases (Papazoglou *et al.*, 2000). Subramanian and Sun (2016) defined integrated value chains as "a responsive system that creates a product or solution for the customer requirement using a system of process called value packet which is capable of quantifying, measuring and managing the value of each activity across the value chain". In the context of supply chain integration Flynn *et al.* (2010) used the Webster dictionary definition of integration which states that integration is the collective control of multiple consecutive economic or industrial processes which were previously carried out independently (Merriam-Webster Inc., 1966).

Another concept that was found in the literature was integration through value-adding partnerships (VAP). Foreman and Roberts (1991) applied this concept of VAPs to health care in order to form effective integrated systems, however the meaning of integration was not defined in the article. A VAP consists of a group of autonomous firms where each coordinates its processes and activities with the other "partners" of the value chain (Foreman and Roberts, 1991). The key term in this definition is "autonomous" since there is no need for the firms to sign an official partnership agreement, each firm is in control and responsible for the way in which its business operates. When the concept of VAPs is applied to health care, partnership activities would involve joint education, outsourcing, purchasing and planning which could ultimately result in economies of scale (Foreman and Roberts, 1991).

3.4.1.1 Horizontal Supply Chain Integration

According to Aboutalebi (2015) there are two forms of horizontal supply chain integration. The first is known as backward horizontal integration where a company integrates with other companies that are similar (Aboutalebi, 2015). For instance, a retail company may own or work with another retail company. The second form of horizontal integration is forward horizontal integration where companies collaborate with one another to provide customers with substitute options (Aboutalebi, 2015). For example, two companies can work together to provide customers road transport and rail transport as an additional option (Aboutalebi, 2015). However, when speaking about horizontal integration it generally refers to the consolidation of two or more organisations that exist in the same tier of the supply chain (i.e. the consolidation of two or

more manufacturers) (Huemer and Furlan, 2011). This is achieved by either merging with a competitor or the acquisition of a competitor (Huemer and Furlan, 2011).

Before the implementation of horizontal integration, managers need to decide what will be integrated and how it will be integrated (PATH and WHO, 2013). According to PATH and WHO (2013) there are two options, either products or processes can be integrated when integrating health supply chains. Supply chains have various functions, including forecasting, procurement, information systems, orders, transport and storage (PATH and WHO, 2013). Product integration is associated with the storage and transport functions and involves the integration of product flows (PATH and WHO, 2013). Process integration includes the other remaining functions that are composed of supply management processes (PATH and WHO, 2013). With regards to how supply chains should integrate; supply chains can be integrated through segmentation where products are grouped and delivered according to product characteristics (PATH and WHO, 2013). For example, all products that require refrigeration may be grouped together. Supply chains can also be fully integrated which means that multiple, vertical supply chains are merged to form one supply chain (PATH and WHO, 2013). Horizontal integration provides the following benefits: improved performance and efficiency, increased adaptability and flexibility, and economies of scale (PATH and WHO, 2013). However, these benefits were achieved by integrating numerous vertical public health supply chains PATH and WHO (2013).

3.4.1.2 Horizontal Supply Chain Collaboration

Horizontal supply chain collaboration is defined, according to Soosay (2010), as “unrelated or competing organisations, producing similar products or different components of a product, that form a cooperative association to share resources such as warehouse space and manufacturing capacity”. Numerous organisations improve their supply chains to such an extent that additional improvements result in insignificant cost savings and efficiency gains (Vanovermeire *et al.*, 2014). However, when these organisations take part in horizontal supply chain collaboration, the efficiency and sustainability of the supply chain improves significantly (Vanovermeire *et al.*, 2014). Research on horizontal supply chain collaboration is still in its infancy since it is a relatively new field of research (Vanovermeire *et al.*, 2014). Currently, research predominantly focuses on horizontal supply chain collaboration in the field of logistics and transportation management (Soosay and Hyland, 2015). Vanovermeire *et al.* (2014) did a case study with three companies in order to test the feasibility of implementing horizontal collaboration in logistics. The three companies do their own deliveries, however 57 percent of two or all three of the companies’ orders are delivered to a common customer. For the case study Vanovermeire

et al. (2014) determined how much it costs each company to: (i) deliver their own products; (ii) deliver the products after the company has been optimised internally; and (iii) deliver the products while collaborating with one another. The results showed that cost savings of 13.65 percent was achieved after the companies were optimised internally, whereas the horizontal collaboration resulted in cost savings of 25.83 percent and a 26.58 percent decrease in the number of delivery trips (Vanovermeire *et al.*, 2014). According to Vanovermeire *et al.* (2014) the efficiency can improve between 10 and 30 percent when horizontal supply chain collaboration is implemented in the logistics area of the supply chain.

Horizontal supply chain collaboration may result in the following (Aboutalebi, 2015; Vanovermeire *et al.*, 2014; Sanchez Rodrigues *et al.*, 2015; Cruijssen *et al.*, 2007): (i) increased delivery frequency and throughput as a result of increased service levels; (ii) sharing of investments; (iii) reduced logistics costs and economies of scale; (iv) market share increase; (v) increased efficiency which results in sustainable logistics; and (vi) sharing and exchanging innovative and best practices. More and more companies are forming horizontal logistics collaborations by consolidating orders and using a shared transportation channel (Vanovermeire *et al.*, 2014). A few companies go a step further when collaborating horizontally by sharing resources and assets, collectively making decisions and bargaining collectively to receive economies of scale; essentially creating a new supply chain (Vanovermeire *et al.*, 2014).

Björnfot and Torjussen (2012) argue that in order for organisations to manage an ever-increasing demand and overcome market uncertainty, supply chains must be structurally flexible. According to (Björnfot and Torjussen, 2012) sharing capabilities and resources through horizontal collaborations enables the supply chain to be structurally flexible and may also result in a more stabilised market. However, horizontal supply chain collaboration has its own set of challenges, such as determining how gains should be divided amongst partners, the risk of sharing information, the lack of appropriate IT support, cultivating relationships and the lack of case studies to facilitate the implementation of horizontal collaboration (Vanovermeire *et al.*, 2014). The barriers to implementing this type of collaboration include coordinating and negotiating with partners, choosing the right partners and adopting the right communications and information technology (Cruijssen *et al.*, 2007). Horizontal collaboration requires trust and commitment, and is based on a long-term relationship with partners (Vanovermeire *et al.*, 2014).

3.4.2 Defining Integration

The purpose of this section is to define integration in order to prevent confusion with all the other definitions of integration. Definitions from Axelsson

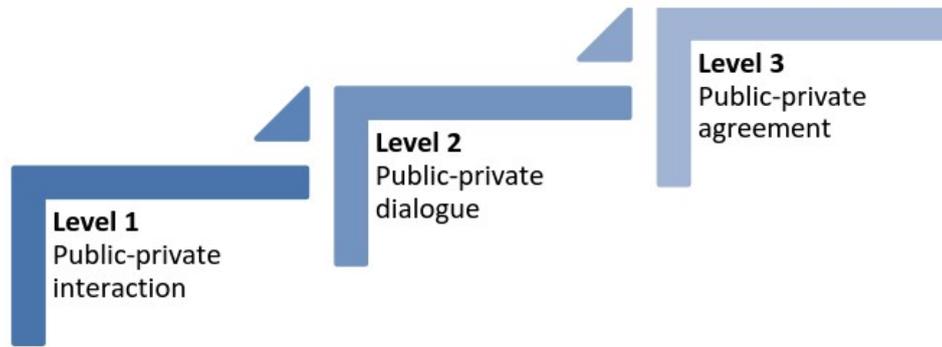


Figure 3.12: The levels of integration

and Axelsson (2006), Foreman and Roberts (1991), National Research Council *et al.* (2000) and UN Commission (2015) were combined to define supply chain integration. For the purpose of this dissertation supply chain integration is defined as two or more autonomous supply chains that work together to (i) improve their collective efficiency and effectiveness; (ii) find synergistic combinations of resources; and (iii) find solutions to problems that each supply chain may not achieve on its own by constructively exploring their differences and combining expertise from different organisations within the supply chains. Similar to the description by Axelsson and Axelsson (2006) this type of supply chain integration can be visualised as a step-wise process that starts from complete autonomy (i.e. no integration) and progresses to interaction, to dialogue and finally to agreement (fully integrated).

3.4.2.1 Levels of Integration

The levels of integration are defined using the private sector engagement model (also known as the P3 Model) as defined by UN Commission (2015). The P3 Model consists of three phases (called levels from here on forth) through which public-private engagements can go. Each level builds on the preceding level, in other words engagements move from level 1 to level 2, and then from level 2 to level 3 in a step-wise manner. However, it is not necessary for each public-private engagement to reach all three levels. As a private engagement progresses to level 3, so will the complexity and formality of the engagement increase. The levels are defined as illustrated in Figure 3.12. Each level is shortly discussed below.

3.4.2.2 Level 1 - Interaction

In public-private interaction, information is exchanged between the two sectors to align understanding and assist each other. For example, private sector providers could share data, such as case detections, with the public sector. An example of interaction from the public sector could be as simple as com-

municating with the private sector to ensure that new regulations have been received and understood. This type of engagement is usually short term with a duration of roughly one to two weeks or ongoing on a periodic basis.

3.4.2.3 Level 2 - Dialogue

Dialogue involves cooperation and negotiation between the public and private sectors around shared interests. Dialogue does not necessitate shared investments or formal agreements, it does however require that the two sectors cooperate and work together effectively. An example of a public-private dialogue is corporate social responsibility initiatives. These engagements usually last about two to four months or ongoing on a periodic basis.

3.4.2.4 Level 3 - Agreement

Public-private agreement is the most complex form of engagement that involves a formal contract between the public and private sectors which stipulates each sector's roles and responsibilities. The agreement should also specify each sector's investments and the conditions under which each sector will take over risks and receive benefits. Specific activities should take place during the agreement process, such as a request for proposal (RFP), contract negotiations and contract award, implementation and contract management. Public-private agreements are typically long-term engagements.

Table 3.2 summarises the characteristics of each integration level.

Table 3.2: Integration level characteristics

Integration level	Timespan	Formality	Engagement focus
Interaction	Short term (1 - 2 weeks)	Informal	Communication
Dialogue	Medium term (2 - 4 months)	Can be informal or formal; does not require a formal agreement or shared investment.	Cooperation
Agreement	Long term (unspecified how long)	Formal	Collaboration

3.5 Public-Private Health Supply Chain Integration as a Possible Solution

Public-private supply chain integration is the application of integration (as defined in Section 3.4.2) to public and private supply chains. Countries that harness the strengths of both the public and private sector often have health supply chains that are more capable of handling epidemics and disease outbreaks, better able to adapt to changing circumstance and more effective (Donato *et al.*, 2016). For instance, developed countries leverage the strengths of the private sector and depend on the private sector to distribute and supply products as well as provide other services that complement the public sector (MIT-Z ILP, 2008). Conversely, in developing countries private sector engagement considerably less, yet face more challenges (MIT-Z ILP, 2008). As a result of greater private sector involvement, health supply chains in developed countries are able to continuously and effectively supply health products (MIT-Z ILP, 2008). This contrast between health supply chains in developed and developing countries made MIT-Z ILP (2008) question whether increased private sector engagement would improve low- and middle-income country health supply chains.

Numerous authors, including Nishtar (2004); Tennyson (2011); IFC World Bank Group (2011); Prybil *et al.* (2015); Kula and Fryatt (2014), argue that both sectors are unable to address current and future health system challenges individually and that the public and private sectors need to work together. According to Nishtar (2004) public-private collaboration is crucial and unavoidable. In order for health supply chains to be responsive and adaptable to the continuously changing environment, the private sector need to be involved and be part of the solution (John Snow Inc., 2016). Kaboru (2012) argues that private sector engagement will result in more effective health supply chains and subsequently the health system will improve. Public-private engagements can increase the availability of health products, thus increasing disadvantaged populations' access to medicines and addressing some public health supply chain problems (MIT-Z ILP, 2008). In addition, the reliability, effectiveness and efficiency of health supply chains can be improved across all sectors, private sector best practices can be adopted and the private sector's reach can be expanded through the implementation of public-private initiatives (MIT-Z ILP, 2008).

Governments need to become aware of the fact that plenty of other supply chains encompass public health supply chains, each consisting of numerous different actors from the private and public sectors as well as faith-based and non-governmental organisations (Bornbusch *et al.*, 2014). Bornbusch *et al.* (2014) argues that although the health system is a complex conglomeration

of supply chains and actors, if it is properly managed and understood, the health supply chains may be “woven into a rationally integrated system”. Consequently, according to Bornbusch *et al.* (2014), the option and flexibility may exist for governments to decrease the number of distributors, suppliers, quality assurance, funders and procurement agencies on account of all actors collaborating to improve health outcomes. As previously mentioned Bornbusch *et al.* (2014) argues that the government should not be operating supply chains, however a few of the supply chain functions will remain the responsibility of the government, including creating a vision and system strategy, regulating pharmaceuticals, supervising the health system, policy-making and managing expenditures. This concept of integration introduced by Bornbusch *et al.* (2014) is similar to a concept by Bornbusch and Bates (2013) called multiplicity (as mentioned in Section 3.1.2). Bornbusch and Bates (2013) call for the need for further research to determine how multiplicity can be implemented such that the performance, risk management and costs of health supply chains can be optimised. Furthermore, Bornbusch and Bates (2013) argue that the implementation of multiplicity is essential as it will enable health supply systems to handle the increasing number and volume of health products in the future.

The public and private sectors have worked together on numerous initiatives, however most of the initiatives occur in disease-specific programs or have been created for the purpose of solving a specific supply chain problem. Research suggests (as discussed in this section) that supply chains from each sector, in this case the public and private sectors, may be integrated to take advantage of each sector’s strengths and address both current and impending supply chain challenges.

3.6 Chapter 3 Conclusion

In this chapter a review of the literature pertaining to three intersecting research fields, as introduced in Chapter 2 are presented. Reviewing the literature provides a deeper understanding of the problem the study aims to address. The review includes an investigation of health supply chains, pharmaceutical supply chains, public-private engagement and supply chain integration.

Chapter 4

Existing Frameworks and Methodologies

From the literature review in the previous chapter, it is evident that public-private integration could potentially be a solution that can improve health supply chains, both in public and private sectors. This can be achieved using the strengths of each sector to improve the efficiency and effectiveness, and to enable supply chains to better deal with current and future challenges. This approach may be ambitious and pose some challenges risks (as discussed in Sections 3.3.2, 3.4.1.1 and 3.4.1.2) when considering to integrate public and private pharmaceutical supply chains. However, it may be beneficial to investigate if it results in improved affordability, access and availability of pharmaceuticals due to better functioning supply chains. Although fully integrated pharmaceutical supply chains may not be feasible from the outset, a good starting point may be the identification of points along the public supply chain where the public and private sectors can integrate.

There are various documents and frameworks that aim to identify opportunities for public-private engagement and frameworks that assist with the implementation of public-private partnerships. However, there are no frameworks, of which the author is aware, that assess pharmaceutical supply chains to identify where along the public supply chain the two sectors can engage and ultimately integrate. Therefore, the aim of this study is to create a framework to assess and identify opportunities for integration along the pharmaceutical supply chain such that (i) it can pave the way for further research on public-private supply chain integration; (ii) it can be used in case studies that aim to investigate the impact and implementation of public-private supply chain integration; (iii) it can assist decision-makers in developing countries to identify opportunities for integration; (iv) it may provide a starting point and facilitate the implementation of public-private supply chain integration.

The aim of some frameworks are similar in the sense that these frame-

works identify opportunities for public-private engagements. However, if the frameworks were to be used to identify opportunities for integration along pharmaceutical supply chains, some research gaps would become apparent. Such research gaps are discussed later in this section.

The aim of this chapter is thus to review existing frameworks and methodologies that identify opportunities for integration or private sector engagements in pharmaceutical supply chains in order to:

- (i) Determine what methods have been used to identify opportunities for public-private health supply chain integration or public-private engagement.
- (ii) Determine whether the aim of this research enquiry has already been addressed by any of the frameworks included in the literature documented in the preceding chapter.
- (iii) Identify the research gaps of the frameworks.
- (iv) Adapt the identified research gaps to framework criteria.

Three different frameworks/methodologies were identified during the literature review, these frameworks include:

- (i) Emerging trends in supply chain management: Outsourcing public health logistics in developing countries
- (ii) Integration of vaccine supply chains with other health commodity supply chains: A framework for decision making
- (iii) Private sector engagement: A guidance document for public health supply chains

Due to the limited research on the integration of public-private pharmaceutical supply chain integration, frameworks and methodologies of general health supply chains were included (i.e. framework i and iii). In the following sections, each method is briefly described after which the research gaps, relative to the aim of this dissertation, and thus the requirements from a framework to support the attainment of the stated objectives, are identified (Sections 4.1 to 4.3). Lastly, in Section 4.4 this chapter's findings are summarised by means of stating the criteria that will be used as guiding principles for the development of the framework.

4.1 Outsourcing Public Health Logistics

USAID (2010) developed a document that enables public health supply chain managers to outsource public health logistics. The document describes the basics of outsourcing, what supply chain functions can be outsourced, when to consider outsourcing and how to outsource logistics functions. According to the document, one section includes “guidance on how to identify potential opportunities for outsourcing within an organization...” (USAID, 2010). The process of identifying opportunities for outsourcing consists of three steps:

Step 1: Identify core competency An organisation’s core competency is its main purpose that allows the organisation to make a profit and compete with other organisations. For example, Dell’s core competency is manufacturing customisable, high-quality computers. According to the USAID (2010), the ministry of health should identify and consider outsourcing activities that are not part of its core competencies or “operational expertise”. For example, the staff at central medical stores are proficient at procuring and managing stock, but have limited knowledge regarding fleet management and scheduling. Transportation is therefore a good candidate for outsourcing.

Step 2: Review the operational process The next step is for supply chain managers to assess the performance of functional areas in order to identify under-performing functional areas. “After the core competency and the process review are complete, the areas to be outsourced should be clear” (USAID, 2010).

Step 3: Feasibility analysis After identifying areas that can be outsourced, stakeholders need to assess the feasibility of outsourcing by making sure there are no political and operational barriers. Additionally, they will need to discuss how funding will be secured.

4.1.1 Research Gap: Outsourcing Public Health Logistics

- (i) This method only focuses on identifying opportunities for outsourcing logistical functions, i.e. distribution, warehousing and inventory management, and not opportunities that may fall within other parts of the end-to-end supply chain.
- (ii) The method only considers one of the private engagement forms, i.e. collaboration, adapting and learning, technical assistance or stewardship.
- (iii) The method is specifically developed for outsourcing only since the aim of the methodology is to shift the responsibility of certain supply chain functions to the private sector so that the public sector can focus on core

competencies. The shifting of responsibility to private sector excludes collaborative engagements where both sectors need to work together. It also misses opportunities for insourcing functions that could be done more efficiently in-house.

- (iv) In addition, the document suggests that private sector engagements should only be considered when supply chain managers are experiencing problems in the supply chain. Perhaps supply chain areas with average performances can be improved to perform excellently or public sector best practices can be upgraded to private sector best practices (in cases where the private sector performs better than the public sector).

4.2 Integrating Vaccine Supply Chains with Other Health Supply Chains

Yadav *et al.* (2014) and WHO and PATH (2013) developed a decision making framework that determines where the integration of vaccine and other health commodity supply chains will provide the most significant benefits. As part of the framework, opportunities for integration (between vaccine and other health supply chains) are identified. Opportunities for integration were identified by investigating the benefits, disadvantages and ease of integration of each supply chain function. The benefits were determined by carrying out a literature review, whereas disadvantages and ease of integration were identified by examining detailed case studies, experiences from integrating family planning supply chains with essential medicine supply chains, and interviewing key stakeholders. The resulting framework lists each supply chain function, the benefits and disadvantages of integrating each function and the ease of integrating each function.

In an evidence brief, PATH and WHO (2013) explain how vaccine supply chains were integrated with other health commodity supply chains. PATH and WHO (2013) focused on the integration of physical products, which was achieved by performing the following steps:

1. Define the goals of the supply chain and obtain stakeholder buy-in
2. Create supply chain segments (supply chain segmentation)
3. Identify standard operating procedures and service objectives of each segment
4. Develop an implementation strategy

4.2.1 Research Gap: Integrating Vaccine Supply Chains with Other Health Supply Chains

- (i) Both methods integrate two or more vertical public health supply chains, instead of integrating a public and private supply chain.
- (ii) Although the framework by Yadav *et al.* (2014) and WHO and PATH (2013) may provide some insightful information regarding the benefits, challenges and ease of integration, there are no clear steps provided regarding how the framework should be used or how users should decide which supply chain functions to integrate.
- (iii) The method described by PATH and WHO (2013) is created to integrate physical products which only occur in two supply chain functions, namely storage and transport. This means that other supply chain functions such as forecasting, procurement, orders and information systems are excluded (PATH and WHO, 2013).

4.3 Private Sector Engagement Guidance Document

The Private Sector Engagement Guidance Document was developed to assist supply chain managers in identifying opportunities for public-private engagement and provide guidance for executing the engagement process (UN Commission, 2015). Opportunities are identified by describing the different forms of public-private engagements as well as the potential barriers each engagement might have. A real world example is given for some of the engagement forms. In the project selection section of the document, a table is provided with methods to help decide whether a problem can be solved through private engagement. In other words, supply chain managers should already know where they want to implement private engagement.

4.3.1 Research Gap: Private Sector Engagement Guidance Document

The document has a substantial list of engagement forms from which supply chain managers could pick to potentially solve a supply chain problem. However, the document does not provide clear steps on how to identify opportunities for integration in a health supply chain.

4.4 Framework Development Criteria

From the above analysis of the three mentioned frameworks, it is evident that the frameworks that are reviewed do not adequately align with the aim of this research enquiry. The contextualisation of the problem (Chapter 3) along with the exploration of the areas where existing frameworks lack to address and support the specific research aim are used to infer the following framework development criteria:

- (i) A clear step-by-step approach is needed to identify opportunities for public-private pharmaceutical supply chain integration.
- (ii) The framework should include various forms of public-private engagements.
- (iii) The framework should assess the end-to-end in-country public pharmaceutical supply chain for integration opportunities.
- (iv) The framework should aim to improve any supply chain area, and should avoid exclusive focus on under-performing areas.

4.5 Chapter 4 Conclusion

In this chapter three existing frameworks and methodologies, that identify opportunities for integration or private sector engagements, are reviewed. Research gaps are identified during the review that are subsequently adapted to framework development criteria.

Chapter 5

Preliminary Framework Development

In this chapter, the objective is to develop the preliminary framework. The methodology of how the framework is developed is described after which the steps, as outlined by the selected framework development methodology, are conducted in order to conclude with a framework that evaluates pharmaceutical supply chains to identify opportunities for public-private integration. This framework is subsequently subjected to subject matter expert validation in the succeeding chapter.

5.1 Preliminary Framework Development Methodology

This section explains how the framework is developed from the criteria that were derived in Chapter 4. Figure 5.1 provides an illustration of the methodology which is discussed in further detail below.

5.1.1 Framework Foundation

The framework foundation consists of the elements of the framework that meet the criteria identified in Chapter 4. These elements are collectively known as the foundation because the framework must have these elements to fulfill the criteria. In this step of the framework development, literature is reviewed to identify possible solutions that may meet the criteria. The solutions are briefly discussed and the best option is then selected.

5.1.2 Individual Steps

Criteria 1 involved identifying an appropriate framework approach. In this step of the framework development, the individual steps are determined using

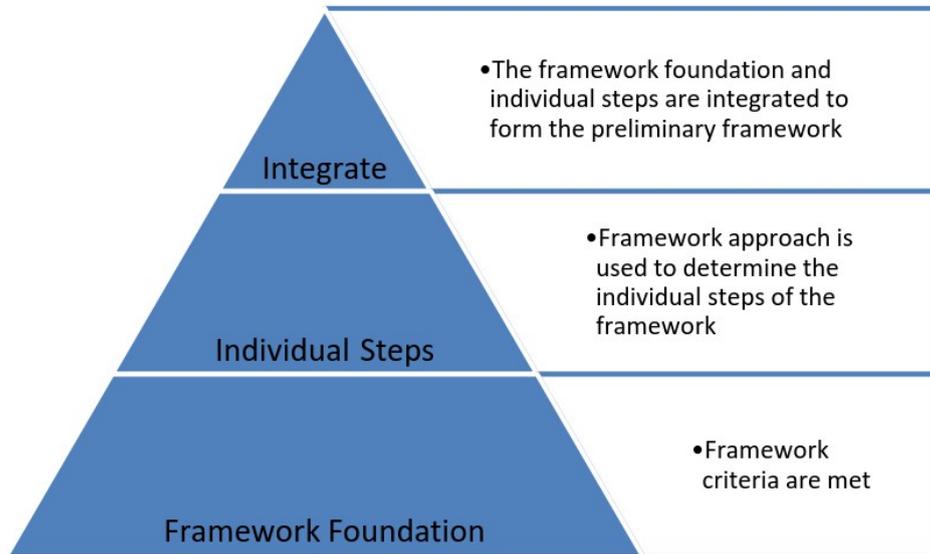


Figure 5.1: Preliminary framework methodology

the framework approach. For each step, a short literature review is carried out to determine what methods other authors have used and why. Next, the methods proposed in the literature are discussed in terms of their relevance to the framework. Thereafter, the most relevant method, or selection of methods, are chosen to be included in the framework.

5.1.3 Integrate

The last step of the framework's development involves integration of the framework foundation and individual steps to form the preliminary framework.

5.2 Framework Foundation

For each of the criteria identified in Chapter 4, a short literature review is carried out to identify suitable solutions. The most appropriate solution is then chosen for the preliminary framework.

5.2.1 Criteria 1

Criteria 1 stated that a clear, step-by-step approach is required, therefore, the aim of this section is to identify an approach which can be used to develop the framework. Four well established process improvement approaches were investigated since the the aim of the framework is to improve pharmaceutical supply chains (i.e. the process) by identifying opportunities for integration.

Each approach is shortly discussed, after which the one most suited to the requirements of the current research is determined.

5.2.1.1 DMAIC

DMAIC is a process improvement acronym which stands for Define, Measure, Analyse, Improve and Control (De Mast and Lokkerbol, 2012). DMAIC is an integral part of the Six Sigma methodology which aims to reduce variability in business processes (Badiru and Osisanya, 2016; Sokovic *et al.*, 2010). However, DMAIC has been applied as a general problem solving and process improvement technique (De Mast and Lokkerbol, 2012; McAdam and Lafferty, 2004). DMAIC is a systematic, fact-based approach that provides result-driven project management (Sokovic *et al.*, 2010). The five steps of DMAIC are as follows (Sokovic *et al.*, 2010):

D: Define by identifying, prioritising and selecting the right project

M: Measure key process characteristics, the scope of parameters and their performances

A: Analyse by identifying key causes and process determinants

I: Improve by changing the process and optimising performance

C: Control by sustaining the improvement gains

5.2.1.2 DRIVE

DRIVE is an approach that can be used for analysis and problem solving during the process improvement process (Badiru and Osisanya, 2016). One of the benefits of this approach is that it helps to identify specific areas where improvements can be made (Boutros and Cardella, 2016). According to Boutros and Cardella (2016) the approach consists of the following steps:

D: Define the scope of the process, deliverables and success criteria.

R: Review the current process and collect data

I: Identify improvements and necessary changes

V: Verify the improvements will meet the defined goals and prioritise changes based on impact

E: Execute the plan by implementing the changes and measuring the results.

5.2.1.3 IDEAL

The IDEAL approach is a cycle of activities similar to the Plan-Do-Check-Act approach (Persse, 2006). Figure 5.2 gives an illustration of the IDEAL approach.

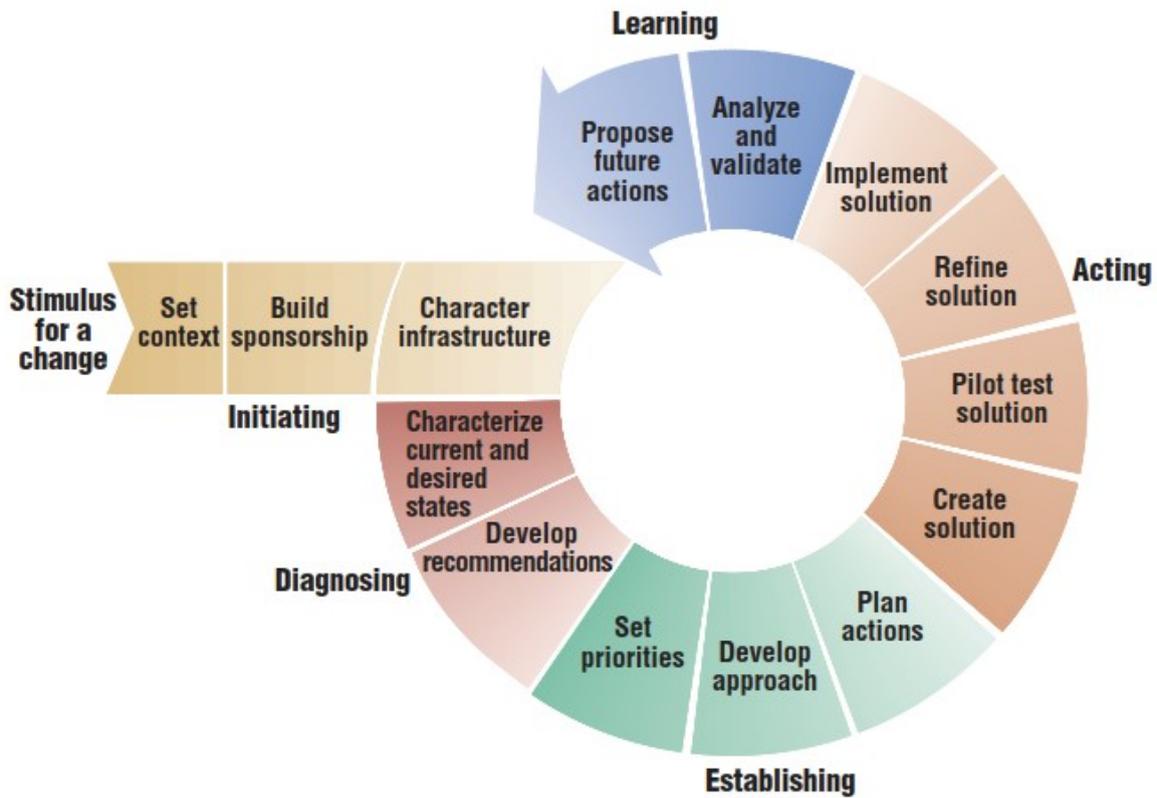


Figure 5.2: The IDEAL cycle. Source: Börjesson and Mathiassen (2004). © [2004] IEEE

These are the steps as described by Persse (2006):

Initiate: In this step the organisation realises it has operational problems that need to be solved. After the realisation, the organisation makes the decision to take action. The initiate step involves the process of acquiring sponsorship and formulating the scope of the problem.

Diagnose: The organisation's current process position, quality, strengths, weaknesses and improvement areas are determined.

Establish: In this step the organisation establishes the solution.

Act: The organisation implements the solution.

Learn: The organisation learn from the implemented solution.

5.2.1.4 FOCUS-PDCA

The FOCUS-PDCA approach was developed by the Hospital Corporation of America and is an expanded version of the Deming cycle (Plan-Do-Check-Act) (Wagner, 2002). FOCUS-PDCA is often used in healthcare research (Wagner, 2002). The approach consists of the following nine steps (Wagner, 2002):

F: Find a process to improve

O: Organise a team that knows the process

C: Clarify the current knowledge of the process

U: Understand sources or causes of variation. Determine how the process varies and what problems resulted.

S: Select the process to improve

P: Plan the improvement

D: Do the improvement

C: Check the results

A: Act to hold the improvement gain

5.2.1.5 Approach Selection

Four process improvement approaches were investigated. The aim of the framework is to identify opportunities for integration, however the implementation/execution of integration is outside the scope of this thesis. Therefore, an approach that focuses primarily on identifying solutions and less on the implementation and learning from the solution would be the most appropriate candidate. As a result, the DRIVE approach was chosen to serve as an overarching structure for the framework developed in this project.

5.2.2 Criteria 2

Criteria 2 stated that various forms of public-private engagements should be included in the framework. The different types of public-private engagements are discussed in Section 3.3.4. As discussed many authors identify and classify public-private engagements differently according to their interpretation of what differentiates and characterises specific engagements (John Snow Inc., 2016; UN Commission, 2015; USAID, 2010; Whyte and Olivier, 2016). Some engagement forms are widely recognised and accepted throughout the literature such as outsourcing, partnerships and the adoption of private sector practices (UN Commission, 2015; John Snow Inc., 2016; USAID, 2010). Not only are there a number of different definitions for engagements, each with its

own nuance, but many engagement types can be further sub-divided according to different characteristics. For example, Roehrich *et al.* (2014) conducted a systematic literature review on one type of public-private engagement, namely public-private partnerships and identified 9 different types of partnerships.

The differences in engagement definitions and the number of different engagement types poses a problem when developing a framework that aims to include most engagement types. From a practical and implementation standpoint it would not make sense to include all the different definitions and nuances. Therefore it may be more useful to use a broader definition of public-private engagements. Using the definition of the P3 provided by UN Commission (2015) will enable the framework to include most public-private engagements since most engagements fall under one of the three categories. See Section 3.4.2 for the full definition of the P3 model.

5.2.3 Criteria 3

Criteria 3 states that the end-to-end in-country public pharmaceutical supply chain must be assessed. Supply chain functions are the activities that, when combined, constitute the supply chain (John Snow Inc., 2017). Health supply chain functions are defined differently by various authors in the health and pharmaceutical supply chain literature and may include a larger number of functions, or fewer. Table 5.1 illustrates the difference between the different definitions of the functions that supply chains consist put forward by different authors.

Assessing the supply chain functions for integration opportunities would prove to be difficult because the supply chain functions consist of many activities. Dividing the functions in Table 5.1 further into smaller activities it will allow for a more precise identification of integration opportunities. When deciding on which author's definition of supply chain functions to use, the practicality of using it in a framework must be kept in mind. SIAPS Ukraine (2016) and John Snow Inc. (2017) break the supply chain functions into too many activities which will make the framework tedious and time consuming, whereas SIAPS (2014) break down the functions into further activities. Therefore, the breakdown provided by MSH (2012) will be used (as indicated in Table 5.2) since there is a balance between the practicality of using the framework and assessing the supply chain in further detail.

Table 5.1: Supply chain functions according to various authors.

Supply Chain Functions	SIAPS Ukraine (2016)	SIAPS (2014)	John Snow Inc. (2017)	MSH (2012)
Product selection	x		x	x
Quantification	x	x	x	
Procurement	x	x	x	x
Warehousing	x	x	x	
Inventory management	x	x	x	
Distribution		x	x	x
Waste management	x			
Transportation	x			
Service delivery		x	x	
Utilisation		x		x
Management support				x
Regulatory policies		x		

5.2.4 Criteria 4

Criteria 4 states that the improvement of the supply chain, through integration, should not be limited to underperforming areas of the supply chain. This criteria is met by assessing the end-to-end supply chain for integration opportunities and not including performance assessment approaches.

5.3 Individual Steps

This section further describes the developed framework by considering each of the DRIVE process steps in a stepwise manner. In particular, each section describes for each part of the DRIVE framework: i) the reviewed literature relevant to that step; ii) a discussion of the relevance of the methods proposed in literature; and iii) a selection of a combination of methods that were deemed to be most relevant and thus included in the preliminary framework.

Table 5.2: The functions and activities of the pharmaceutical supply chain as defined by MSH (2012)

Supply Chain Functions

1. Selection

Review prevalent health problems

Identify treatments of choice

Choose individual medicines & dosage

Decide which medicines will be available at each level of the health care system

2. Procurement

Quantify medicine requirements

Select procurement methods

Manage tenders

Establish contract terms

Assure pharmaceutical quality

Ensure adherence to contract terms

3. Distribution

Clear customs

Stock control

Stores management

Deliver to drug depots & health facilities

4. Use

Diagnose

Prescribe

Dispense

Use by patient

5. Management support

Organization of system

Finance & sustainability

Information management

Human resource management

5.3.1 Define the Scope of the Supply Chain (D in DRIVE)

The first step of the DRIVE approach involves, as the name suggests, defining the scope of the problem as well as the success criteria such as deliverables and success criteria (Boutros and Cardella, 2016).

5.3.1.1 Literature Review

In many projects or assessments one of the first steps is to decide the scope of the project as seen in project reports by PATH and WHO (2013), UNICEF (2016), USAID | DELIVER PROJECT Task Order 4 (2013), USAID (2013) and USAID | DELIVER PROJECT Task Order 1 (2011*a*). According to the assessment guide and tool by USAID | DELIVER PROJECT Task Order 4 (2013), the assessment scope informs which data will be collected and what will be analysed. Although the assessment guide and tool by USAID | DELIVER PROJECT Task Order 4 (2013) focuses on the human resources of health supply chains, the document may provide some insight that can be used for this framework. In a public health supply chain strengthening framework developed by UNICEF (2016) the scope is defined before the strengthening exercise due to the complexity of public health supply chains and the many factors that need to be taken into consideration. Factors include the large variety of health programmes and products (such as HIV, TB, vaccines, etc.), the multiple levels health supply chains have, the different functions of health supply chains (such as procurement, quantification, distribution, etc.) and the various support systems and policies (UNICEF, 2016). All elements within each of the factors cannot be feasibly managed during a single project, therefore UNICEF (2016) argue that consensus should be reached among the stakeholders regarding priority areas on which joint efforts will focus. The assessment scope should be collaboratively developed and agreed upon by taking opinions of various stakeholders into account (USAID | DELIVER PROJECT Task Order 4, 2013; UNICEF, 2016).

The scope of the assessment largely depends on the available time and resources (Eichler *et al.*, 2012; USAID | DELIVER PROJECT Task Order 1, 2011*a*). The scoping phase of the tool developed by USAID | DELIVER PROJECT Task Order 4 (2013) consists of five sections, namely: developing the scope of the assessment; building and recruiting the assessment team based on the required skills and knowledge as defined in the assessment scope; engaging stakeholders since the assessment success depends on the involvement of these stakeholders; compiling reference materials related to the country, context and supply chain in question; and developing a health supply chain profile by asking stakeholders to complete a survey regarding the capacity and performance of the supply chain. According to USAID | DELIVER PROJECT

Task Order 4 (2013) the assessment scope should include the purpose of the assessment, the human resources building blocks that will be included, the levels of the supply chain that will be assessed, the time frame of the assessment and the desired skills of the assessment team. As part of developing the scope, a budget needs to be developed in order to balance the priorities of the assessment with budget constraints (USAID | DELIVER PROJECT Task Order 4, 2013). USAID | DELIVER PROJECT Task Order 1 (2011*a*) and USAID (2013) also include the development of a budget in the scoping phases of the supply chain assessments to ensure that the objectives of the assessment are met.

UNICEF (2016) define the supply chain scope according to four dimensions, namely: supply chain levels, supply chain products/programmes, supply chain functions and policy and support systems. UNICEF (2016) provide a checklist with the dimensions to assist with the definition of the scope. According to UNICEF (2016) defining the scope according to these four dimensions help manage the supply chain complexity. Similarly to USAID | DELIVER PROJECT Task Order 4 (2013) and UNICEF (2016), USAID (2013) determine which commodities will be included in the scope, the timeframe of the assessment, as well as the health facilities that will be assessed.

5.3.1.2 Discussion of Methods

The majority of sources define the scope according to the supply chain levels and groups of products, others also include specific supply chain functions and support systems. No specific reason is given as to why the scope of the supply chains is defined in this way, however it is assumed it is done for the same reason that UNICEF (2016) provided, which is that it reduces the complexity of the supply chain and thus the assessment as well. In many projects the identification of and engagement with stakeholders is important since stakeholders provide the required data, information and insight that enables execution of projects and assessments. Some scoping exercises require that assessment teams be recruited so that they can work with the client who requested the assessment or whose supply chain is being assessed. The assessment team assists with data collection, preparations and report writing.

This framework is developed for public supply chain managers who want to assess their own supply chains. Since the assessment will not be used for clients an assessment team may not be required. If the supply chain manager needs some assistance with the assessment, he/she can identify competent employees to help with the assessment. Recruiting an assessment team is not crucial for the success of the assessment outcome. Some projects and assessments require that reference materials be collected and reviewed during the process of defining the scope in order to gain a better understanding of the supply

chain environment. This is addressed in the second step of the DRIVE approach, which is to review the current situation, and is therefore not necessary in the scope definition step. It is often recommended that the purpose of the project or assessment be clearly defined as part of the scope definition. While some frameworks or assessments could serve multiple purposes, this framework serves one purpose which is to identify opportunities for integration. Thus, it will not be required to define the purpose of the assessment during the scope definition.

Sometimes employees and stakeholders are required to travel to a destination (or multiple destinations) where the assessment will take place. This means that money will be spent on travelling, transport, hiring venues and in the case of workshops, money will be spent on refreshments, food and any other materials that may be required (such as printed guides, questionnaires, projectors, etc.) It is therefore important for the person who is carrying out the assessment to draw up a budget to ensure that there is enough funding for the assessment and to prevent overspending. It is also important to develop a timeframe to ensure that deliverables are met on time and preventing the assessment from taking longer than it should.

5.3.1.3 Selection of Methods

The proposed approach to scope the supply chain assessment includes four components as described in Table 5.3, along with the reason why each method was selected.

5.3.2 Review the Current Situation (R in DRIVE)

According to the DRIVE approach this step requires that the current situation is reviewed by understanding the background and collecting information such as performance data, problem areas and improvement options (Boutros and Cardella, 2016). Therefore this section will be divided into two subsections, namely: review and data collection.

5.3.2.1 Literature Review

Considering that the “R” in DRIVE consists of two steps, namely a review and the collections of data, the literature review will be divided into two sections. First, literature related to the review of the current situation will be reviewed, followed by a literature review of methods used to collect data.

Review

According to UNICEF (2016), a review of the current situation is required to ensure that problems and performance gaps are agreed upon by all stake-

Table 5.3: Proposed components for determining the scope of the assessment

Component	Reason for inclusion	Adapted from
List of supply chain levels and products	Assists with the scope definition and reduces/manages the complexity of the assessment (UNICEF, 2016)	UNICEF (2016); USAID DELIVER PROJECT Task Order 4 (2013); USAID (2013)
Stakeholder engagement	Stakeholders can review approaches and outputs. Stakeholders can contribute to the data collection and methodology. Stakeholders can verify findings and recommendations. Stakeholders can give input on the feasibility and impact of recommendations. (USAID DELIVER PROJECT Task Order 4, 2013)	USAID DELIVER PROJECT Task Order 4 (2013)
Timeframe	Establishing a timeframe will inform when specific assessment steps will take place and when deliverables are due (USAID DELIVER PROJECT Task Order 4, 2013)	USAID DELIVER PROJECT Task Order 4 (2013); USAID DELIVER PROJECT (2011); USAID (2013)
Budget	Developing a budget will determine whether there is sufficient funding available to carry out the assessment, achieve assessment objectives and prevent unnecessary spending (USAID DELIVER PROJECT Task Order 4, 2013) and (USAID DELIVER PROJECT, 2011)	USAID DELIVER PROJECT Task Order 4 (2013); USAID DELIVER PROJECT (2011); USAID (2013)

holders. USAID | DELIVER PROJECT Task Order 4 (2013) suggest doing a document review to develop a better understanding of the larger context of the supply chain. Being familiar with the context of the country and the chosen supply chain will help to identify and clarify the supply chain's constraints (USAID | DELIVER PROJECT Task Order 1, 2011*a*). Many health supply chain guides, frameworks and reports make use of literature reviews to (i) identify information gaps (Pharasi, 2009); (ii) collect background information before an assessment (USAID, 2017; Village Reach, 2015; Islam, 2007; Lusby and Panlibuton, 2006; USAID | DELIVER PROJECT Task Order 4, 2013); (iii) understand the context of various fields (Steele, 2015; USAID | DELIVER PROJECT Task Order 4, 2013); (iv) review past assessments (Village Reach, 2015); and (v) to collect data (Islam, 2007).

Reviews can be carried out to determine what relevant information already exists and to understand the issues that affect the supply chain (USAID | DELIVER PROJECT Task Order 1, 2011*a*). Reviews are carried out by collecting background materials and documents and using questionnaires to gather further background information about the supply chain (USAID | DELIVER PROJECT Task Order 1, 2011*a*; USAID, 2013). These questionnaires contain questions regarding the supply chain context, stakeholders and reports that may be relevant to the assessment (USAID, 2013). Documents that should be included in the review include national health strategic plans that have been conducted on the specific supply chain (USAID | DELIVER PROJECT Task Order 1, 2011*a*; USAID, 2013), previous assessments or reports (Village Reach, 2015; UNICEF, 2016), documents related to programs, processes and policies, as well as any other documents recommended by stakeholders (USAID | DELIVER PROJECT Task Order 4, 2013; UNICEF, 2016; USAID, 2013). The country's strategic plan will help with understanding the country's supply chain before the assessment (USAID | DELIVER PROJECT Task Order 1, 2011*a*). Other documents include surveys that have been conducted by the country (USAID | DELIVER PROJECT Task Order 1, 2011*a*). Health supply chain reviews should include the supply chain structure and general operations and processes UNICEF (2016).

The supply chain structure can be determined by developing a map of the supply chain (Gardner and Cooper, 2003). Gardner and Cooper (2003) defines a supply chain map as follows: "A supply chain map is a representation of the linkages and members of a supply chain along with some information about the nature of the entire map". Examples of supply chain maps are illustrated in Figures 3.1 and 3.2. When strengthening public health supply chains, the review should include the current performance, how it compares with the desired performance as well as the determinants of success and failure (UNICEF, 2016). According to USAID (2013) the focus of the review should be to identify weaknesses within the chosen supply chain. Documents collected during

the review are collected and distributed amongst assessment team members (Islam, 2007; USAID | DELIVER PROJECT Task Order 4, 2013). Review documents should be gathered and reviewed before commencing with the data collection (USAID | DELIVER PROJECT Task Order 4, 2013). Other methods of collecting relevant information for the review include having meetings with stakeholders, government officials and service providers (USAID, 2017; Pharasi, 2009), visiting health facilities, reviewing processes and mapping the distribution, procurement and storage of health commodities (Pharasi, 2009).

Data collection

There are various methods of collecting data, such as focus groups, interviews, surveys (USAID | DELIVER PROJECT Task Order 4, 2013; Pharasi, 2009; Islam, 2007; USAID, 2013; USAID | DELIVER PROJECT Task Order 1, 2011*a*; SIAPS Ukraine, 2016). Some frameworks, such as the one developed by USAID | DELIVER PROJECT Task Order 4 (2013) include data collection plans where the geographic focus, key informants, organisations, data collection methodologies and schedules are taken into consideration. There are also various data collection tools such as Excel[®] based tools, paper based surveys, questionnaires, software programs, capability maturity models, KPI tools (USAID | DELIVER PROJECT Task Order 4, 2013; Pharasi, 2009; WHO; SCMS/Rwanda Ministry of Health, 2013; Tien *et al.*, 2013; SIAPS Ukraine, 2016). USAID | DELIVER PROJECT Task Order 4 (2013) use a data collection tool for the assessment of public health supply chains. The tool consists of four components where each component is specifically designed to collect specific data. The data collection tool consists of the following components: reference document review, public health supply chain profile, diagnostic dashboard and a supplemental survey (USAID | DELIVER PROJECT Task Order 4, 2013). The data collection tool was designed to increase the reliability, validity and accuracy of the data while ensuring that data collection is carried out in a consistent manner (USAID | DELIVER PROJECT Task Order 4, 2013).

5.3.2.2 Discussion of Methods

Similarly to Section 5.3.2.1, this section will be divided into two sections, namely review and data collection.

Review

Reviewing documents is a major component of the majority of assessments and projects for various reasons, as discussed in Section 5.3.2.1. These documents contain important information that is useful and relevant to assessments. Questionnaires and interviews with stakeholders also provide important information since stakeholders' experiences and insights can be gathered and may

include missing information that is not available in any documents. Stakeholders can also provide documents that are relevant to the assessment and can be included in the document review. Knowing the supply chain structure gives additional background information on the functioning and context of the supply chain. Developing a supply chain map allows stakeholders to reach an agreement on its structure and how it functions, and ensures that all stakeholders have the same level of understanding of the supply chain in question. Health facilities are usually visited when they are part of an assessment or data needs to be collected from the facilities. Due to the fact that this framework is a high-level supply chain assessment, it may not be required to visit specific health facilities.

Data Collection

All assessments and projects reviewed in Section 5.3.2.1 collect data by means of focus groups, interviews and surveys with stakeholders. This is because stakeholders have experience in the assessed field and can provide in-depth information and explanations. Their expertise and knowledge might not be available from other sources of information. Various data collection tools have been used to ensure that data is collected in a consistent manner, it also ensures that data is properly and correctly recorded thus increasing the reliability and accuracy.

5.3.2.3 Selection of Methods

The proposed components and the reason for selection for the review of the current situation are described in Table 5.4.

It is proposed that data will be collected on the current level of integration in order to get a further understanding of the current situation. Determining the current level of integration will give an indication of the current public-private engagements in each supply chain area as well as the degree of integration. Knowing the current level of integration will help determine where future public-private engagements might be needed/helpful to the pharmaceutical supply chain and prevent the duplication of existing public-private engagements. It may also enable the identification of integration opportunities that could contribute to the strategic goals of the public sector. Data will also be collected on the level of integration that the pharmaceutical supply chain is capable of achieving in order to identify improvement options as suggested by Boutros and Cardella (2016). Identifying the level of integration that the supply chain is capable of (integration capability) gives an indication of potential integration opportunities, the impact the integration could have on the supply chain and identifies the supply chain areas where improvements can be made. The proposed components and the reason for selection of the data collection phase is shown in Table 5.5.

Table 5.4: The proposed components for reviewing the current situation

Component	Reason for inclusion	Adapted from
Desktop/ document review of the supply chain and current public-private engagements	To gain a better understanding of the supply chain and its context (USAID DELIVER PROJECT Task Order 4, 2013); identify problems (UNICEF, 2016), constraints (USAID DELIVER PROJECT Task Order 1, 2011) and information gaps (Pharasi, 2009)	USAID DELIVER PROJECT Task Order 1 (2011); USAID (2013); USAID DELIVER PROJECT Task Order 4 (2013); UNICEF (2016); Village Reach (2015)
Supply chain map indicating the structure of the supply chain	The process of developing and disseminating a supply chain map leads to a common understanding of the supply chain. Mapping helps with the visualisation of the supply chain and identification of areas that need to be further analysed (Gardner and Cooper, 2003)	UNICEF (2016)
Questionnaire or interview with stakeholders	In cases where information is missing, insufficient or unclear, stakeholders may provide the required information or recommend relevant reports and documents.	USAID (2013); USAID DELIVER PROJECT Task Order 1 (2011)

5.3.3 Identify Improvements and Necessary Changes (I in DRIVE)

In order to identify improvements and the necessary changes it is proposed that the supply chain's current level of integration and its integration capability be compared. Although the results from the data collection tool (in Section 5.3.2.3) can be compared side-by-side, it could be quite a time-consuming process and due to the size of the matrices, mistakes can be made during the comparison. Therefore, visual representations of the data will be used to compare the current level of integration with the supply chain integration capability.

Graphs are excellent for visual representations because large amounts of data can be condensed into formats that are easy to understand and effectively

Table 5.5: Proposed components of the data collection phase

Component	Reason for inclusion	Adapted from
Data collection tool: Excel	A data collection tool may simplify the process of collecting data and ensure that data is collected in a consistent manner regardless of who uses the framework	USAID DELIVER PROJECT Task Order 4 (2013). Data collection matrix developed by author. See Appendix A.
Interview/ focus group with stakeholders	Stakeholders have a good understanding of the public pharmaceutical supply chain and how it functions. Stakeholders will also know to what extent the supply chain can integrate and whether the PPSC has the capacity to engage with the private sector.	USAID DELIVER PROJECT Task Order 4 (2013); Pharasi (2009); Islam (2007); USAID (2013); SIAPS Ukraine (2016)

communicate key points. It was decided that a radar graph will be used for the comparison since it allows for a quick comparison and it is easy to determine the gap between the current level of integration and the supply chain integration capability.

5.3.4 Verify and Prioritise (V in DRIVE)

In this step of the DRIVE approach it needs to be verified that the improvements will meet the defined goals and changes need to be prioritised based on its impact (Boutros and Cardella, 2016).

5.3.4.1 Literature Review

The most common method of validating data and findings is by hosting a workshop with stakeholders (Steele, 2015; McCord *et al.*, 2013; Islam, 2007; USAID | DELIVER PROJECT Task Order 4, 2013; UNICEF and MSH, 2012). During the workshops McCord *et al.* (2013) validate data by eliminating errors and speaking with stakeholders to correct and double check discrepancies. In the assessment tool developed by USAID | DELIVER PROJECT Task Order 4 (2013) the collected data is reviewed and analysed. Findings are validated

and supported by the secondary information collected during the document review. In cases where the assessment team still have questions or findings cannot be validated with secondary information, stakeholders are re-interviewed to validate the findings (USAID | DELIVER PROJECT Task Order 4, 2013). Once the data has been validated the assessment team develops recommendations which also validated during a validation workshop (USAID | DELIVER PROJECT Task Order 4, 2013). According to USAID | DELIVER PROJECT Task Order 4 (2013) findings and recommendations should be validated by two groups of stakeholders, namely: key stakeholders who are decision makers (for example managers or donors) and stakeholders who are responsible for funding or implementing the identified recommendations.

In addition to validating recommendations, stakeholders are also asked to prioritise recommendations. Other authors such as UNICEF and MSH (2012) and Islam (2007), also require stakeholders to prioritise solutions and results during the validation workshop. Other methods include validating and clarifying collected information by conducting face-to-face interviews with stakeholders (Tata and Babaley, 2012). In some assessments, such as SIAPS Ukraine (2016), information gathered during interviews is verified by observing processes and assets in health facilities. USAID (2013) verify information by observing, walking through and taking photos in health facilities. During the assessment, developed by USAID | DELIVER PROJECT Task Order 4 (2013), stakeholders are asked to prioritise interventions. This ensures that the interventions are prioritised by people who understand the context the best (USAID | DELIVER PROJECT Task Order 4, 2013). Interventions are prioritised according to criteria such as the feasibility, importance, affordability, cost, timeframe, risk and impact of the intervention (USAID | DELIVER PROJECT Task Order 4, 2013; Eichler *et al.*, 2012; Unicef, 2011).

WHO (2004) prioritise according to the urgency of need and the availability of resources. USAID | DELIVER PROJECT Task Order 1 (2011b), Unicef (2011) and Galer *et al.* (2008) score each criteria on a scale from one to three, where one is low and three is high. Criteria included the priority, feasibility and availability of resources (USAID | DELIVER PROJECT Task Order 1, 2011b). Priority refers to the size of the impact and the importance of the intervention; the feasibility refers to the extent of political and cultural support, infrastructure and policies; lastly resources refer to the funds, skills and materials (USAID | DELIVER PROJECT Task Order 1, 2011b). There many prioritisation methods that can be used, however according to Eichler *et al.* (2012) the method should be consistent and transparent. Galer *et al.* (2008) make use of a prioritisation matrix where interventions are ranked based on the timeframe, cost, availability of resources and importance to quality. A prioritisation matrix (PM) is a simple technique that objectively sorts and ranks items according to importance (Fernandes *et al.*, 2006; Gosenheimer *et al.*,

2012). Items are ranked based on a set of important criteria (Gosenheimer *et al.*, 2012).

5.3.4.2 Discussion of Methods

Of the reviewed documents that discuss how data is validated, all used workshops or interviews with stakeholders to validate outcomes, recommendations and data. This is likely because of stakeholders' experience in the field. Projects are prioritised according to various different criteria as mentioned in Section 5.3.4.1. Although the criteria of the different assessments and projects are similar, criteria are usually defined based on what is important for each project.

5.3.4.3 Selection of Methods

Due to the high risks associated with public-private engagements (as discussed in Section 3.3.2 it is proposed that the possible improvements identified in Section 5.3.3 be prioritised by analysing the risks and benefits of engaging with the private sector. The proposed components of the verify and prioritise phase are shown in Table 5.6.

5.3.5 Execution (E in DRIVE)

The framework only focuses on identifying opportunities for integration in the pharmaceutical supply chain, therefore implementing public-private engagements in the identified opportunities is outside of the scope of this thesis. There are many useful guides and documents that assist with determining the feasibility of public-private engagements as well as identifying potential partners for engagement and implementing public-private engagements. Consequently, the execution step of the DRIVE approach will be excluded from the framework. A list of useful documents is provided in Table 5.7.

Table 5.6: Components of the verify and prioritise phase

Component	Reason for inclusion	Adapted from
Validation workshop/ interview	The majority of assessments that were reviewed, validated data and findings via workshops and interviews with stakeholders. Stakeholders are able to validate data and findings because of their expertise.	USAID DELIVER PROJECT Task Order 4 (2013); UNICEF and MSH (2012); Steele (2015); McCord et al. (2013); Islam (2007)
Risk-benefit prioritisation	Public-private engagements are inevitable and provide many opportunities but also considerable risks (Buse and Waxman, 2001). Risks and benefits need to be weighed when engaging with the private sector (O’Hanlon and Jeffers, 2013; John Snow Inc., 2016; Tennyson, 2011)	Developed by author. See Appendix B.

Table 5.7: A list of documents that are useful for implementing public-private engagements

Author(s)	Title
South African National Treasury	PPP Manual
Tennyson	The partnering toolbook: An essential guide to cross-sector partnering
United Nations Commission on Life-Saving Commodities	Private Sector Engagement: A Guidance Document for Public Health Supply Chains
O’Hanlon and Jeffers	Reference Guide for Development of Public Private Partnerships in the Health Sector for Countries in the SADC Region
Herzberg and Wright	Public-Private Dialogue: The PPD Handbook - A Toolkit for Business Environment Reformers
Smith et al.	Working with Private Sector Providers for Better Health Care: An Introductory Guide

5.4 Preliminary Framework

The preliminary framework is created by integrating the framework foundation and individual steps. Figure 5.3 gives an illustration of the preliminary framework.



Figure 5.3: The proposed preliminary framework

5.5 Chapter 5 Conclusion

In this chapter the development of the preliminary framework is discussed. The chapter outlines the methodology that is employed to develop the framework. Furthermore, the methodology is carried out on a step-by-step basis to ensure that the criteria identified in Chapter 4 are met, and to determine the specific steps required in the proposed framework. Finally, the chapter concluded by integrating all the steps and presenting the preliminary framework.

Chapter 6

Framework Validation

The objective of this chapter is to validate the preliminary framework that was developed in Chapter 5. Section 6.1 discusses how internal validation was carried out on the framework and Section 6.2 discusses how the framework was externally validated through SMEs. Improvements were made to the preliminary framework according to the feedback provided by the SMEs, resulting in the final framework which is presented in Chapter 7.

6.1 Internal Validation

As part of the framework, an Excel[®] file was created (See the USB which accompanies this thesis)¹ to assist with the data collection and supply chain assessment of identifying integration opportunities in pharmaceutical supply chains. In order to determine whether the Excel[®] file functions properly, internal validation was conducted by the researcher. Internal validation was carried out by entering mock data and evaluating whether the framework provided the corresponding expected outputs. This was done iteratively with various scenarios/different input data, so that a variety of different outcomes could be tested. When errors occurred or incorrect outputs were given, corrective action was taken to ensure that the Excel[®] file functions as intended.

6.2 External Validation

The framework was externally validated through the use of a questionnaire. Four subject-matter experts with experience in the health supply chain field were part of the validation process. The framework was presented to the SMEs who provided feedback based on their experience and insight. The framework was amended and improved based on the feedback provided by the SMEs.

¹Alternatively use the link provided in Appendix F

Table 6.1 provides a description of each SME's current position, background with regards to health supply chains and exposure to public-private engagements. Some SME's have decided to remain anonymous, in which case a code is used to replace their name and their occupational descriptions are written in such a way as not to violate anonymity.

Section 6.2.1 provides a description of the process that was followed to validate the framework. Section 6.2.2 discusses each questionnaire question along with the feedback that was received for that question. Lastly, Section 6.2.3 concludes the external validation.

Table 6.1: Subject-matter experts' background and exposure to public-private engagement

SME	Position	Role	Public-private engagement exposure
SME 1	General Manager	Responsible for the management of the centralised dispensing for chronic medication project as well as the projects and engineering division	Employed by a private company that provides services to the public sector
SME 2	Contract Manager/Consultant	Responsible for contract management post contract award and ensuring the availability of essential medicines to public and sometimes private patients	Has experience with public-private engagements with regards to relationship management, contract management, risk management, tendering and service provider licensing inter alia.
SME 3	Supply Chain Manager	Manages a supply chain, procurement and exports of health commodities into Africa	Manages the supply and customer relationship between a business and NDoH
SME4	Consultant Pharmacist	Managing technical assistance projects	Management of technical assistance projects across the medicine supply chain

6.2.1 Validation Process

The validation of the framework was carried out by sending each SME three electronic files. The first file is a guide that explains: (i) the reason for creating the framework; (ii) the objectives of the framework; and (iii) how to use the framework. In addition, the document provides necessary definitions and documentation (such as templates, forms and questionnaires) that are needed to further understand and apply the framework (See Appendix E). The second file is an Excel[®] file which is used for the practical component of the framework (See the USB accompanying this thesis)². This file is used to collect data, identify opportunities for integration, assess the risks and benefits of the identified opportunities as well prioritise the identified opportunities. The third file is the questionnaire that is used to record SME's responses.

Once the documentation has been received, each SME could work through the guide and Excel[®] file in their own time. In cases where SMEs needed further clarity regarding the framework, telephonic calls were organised so that SMEs could have their questions addressed by the student. Face-to-face interviews were not conducted with SMEs as most were either out-of-country or in another province. SMEs electronically forwarded the completed questionnaires to the researcher after which telephonic calls were organised in the event where the researcher needed more clarity on some of the answers. The questionnaire and feedback from SMEs are further discussed in Section 6.2.2.

6.2.2 Questionnaire and SME Feedback

The questionnaire consists of two sections. The first section contains background questions regarding the SMEs. These questions were used to determine what experience the SMEs have had with supply chains and whether they have experience with public-private integration. The second section contains questions regarding the framework. A copy of the questionnaire is presented in Appendix C. Each question of the questionnaire and the relevant feedback provided are discussed below. The completed questionnaires are provided in Appendix D. Some information was removed from the completed questionnaires to ensure the anonymity of some SMEs.

1. Is there a need to identify opportunities for integration between the public and private sectors in pharmaceutical supply chains?

All SMEs agreed that there is a need for integration between public and private pharmaceutical supply chains.

²Alternatively use the link provided in Appendix F

SME 1 further stated that it is especially needed in areas such as the management of stock at facilities, data integration and basic supply chain procedures.

SME 2 stated that integration is needed to increase direct deliveries and to improve demand and supply planning as well as the visibility of the supply capacity. Furthermore, integration opportunities may be useful during the phased implementation of the NHI in South Africa as integrating with the private sector may assist with supply chain visibility and logistics management. Public-private integration may also assist with the establishment of an Early Warning System which would be used to prevent stock-outs and/or medicine shortages. SME 2 further added that identifying opportunities for integration will not only be needed for pharmaceuticals, but also for consumables and surgical products.

SME 3 elaborated that the public sector aims to buy the cheapest medicine so that more patients can be treated. However, this leads to fierce competition between suppliers as well as import replacements, further resulting in job losses. The integration of the public and private sector could make local supply more sustainable, retain more jobs, improve South Africa's Balance of Payment and result in more South African tax levied.

SME 4 stated that integration opportunities need to be identified so that more private sector institutions can provide public services to public sector patients. This is important for the implementation of NHI. In addition, the integration of the public and private sector can help the public sector to meet the health needs of the public sector. Public-private integration will also improve supply chain visibility which will provide decision makers with more information on the public sector demand as well as the supply capacity of the supply chain. This information can then be used to prevent stock-outs.

2. Do you believe this framework would be a useful assessment tool to identify integration opportunities?

All SMEs agreed that the framework is a useful tool to identify opportunities for public-private integration.

SME 1 agreed that the framework is a useful tool to identify opportunities for integration. He further stated that there are some Excel[®] issues that need to be improved. It was clarified that he wanted measures put in place to ensure that framework users cannot enter invalid data during data collection. For example, when collecting data on the current level of integration, users are required to enter a capital 'x' in the appropriate space and only enter one 'x' per supply chain activity. Therefore, SME 1 suggested putting measures

in place that would prevent users from entering other letters or entering more than one 'x' per supply chain activity. Furthermore, SME 1 suggested removing the 'customs clearance' supply chain activity as it is irrelevant.

Both SME 2 and SME 4 stated that the public sector has limited capacity and that the private sector's best practices need to be adopted and their capacity needs to be leveraged. Improved collaboration between the public and private sector can increase the robustness of the supply chain and result in a strong supply chain. In addition, the public sector needs to overcome many supply chain and engagement challenges in order for the successful implementation of NHI.

3. Are there other frameworks that have the same purpose and results that you are aware of?

None of the SMEs are aware of a similar framework.

4. Are there any shortcomings or feedback on the methodology employed by the proposed framework? (Or what are the strengths and weaknesses?)

SME 1 believes the framework is well thought through. However, he further states that the framework may be too long and suggests that there should be two versions, a short version and a detailed version.

Both SME 2 and SME 4 commented that the employed methodology is sound and that the framework is structured in a way that allows for easy data capturing. SME 4 further stated that the framework will improve compliance from stakeholders.

SME 3 commented that he thinks the framework will be very useful as a checklist to determine supply chain readiness. In addition, he states that the framework will facilitate objective debates between stakeholders from the public and private sectors.

5. In your opinion, how can the framework be improved?

SME 1 provided the same answer as for Question 4.

SME 2 and SME 4 suggested that a formulary and Standard Treatment Guideline (STG) component be added to the framework. As the public sector moves closer to the implementation of NHI, the establishment of formularies and STGs will need to be strengthened; more private sector stakeholders are needed to participate with the establishment of formularies and STGs. In addi-

tion, they suggested that contract management, demand planning and supply planning components be added to the framework. SME 4 stated that contract management is closely linked to supply chain performance and provides a good opportunity for improving collaboration and planning. SME 4 also states that improved collaboration in demand and supply planning could assist with the prevention of medicine shortages. Lastly, SME 4 suggested that ‘clearing customs’ should be removed, as it is not an issue for the public sector, and that information management play a bigger role in the framework. Information management is an important for the planning and execution of supply chain activities. The ability to share information timeously is also important for decision-making.

SME 3 stated that some terminologies may need to be improved, but that it would not add value to the developed framework. SME 3 then suggested to rather leave the framework as is.

6.2.3 Validation Conclusion

The feedback from the questionnaires indicated that the SMEs found that there is a need to identify opportunities for integration in pharmaceutical supply chains and that the framework would be a useful tool to achieve that need. Overall the SMEs were very positive and content with the framework. Some recommendations were made as to how the framework could be further improved. These recommendations do not affect the fundamental steps of the framework. However, the recommendations were used to add some components, that were deemed important by some SMEs, to the Excel[®] file and remove some supply chain activities that do not add value to the assessment.

6.3 Chapter 6 Conclusion

The validation of the developed framework is discussed in this chapter. The validation process involved the completion of a questionnaire by four SMEs. The feedback from the SMEs was positive and was used to refine the framework. The refined framework formed the final framework which is presented in Chapter 7.

Chapter 7

Final Framework

This chapter presents the final framework which was developed throughout Chapters 4 to 6. Section 7.1 provides an overview of the framework, after which Sections 7.2 to 7.6 discuss each phase of the framework. Lastly, Section 7.7 provides an explanation of the results that are displayed on the dashboard which is included in the Excel[®] file (See the USB accompanying this thesis)¹.

It is recommended that this chapter is considered along with the supplementary documents provided: (i) Excel[®] on the USB drive, and (ii) the framework guide presented in Appendix E.

7.1 Framework Overview

The framework consists of five phases, namely:

1. Define scope
2. Review
3. Data collection
4. Identify Improvements
5. Verify & prioritise

Figure 7.1 illustrates the five phases of the final framework, as well as the corresponding pages in the guide (Appendix E), and tabs in the Excel[®] file (See the USB accompanying this thesis). Each phase is discussed in detail below.

¹Alternatively use the link provided in Appendix F

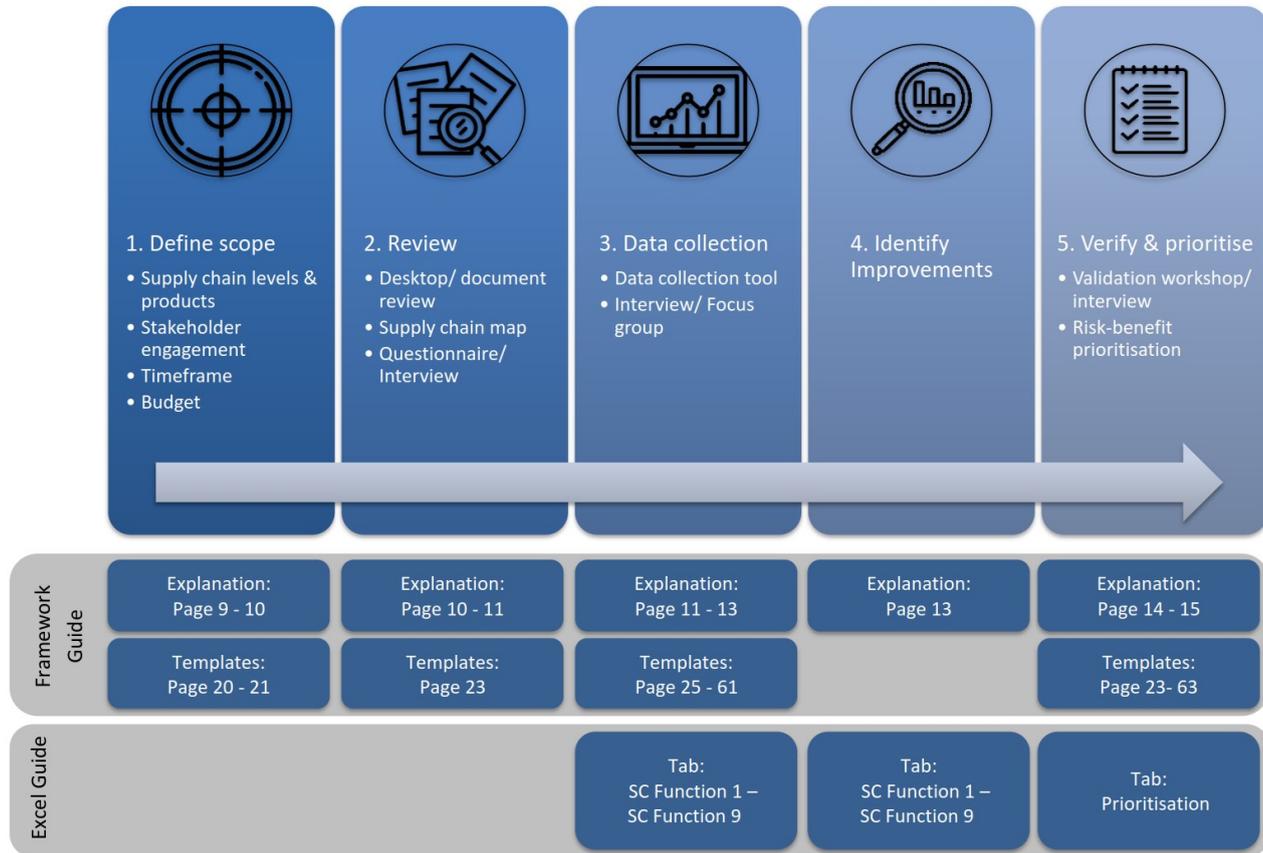


Figure 7.1: Final framework

7.2 Phase 1: Define Scope

Before commencing with the assessment, it is important to define the scope of the assessment as well as the supply chain that is being assessed. The scope will inform assessors of: (i) the scope of the supply chain that is being assessed (i.e. where it begins and ends, which supply chain functions are being assessed and the type of supply chain, for example malaria or TB medicine supply chain); (ii) which stakeholders to engage during the assessment; and (iii) the data that needs to be collected. This phase consists of four parts, namely: supply chain levels and products, stakeholder engagement, timeframe and a budget. Each of these are addressed in Section 7.2.1 through 7.2.4, respectively.

7.2.1 Supply chain levels and products

During the scope definition, a decision needs to be made regarding the supply chain levels and pharmaceutical products that will be assessed. Public health supply chains usually consist of multiple levels, for example: national, regional, district and community level. Public health supply chains often also

Supply Chain Levels	
	National
	Regional
	District
	Community
Products/Programmes	
	HIV
	Malaria
	Immunisation
	Maternal & child health
	TB
	Essential medicines

Figure 7.2: Illustrative list of supply chain levels and products.

serve specific health programmes, each of which require unique groups of pharmaceuticals (for example TB, essential medicines or vaccines). These factors need to be taken into consideration during the definition of the scope. Appendix 1 in the framework guide (Appendix E) provides a list of the various supply chain levels and pharmaceutical products that assessors can use to narrow the scope of the assessment. An illustration of the list is provided in Figure 7.2.

7.2.2 Stakeholder Engagement

The success of the framework relies on the involvement of stakeholders. Stakeholders are engaged and involved in the process from the first phase to the last as they are important for collecting data, identifying improvements, validating outcomes and prioritising identified opportunities. Therefore, appropriate stakeholders need to be identified. The identified stakeholders should include, but not be limited to, people who have expertise in the supply chain that is being assessed. Examples of stakeholders that could be contacted to take part in the assessment include:

- (i) Government (e.g. Ministry of Health ministers or stakeholders from other departments such as finance, treasury, etc.).
- (ii) Private sector organisations and businesses involved in health supply chains.
- (iii) Donors (e.g. WHO, USAID)
- (iv) Local government.

- (v) Public pharmaceutical supply chain stakeholders (e.g. medical stores manager, procurement unit, logistics manager).
- (vi) Committees and coordinating bodies (e.g. regional drug and therapeutics committees, formulary and treatment guideline committees, national drug committee).
- (vii) Regulatory bodies.

7.2.3 Timeframe

Submission dates for each of the assessment activities should be decided upon in order to inform stakeholders when specific assessment tasks will take place, to ensure that the all deliverables are completed and to prevent the assessment from being extended too long. Appendix 2 in the framework guide (Appendix E) provides a template that can be used to determine the timeframe of the assessment as well as the submission dates of specific steps of the assessment.

7.2.4 Budget

The last task of the scope definition is to set up a budget in order to ensure that there is sufficient funding to carry out the assessment. The following should be taken into consideration when setting up the budget:

- (i) Available funds for the assessment.
- (ii) Travel costs that may be incurred to get stakeholders and assessors to the location where the assessment will be carried out (e.g. flights, transport, car hire).
- (iii) Time and costs associated with the assessor(s) taking time off work to carry out the assessment.
- (iv) Venues that may need to be hired for meetings and/or workshops.
- (v) Materials and equipment that may be used during the assessment (e.g. projectors, printed materials, stationery).
- (vi) Refreshments during the assessment.

7.3 Phase 2: Review

The second phase of the assessment is to collect and review information about the selected supply chain in order to gain a better understanding of the supply chain context, especially with regards to current public-private engagements. Phase 2 consists of three parts, namely a document review, a supply chain

map and a questionnaire or interview. These are further discussed in Sections 7.3.1 through 7.3.3.

7.3.1 Document Review

Background documents about the relevant supply chain should be collected and reviewed. These documents may provide insight regarding current private engagements, problems that affect the supply chain, potential integration opportunities, gaps in information, supply chain constraints as well as the general context of the supply chain. Reviewing background documents will also assist stakeholders to understand the supply chain. The following documents should be considered for the review:

- (i) Previous assessment reports.
- (ii) Documents that relate to public-private engagements in the relevant supply chain.
- (iii) Documents related to the supply chain functions.
- (iv) Supply chain stakeholder and process maps.

Identified documents should be collected and distributed to all stakeholders and assessors. Documents can be reviewed individually in each person's own time or in groups. It is important that a list of the documents be kept. If any information from one of the documents is used, the relevant document must be cited in case any questions are raised or information needs to be verified.

7.3.2 Questionnaire/Interview

In the case where information from the review is missing, insufficient or unclear, stakeholders may need to be to complete a questionnaire or be interviewed in order to acquire the required information. It is subject to the assessor's discretion whether enough information was acquired during the document review. In the case where it has been decided that additional information is required, the assessor can either collect information from the stakeholders who are currently involved in the assessment process or additional stakeholders may be identified for this part of the assessment. Appendix 3 in the framework guide (Appendix E) provides a template for the questionnaire or interview. The template may be adapted as required and the questions can serve as a guide when interviewing stakeholders.

7.3.3 Supply Chain Map

Once all the information has been collected, stakeholders are required to map the supply chain based on the collected information. Mapping the supply

chain leads to a common understanding of the supply chain and provides a visual representation of the supply chain. Assessors should decide how much detail should be included in the supply chain map. However, a more detailed map may provide insight to current private sector engagements as well as opportunities for new engagements.

7.4 Phase 3: Data Collection

As the name suggests, phase 3 consists of data collection. Two main data collection methods are used during phase 3, namely focus groups and interviews with the stakeholders that were identified in Phase 1. Data is collected using the Excel[®] file as well as paper-based collection forms which serve as templates (Appendix 4 in the framework guide) for the focus groups and interviews. During the data collection phase, data is collected on each of the nine supply chain functions in the Excel[®] file. The nine supply chain functions are:

- (i) Selection
- (ii) Forecasting
- (iii) Supply planning
- (iv) Procurement
- (v) Contract management
- (vi) Distribution
- (vii) Use
- (viii) Management support
- (ix) Information management

Each supply chain function consists of a number of activities that need to be carried out. Each of these supply chain function activities are assessed (using the definition created in Section 3.4.2) to determine if there are opportunities for integration. The Excel[®] file and templates are used to collect information regarding: (i) current public-private engagements at each supply chain function activity; (ii) the current level of integration of each supply chain function activity; (iii) the level of integration supply chain function activities should reach to support operational efficiency and effectiveness; and (iv) the reasons why specific levels were chosen in (iii). The collected data inform assessors of supply chain function activities' current level of integration as well as the level of integration that may be reached to support the supply chain's the most optimal operational efficiency and effectiveness (also known as the integration aim). Figure 7.3 provides an example of the table that is used in the Excel[®]

file to collect data on the integration level for a specific supply chain function, in this case the ‘Selection’ supply chain function. The framework elements relevant to the other supply chain functions are available in the Excel[®] on the USB drive² attached to this document.

Section B: Current Level of Integration				
Supply Chain Function Activity	No Engagement	Interaction	Dialogue	Agreement
Review prevalent health problems				
Develop STGs and formularies				
Choose individual medicines & dosages				
Decide which medicines will be available at each level of the health care system				
Identify treatments of choice				

Figure 7.3: The selection supply chain function data collection table used in the Excel[®] file

7.5 Phase 4: Identify Opportunities

During phase 3, data was collected to determine the current level of integration as well as the integration aim. In phase 4, the collected data is used to identify opportunities for integration. This is achieved by comparing the current level of integration and the integration aim. The levels of integration can be compared by creating graphs of the integration levels and looking at the difference between them. The graphs are automatically generated in the Excel[®] file once the data for a supply chain function is collected. Figure 7.4 provides an example of the graph for the ‘Selection’ supply chain function. In the example it is clear that for each supply chain activity the integration aim is higher than the current level of integration, therefore there is an opportunity to further integrate with the private sector. Opportunities can be identified on the same tabs as where data is collected in the Excel[®] file (See USB accompanying this thesis) and page 13 of the guide (Appendix E) provides an explanation of how opportunities are identified.

7.6 Phase 5: Verify & Prioritise

The last phase of the framework involves the validation of the data and findings of the previous phases, prioritising the identified integration opportunities according to the risks and benefits of engaging with the private sector, and lastly validating the prioritisation of the supply chain function activities by means of a validation workshop or interviews. Each of these aspects are discussed in Sections 7.6.1 through 7.6.3, respectively.

²Alternatively use the link provided in Appendix F

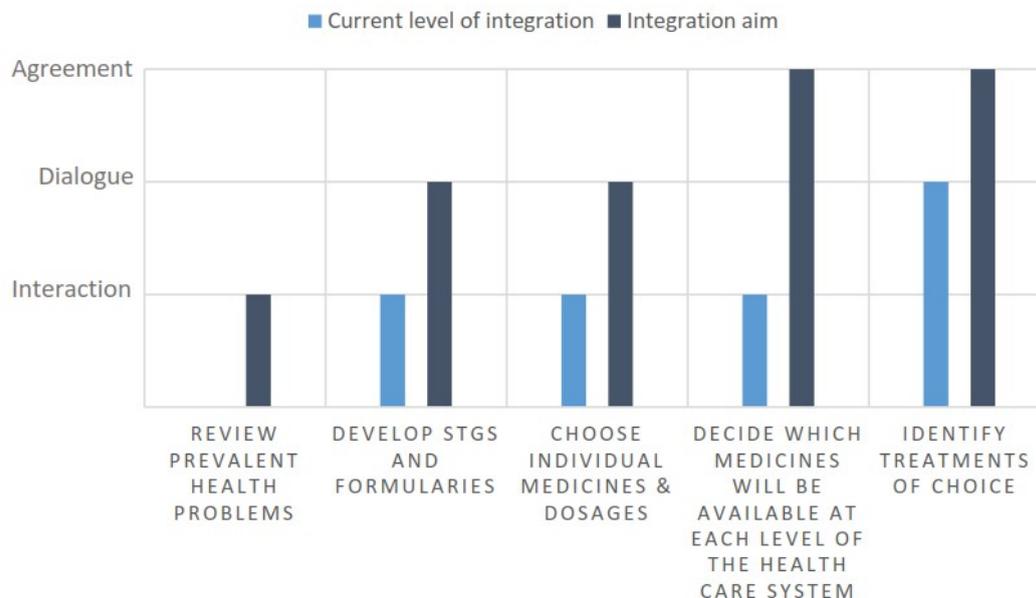


Figure 7.4: Identifying opportunities for integration

7.6.1 Data Validation/Interview

Before continuing with the prioritisation of the supply chain function activities, it is important that the data collected thus far is validated and agreed upon. The validation workshop is intended for stakeholders to:

- (i) Review and resolve any questions, issues or disagreements that reocurred during the assessment.
- (ii) Discuss and validate the findings of the assessment.
- (iii) Provide input on the findings.

In some cases, specific information or findings may need to be validated; or remaining questions need to be answered. In these cases where the issue cannot be solved in the workshop, stakeholders may need to be interviewed again to resolve the issue. Two types of stakeholders should be included in the workshop, namely: those make decisions (for example the MOH) and those who will be responsible for taking the findings further.

7.6.2 Risk-Benefit Prioritisation

In the last phase, supply chain activities with opportunities for integration were identified. In this phase these activities are prioritised in order to determine which supply chain activity shows the greatest potential and should be focused on first. This is achieved by examining the risks and benefits of private engagement in the particular supply chain activity.

	Benefits (Scale from 0 - 5)					Risks (Scale from 0 - 5)								Priority of functions			
	Close the resource gap	Improve access and efficiencies	Innovation	Expand and retain human resource	Build capacity	Shared risk	Risks of engaging with the private sector				Risks of engaging with the public sector						
							Conflict of interest	Limited capacity to engage with the private sector	Regulatory issues	Sharing information	External constraints	Lack of control	Delayed decision making by public sector		Contracting challenges	Payment terms	Sharing information
Selection																	
Forecasting																	

Figure 7.5: Partial illustration of the prioritisation table

On the Prioritisation tab of the Excel[®] file, the supply chain activities that have opportunities for integration are automatically listed under their respective supply chain functions. A list of benefits and risks are provided at the top of the page. Explanations of the risks and benefits are provided in Appendix 5 of the framework guide, which can be distributed to stakeholders to ensure that everyone understands each risk and benefit.

In order to prioritise the supply chain activities, stakeholders need to rate the impact each benefit and risk (in the Excel[®] file) will have on the engagement on a scale from 0 - 5, where 0 = no impact and 5 = very high impact. Once the risks and benefits ratings of each supply chain activity have been completed, the supply chain activities will be prioritised. Supply chain activities are prioritised by calculating the benefit-risk ratio for each activity and then ranking each activity from the highest benefit-risk ratio to the lowest. The ratios are automatically calculated and each activity is ranked in the last column of the sheet. At the bottom of the Prioritisation sheet is a results section where the total risk and benefit of each supply chain activity is plotted on a graph to allow for a visual comparison of the risks and benefits. Figure 7.5 shows an empty prioritisation table that is used to prioritise the supply chain function activities. This is discussed on page 14 of the guide and explanations of the risks and benefits are provided in Appendix 5 of the guide (Appendix E).

7.6.3 Prioritisation Validation

After the supply chain function activities have been prioritised, the risks and benefits of private sector engagement, as selected in the previous step, as well as the prioritisation results can be validated by taking part in another validation workshop or interview with stakeholders. These validation

workshops/interviews have the same format as the previous validation workshops/interviews.

7.7 Dashboard

The dashboard is the landing page of the Excel[®] file (See the USB accompanying this thesis)³. It summarises the results of the steps that are carried out in the Excel[®] file. It is divided into the following four sections which are shortly described in Sections 7.7.1 through 7.7.3, respectively: level of integration, percent integrated, prioritisation and risks and benefits.

7.7.1 Percent Integrated

In this graph the current level of integration and the integration aim for each supply chain function is compared. The levels of integration for each supply chain function is averaged and converted to a score out of 100. This shows how integrated each supply chain function is, where 100% indicates that all supply chain activities, in the specific supply chain function, are at the agreement level and that the supply chain function is fully integrated.

7.7.2 Risks and Benefits

This section contains two graphs, one for the risks and one for the benefits. Each graph indicates how much a risk/benefit impacts each supply chain function, where 100 indicates a very high impact.

7.7.3 Prioritisation & De-integration

Under the prioritisation section the supply chain activities with opportunities for integration are listed according to their rank (i.e. from highest priority to lowest priority). The de-integration section lists the supply chain activities that should de-integrate, i.e. engagements should go from a higher integration level to a lower integration level. Although identifying supply chain de-integration possibilities is not the aim of the framework, it is included as it may be relevant to stakeholders and may prompt important discussions.

7.8 Chapter 7 Conclusion

This chapter presents the final framework (contained in Appendix E and the USB accompanying the thesis) by discussing each step of the framework and presenting some examples from the framework guide and Excel[®] file. Lastly,

³Alternatively use the link provided in Appendix F

the dashboard, which summarises the results of the assessment, is briefly discussed.

Chapter 8

Illustrative Case Study

The purpose of this chapter is to apply the final framework to illustrate how it can be used, what the outcome is of using it in a real world scenario and to identify further opportunities for improvement that it may have. The scope of the case study is discussed in Section 8.1. Next, contract management in South Africa is briefly discussed in Section 8.2 to provide context. In Section 8.3 the framework is used to identify opportunities for integration as part of the case study. Lastly, Section 8.4 discusses some opportunities for further improvement.

8.1 Scope of Case Study

For the case study, the framework is only applied to the contract management supply chain function. In addition, it is applied to the South African context, at the national level and does not focus on a specific product's supply chain but rather on pharmaceutical supply chains in general. Furthermore, only the Excel[®] tool part of the framework was utilised for the case study. Figure 8.1 gives an indication of the framework phases that were carried out. However, because only the Excel[®] tool was used, the data collection forms were not completed during the data collection phase and the validation interviews/workshops were not carried out. Reasons for the limited scope of the case study include:

- (i) Time constraints prevented the application of the entire framework. Therefore, only a section of the framework is used for the case study.
- (ii) The South African context and the contract management function is the focus of the case study as this is the field of knowledge of the subject-matter expert (SME) that participated and assisted in the case study.
- (iii) The Excel[®] part of the framework is chosen for the case study as this is the part that is primarily used to identify opportunities for integration and produces the results of the assessment.

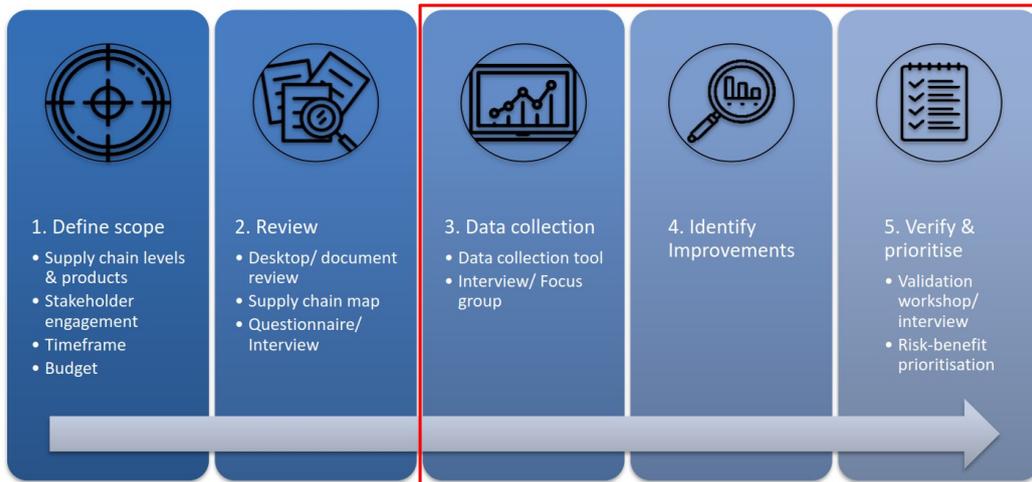


Figure 8.1: Phases that were carried out during the case study.

8.2 Contract Management in South Africa

The South African government provides all national and provincial departments with a generic Contract Management Framework (CMF) that outlines the requirements with regards to accounting for and management of contracts (Department of National Treasury - Republic of South Africa, 2010). In addition, a Contract Management Guide (CMG) is provided which, as the name suggests, provides guidance on how the CMF should be applied (Department of National Treasury - Republic of South Africa, 2010). Together, the CMF and CMG enables each department to develop and approve its own procedures, policies and competencies within the scope of the CMF. According to the CMF and CMG, contract management comprises of accounting for all contracts and the management of contracts during the Contract Life Cycle (Department of National Treasury - Republic of South Africa, 2010). The Contract Life Cycle starts with the planning of the contract and ends with the close-out or renewal. Furthermore, the CMF, as illustrated in Figure 8.2, guides government institutions on how to (Department of National Treasury - Republic of South Africa, 2010):

- (i) ensure that suitable procedures and policies are established
- (ii) utilise appropriate contract management processes
- (iii) recognise contractual obligations in financial statements



Figure 8.2: The Contract Management Framework. Source: Department of National Treasury - Republic of South Africa (2010)

In recent years, South Africa's National Department of Health (NDoH) has been implementing and piloting a number of initiatives that aim to strengthen the health system (Meyer *et al.*, 2017). These initiatives aim to provide a continued supply of products and services, reliable payments, improved governance and efficiencies, accessibility and affordability of medicines and assist the government with the successful implementation of National Health Insurance (NHI) (Meyer *et al.*, 2017). These initiatives are centred around the core functions of the medicine value chain, as illustrated in Figure 8.3.

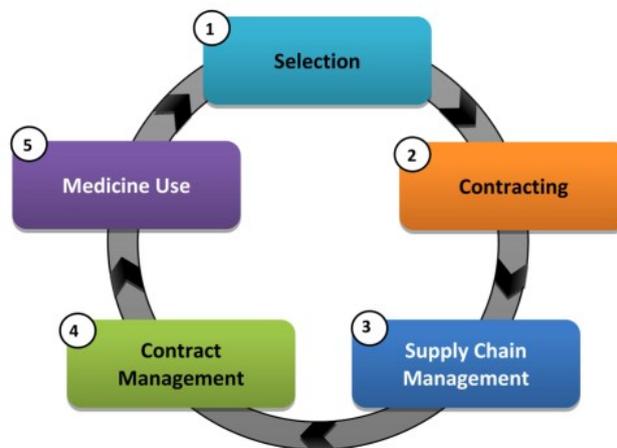


Figure 8.3: The medicine value chain functions. Source: Meyer *et al.* (2017)

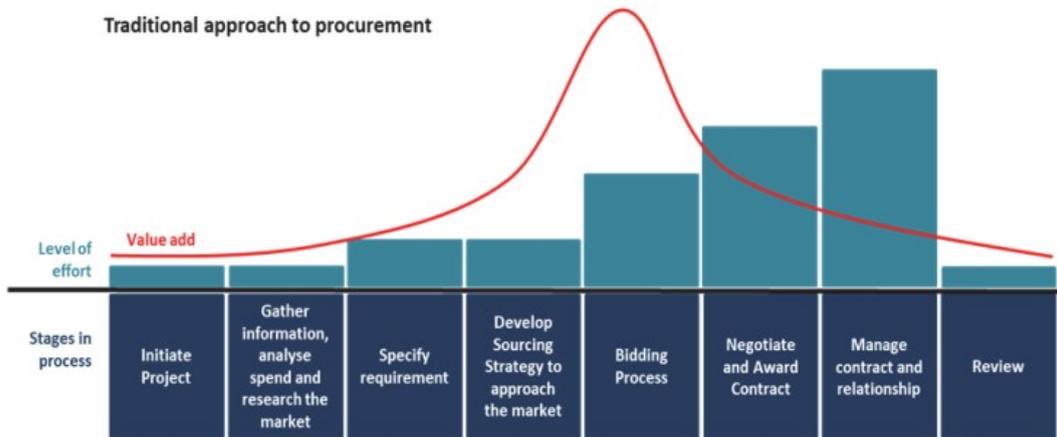


Figure 8.4: Traditional procurement approach. Source: Department of National Treasury - Republic of South Africa (2015) which adapted it from: New Zealand Ministry of Economic Development (2011)

A number of initiatives are currently being implemented in the contract management function due to fragmentation which is caused by a lack of standard procedures and systems (Meyer *et al.*, 2017). One such initiative is the introduction of a National Contract Management Unit (CMU). The CMU will be responsible for monitoring the aggregated information, such as performance metrics, collected by Medicine Procurement Units (MPUs) (Meyer *et al.*, 2017). MPUs have numerous responsibilities, including the management of provincial contracts and implementing strategic and consistent protocols regarding contract management (Meyer *et al.*, 2017). MPUs provide these services for health facilities within its jurisdiction (Meyer *et al.*, 2017). Although the MPUs and the CMU's shared job has already been put in place, institutional processes that are responsive to a dynamic market will need to be developed in order to further improve contract management, especially when taking the implementation of NHI into account (Meyer *et al.*, 2017).

Another initiative is the implementation of "strategic sourcing" as a means of procurement in public supply chains (Department of National Treasury - Republic of South Africa, 2015). During traditional procurement, very little effort is put into the initial planning phase, resulting in a need for greater effort during relationship management and contract management phases where little added value can be achieved (Department of National Treasury - Republic of South Africa, 2015). This phenomenon is depicted in Figure 8.4.

However, with the implementation of strategic sourcing (Figure 8.5) each phase of procurement is methodically worked through (Department of National Treasury - Republic of South Africa, 2015). This results in more effort being put into the initial planning and research which assists in identifying solutions

that enable needs to be met (Department of National Treasury - Republic of South Africa, 2015). Furthermore, in the contract and relationship management phase, less effort is required for resolving problems, allowing more effort to be put into assessing supplier's performance and identifying opportunities to save costs and realise benefits (Department of National Treasury - Republic of South Africa, 2015).

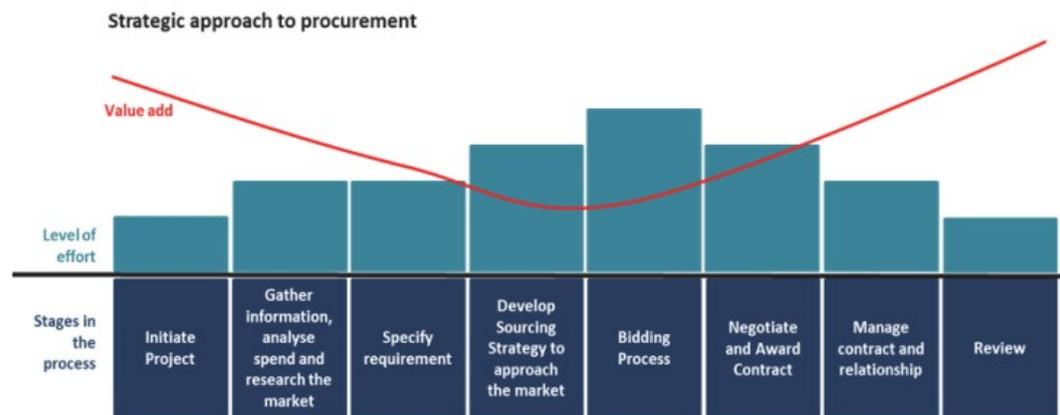


Figure 8.5: Strategic sourcing approach. Source: Department of National Treasury - Republic of South Africa (2015) which adapted it from New Zealand Ministry of Economic Development (2011)

8.3 Application of Framework

The contract management supply chain function in framework consists of the following activities which will be assessed as part of the case study (Elsay, 2007; John Snow Inc., 2017):

- (i) Needs clarification
- (ii) Tender preparation
- (iii) Tender publication
- (iv) Bids evaluation
- (v) Contract award
- (vi) Changes in contract
- (vii) Service delivery management
- (viii) Relationship management
- (ix) Contract administration

- (x) Risk assessment
- (xi) Purchasing organisation's performance and effectiveness review
- (xii) Contract closure

The case study followed a step-wise procedure as outlined in the framework. The following steps were carried out, which are further discussed in Sections 8.3.1 to 8.3.5:

1. Identify the current level of integration
2. Identify the integration aim
3. Identify opportunities for integration
4. Prioritise the identified opportunities for integration according to risks and benefits
5. Interpret and discuss results

As mentioned in Section 8.1, data was collected by working with an SME that has expert knowledge on contract management in the public sector of South Africa.

8.3.1 Current Level of Integration

As discussed in the framework guide in Appendix E, for each activity of the supply chain function that is being assessed the current level of integration should be selected. Figure 8.6 below indicates which level of integration was selected for each activity. In cases where integration levels 'interaction', 'dialogue' or 'agreement' were selected, Table 8.1 provides short explanations for why a specific level was selected.

8.3.2 Integration Aim

For the integration aim, the same procedure is followed as with the current level of integration. However, the level of integration is selected based on the level of integration that may be achieved in the medium term in order to support optimal operational efficiency and effectiveness in the specific activity. Figure 8.7 below indicates which level of integration was selected for each activity. Table 8.2 discusses the activities for which the integration aim is different to the current level of integration as identified in Section 8.3.1.

Table 8.1: Explanations for why specific levels of integration were chosen

Activity	Integration Level	Explanation
Contract award	Dialogue	The public and private sector organisations may negotiate once the contract is awarded. Both parties have shared interests as both parties need the contract terms to be met. The public sector needs assurance from suppliers that products will be delivered on time so that a continuous supply can be provided to patients at an agreed price. Conversely, the suppliers need assurance that payments will be received on time so that business can continue as usual. Therefore, the public sector and suppliers negotiate, cooperate and work together to ensure contract terms will be met.
Changes in contract	Dialogue	In cases where suppliers may not be able to fulfill contract obligations, for example when suppliers will not be able to deliver x amount of a product due to a shortage of a specific active ingredient, suppliers will notify the public sector that there will be a shortage and the reason therefor. The public sector and suppliers will then negotiate, work together and discuss how the problem may be overcome so that patients do not experience a shortage or stock-out of the medicine. In addition, both parties need to negotiate what happens to other contract terms, such as payments, when contract obligations are not met. Other contract amendments such as changes in objectives or scope, are dealt with in the same manner and the contract is amended.
Service delivery management	Agreement	The public sector makes use of a third party to assist with the performance management and assessment of companies and organisation with whom they have contracts with.
Relationship management	Interaction	The public sector periodically interacts and exchanges information with organisations with whom they have contracts to keep each other informed about the current state of affairs, to ensure contract terms are met and to maintain trust and understanding.
Contract administration	Interaction	During contract administration, the public sector and organisations with which it has contracts will communicate and may exchange information regarding tasks such as budget and payment procedures, resource management, orders and the monitoring of costs.
Risk assessment	Interaction	During risk assessments, the public and private sector exchange information and discuss how identified risks may be avoided or managed.

Table 8.2: Explanation for why a different integration level was chosen

Activity	Change in Integration Level	Explanation
Tender preparation	From no engagement to interaction	The public sector would be interested in communicating and interacting with the private sector to determine what the best practices are regarding tender preparation. The implementation of private sector best practices could lead to the improvement in the efficiency and effectiveness of the tender preparation process.
Purchasing organisation's performance and effectiveness review	From no engagement to dialogue	At national level, the department of health's downstream purchasing organisations are the provincial health departments because they "purchase" pharmaceuticals from the NDoH. In this case, the provincial departments of health act as procurement agents. The department of health would integrate with the private sector organisations (such as distributors and suppliers) to assist with the assessment of provincial health departments' performance and effectiveness regarding procurement and purchasing. For example, the province's ability to follow standard procedures may be checked, or their ability to procure medicines in-time (so that medicines can be timeously delivered) may be assessed. Private distributors and suppliers can then inform the department of health where there may be problems during procurement and negotiate and assist with providing a solution. Ensuring that patients receive the necessary medicines, on-time, is the priority and a mutual interest of the NDoH, private suppliers and private distributors. Therefore the two sectors may work together to improve procurement processes.
Contract closure	From no engagement to interaction	Contracts with government are usually in place for 2 to 3 years. Once the contract ends, suppliers may be required to lay-off workers due to the loss of an income stream (from the government) and may incur more expenses since some labs/factories may not be used again (as in the case where hormones are an ingredient). This is likely to persist unless they are able to procure another government tender. This is a disadvantage for suppliers. However, the public and private sector may assist one another by negotiating longer contracts during contract closure (eg. 10 years) so that suppliers do not have to deal with these problems. In return, suppliers need to improve their offer (i.e. lower prices, better efficiency).

Section B: Current Level of Integration				
Supply Chain Function Activity	No Engagement	Interaction	Dialogue	Agreement
Needs clarification	X			
Tender preparation	X			
Tender publication	X			
Bids evaluation	X			
Contract award			X	
Changes in contract			X	
Service delivery management				X
Relationship management		X		
Contract administration		X		
Risk assessment		X		
Purchasing organisation's performance & effectiveness review	X			
Contract closure	X			

Figure 8.6: Current level of integration for contract management

Section C: Integration Aim				
Supply Chain Function Activity	No Engagement	Interaction	Dialogue	Agreement
Needs clarification	X			
Tender preparation		X		
Tender publication	X			
Bids evaluation	X			
Contract award			X	
Changes in contract			X	
Service delivery management				X
Relationship management		X		
Contract administration		X		
Risk assessment		X		
Purchasing organisation's performance & effectiveness review			X	
Contract closure		X		

Figure 8.7: Integration aim for contract management

8.3.3 Identify Opportunities for Integration

Once the current level of integration and the integration aim have been identified, a graph will be created in the Excel[®] file. Opportunities for integration can be identified by comparing the current level of integration and the integration aim. The graph in Figure 8.8 is generated from the data collected in Sections 8.3.1 and 8.3.2. From the graph it can be seen that there are opportunities for integration at various stages, such as the tender preparation, purchase organisation's performance and effectiveness review, and contract closure activities due to the difference between the current level of integration and integration aim.

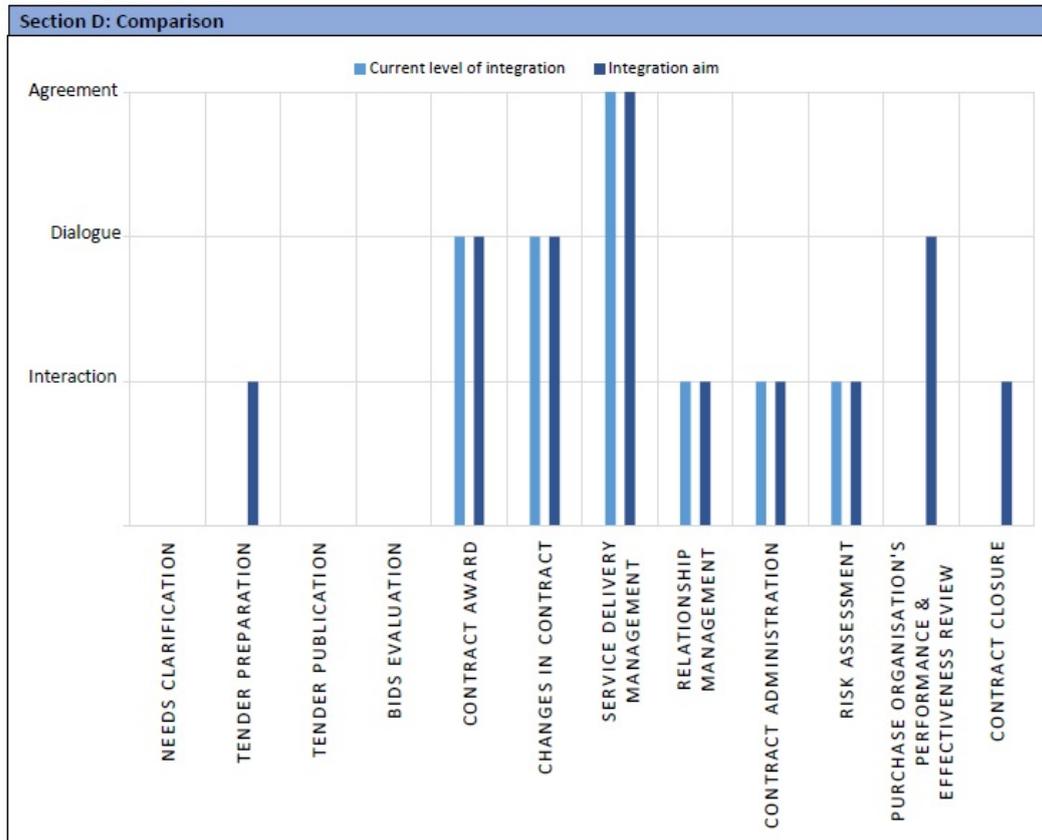


Figure 8.8: Graph indicating the current integration level and integration aim of the contract management activities

8.3.4 Prioritisation

Once the integration levels have been identified for the current situation and the integration aim, the activities with opportunities for integration are automatically populated on the prioritisation Excel[®] sheet. These activities are then prioritised according to the risks and benefits of implementing the new public-private engagement. Each risk and benefit is rated on a scale from 0 - 5, where 0 indicates that the risk/benefit will have a low impact on the engagement and 5 indicates that the risk/benefit will have a very high impact on the engagement. Figure 8.3.5 shows the results of the risk and benefit ratings. Once the risks and benefits have been rated for each activity, the activities are prioritised to determine which activity shows the most potential and should be focused on first. Activities are prioritised from lowest risk, highest benefit to highest risk, lowest benefit. In the last column in Figure 8.3.5 it can be seen that the activity 'tender preparation' has first priority and should therefore be focused on first.

	Benefits (Scale from 0 - 5)							Risks (Scale from 0 - 5)										Priority of functions					
	Close the resource gap	Improve access and efficiencies	Innovation	Expand and retain human resource	Build capacity	Shared risk	Conflict of interest	Risks of engaging with the private sector					Risks of engaging with the public sector										
								Limited capacity to engage with the private sector	Regulatory issues	Sharing information	External constraints	Lack of control	Delayed decision making by public sector	Contracting challenges	Payment terms	Sharing information							
Contract Management																							
Tender preparation	3	4	4	2	2	2	2	3	2	3	3	2	2	3	1	3	1						
Purchasing organisation's performance & effectiveness review	4	4	3	2	3	4	3	3	5	5	3	3	4	3	2	4	2						
Contract closure	2	4	2	3	3	4	3	4	5	3	3	5	5	5	4	4	3						

Figure 8.9: Rating of activities according to risks and benefits

In addition, the total risk and benefit of each activity is compared in a graph. Figure 8.10 illustrates the graph that is generated once the risks and benefits of each activity has been rated. Although the activity ‘purchasing organisation’s performance and effectiveness review’ has the highest benefit, it has a higher risk than tender preparation. Tender preparation may have the lowest benefit, but it also has the lowest risk. Tender preparation is therefore considered the priority of the three opportunities as it is a ‘low hanging fruit’. Contract closure has the highest risk which is why it should be considered for implementation last.

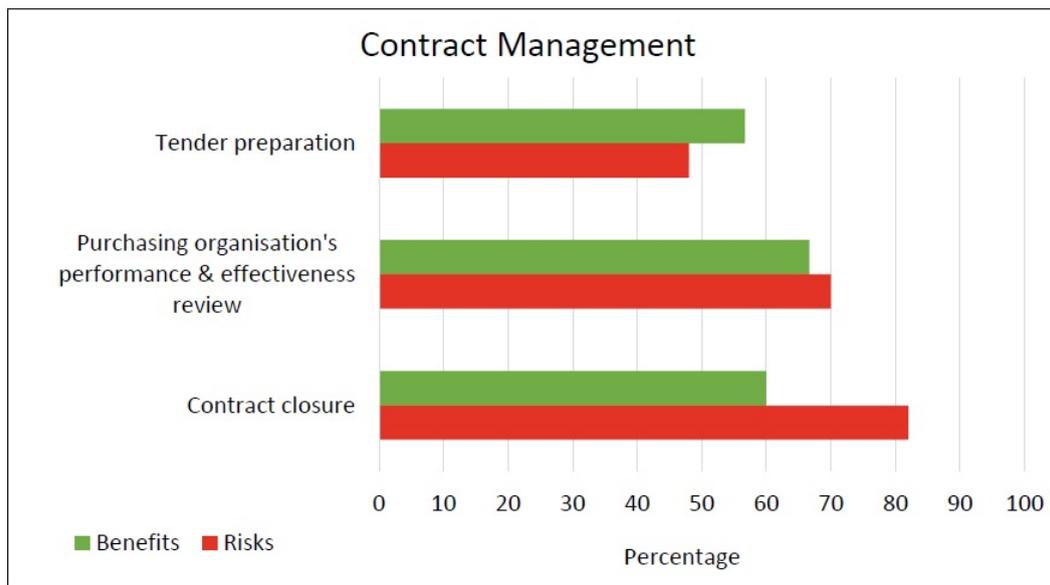


Figure 8.10: A comparison of the total risk and benefit of each contract management activity

8.3.5 Results

As part of the framework, the Excel[®] file also provides a dashboard that summarises the results of the assessment. The results displayed on the dashboard are briefly discussed below.

The first result is a graph of the percentage integrated, as shown in Figure 8.11. The graph indicates how integrated the contract management function currently is, and how integrated it would be if all the opportunities for integration, that were identified during the assessment, were to be implemented. From the figure it is clear that the contract management function would be 11% more integrated if the three opportunities for integration were implemented.

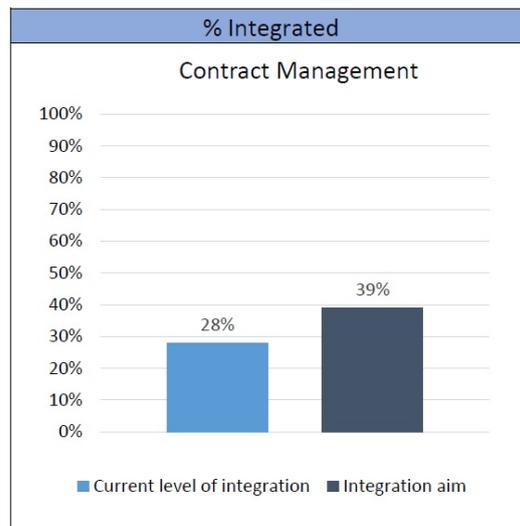


Figure 8.11: The current and possible percentage of integration of contract management

The second result summarises the risks and benefits of implementing the identified integration opportunities of contract management. In Figure 8.12 it is clear that the biggest benefit from implementing the integration opportunities would be that process efficiencies would improve and that more risk would be shared with the private sector. In addition, the biggest risks are regulatory issues, the sharing of information, lack of control on part of the private sector, delayed decision making by the public sector and contracting challenges. It is also clear that on average, the private sector (indicated by the green bars in Figure 8.12) would bear more risks than the public sector (indicated by the blue bars). However, the public sector bears the highest risk of 'regulatory issues'. These graphs allow assessors to identify how integrating with the private sector will benefit the supply chain and which risks need to be mitigated and planned for.

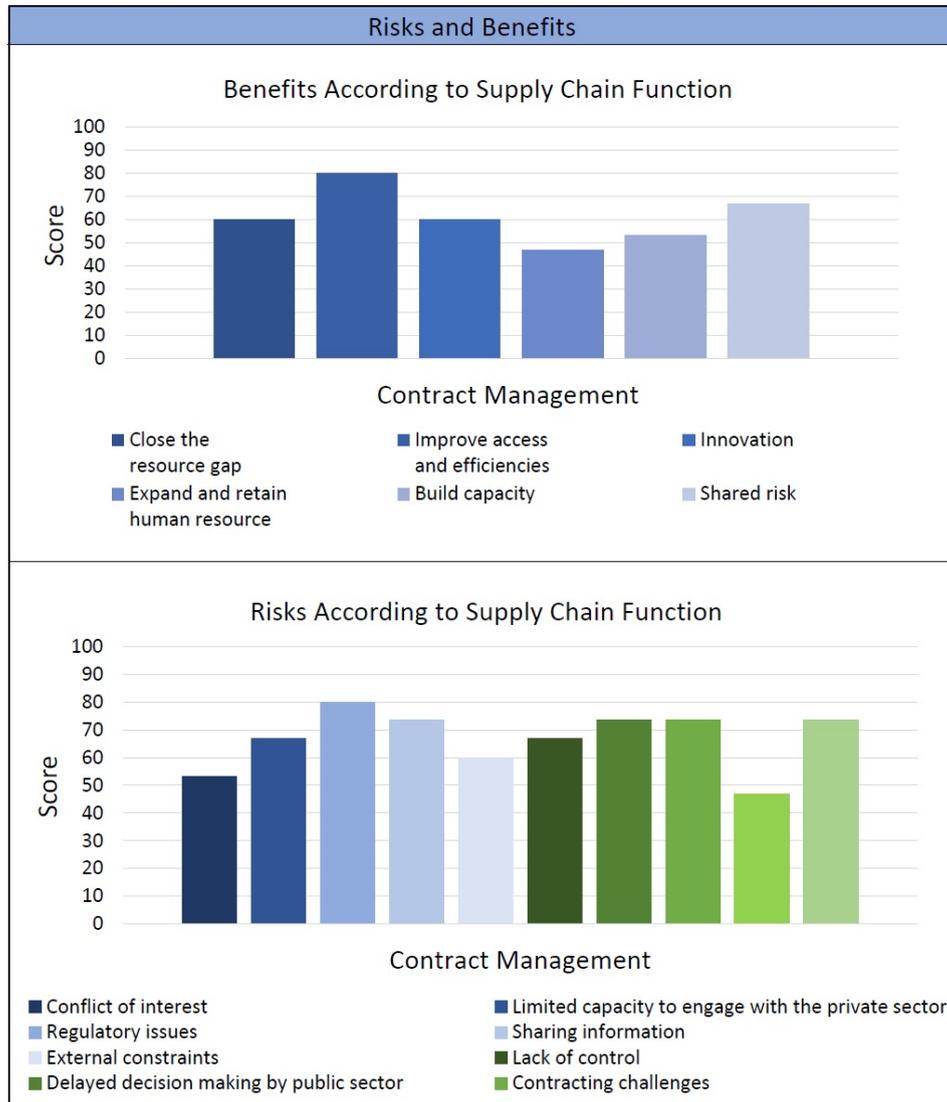


Figure 8.12: A summary of the risks and benefits of implementing integration opportunities in the contract management function.

The last result indicates the priority that each supply chain activity was assigned after the risk and benefit assessment. Figure 8.13 indicates that the integration opportunity identified during the preparation of tenders is the first priority. As discussed in Section 8.3.4, integrating with the private sector during tender preparation is seen as a ‘low hanging fruit’ due to the low risk.

Prioritisation	
Rank of supply chain activities according to priority	
Rank	Supply Chain Activity
1	Tender preparation
2	Purchasing organisation's performance & effectiveness review
3	Contract closure

Figure 8.13: The assigned priority of each supply chain activity

8.4 Case Study Discussion

In this section the opportunities for improvement that were identified during case study are discussed. Three main improvement opportunities were identified. These related to (i) the definition of integration (Section 8.4.1); (ii) the identification of integration opportunities (Section 8.4.2); and (iii) the identification of risks and benefits (Section 8.4.3).

8.4.1 Definition

As mentioned in Section 3.4.2, integration is defined as follows: “Integration occurs when two or more autonomous supply chains work together to (i) improve their collective efficiency and effectiveness; (ii) find synergistic combinations of resources; and (iii) find solutions to problems that each supply chain may not be able to achieve on its own. Integration is achieved by constructively exploring each supply chain’s differences and combining expertise from different organisations within the supply chains. This type of integration can be visualised as a step-wise process that starts from complete autonomy (i.e. no integration) and progresses to interaction, to dialogue and finally to agreement (fully integrated).”

However, during the case study it became apparent that it is sometimes difficult to distinguish between contractual relationships with the private sector and integrating with the private sector. For example, many private suppliers are contracted to supply pharmaceutical products to the government. Just because the private supplier and the NDoH are contractually bound does not mean that, at this point, the supply chain is fully integrated. It is strictly a customer-supplier relationship. However, when the supplier and NDoH work together to improve efficiencies, share resources and solve problems, as stated in the definition of integration, then there is a degree of integration. For instance, if the NDoH and a private supplier continuously aim to improve

processes and cooperate with one another, the level of integration would be “Dialogue” and not “Agreement”, even though they are bound by a contract.

In order to determine whether it is integration or not, one should look at the definition of integration and identify whether one or more of the conditions of the definition is met. In other words, does the public-private relationship aim to improve the efficiency and effectiveness, find synergistic combinations of resources or find solutions to problems that each supply chain may not achieve on its own?

8.4.2 Integration Opportunities

The second opportunity for improvement is best explained in conjunction with Figure 8.14 which illustrates opportunities for integration.

Some integration opportunities may be missed because the current level of integration and the integration aim may be the same. For example, in Figure 8.14 the current level of integration for contract administration is ‘Interaction’. If, for instance, the public sector wanted to integrate with the private sector to improve the public sector’s contract administration at an ‘Interaction’ level (see integration aim for contract management in Figure 8.14), the opportunity would be missed because the integration levels are the same. The framework only identifies opportunities for integration when the integration levels are different (i.e. the integration aim is higher than the current level of integration).

In order for the framework not to miss such opportunities, each supply chain activity would have to be further broken down into their constituent steps or activities, such that each step can be assessed for integration. This may become a very cumbersome process and is thus outside the scope of this study. However, it may be useful for future work to develop a much more detailed framework, where single supply chain functions may be assessed at a time.

8.4.3 Risks and Benefits

The last shortcoming is that the assessment of the risks and benefits are subjective. The risks and benefits of integrating with the private sector are determined based on the ratings of stakeholders. Not only is it subjective but the results may also vary depending on the background of the stakeholders that are part of the assessment. For instance, if the majority or all of the stakeholders that are part of the assessment represent the public sector, the benefits of integrating may be perceived to be much higher and the risks that the private sector bears may be perceived to be much lower. This may occur because some public sector representatives may not be informed about how the

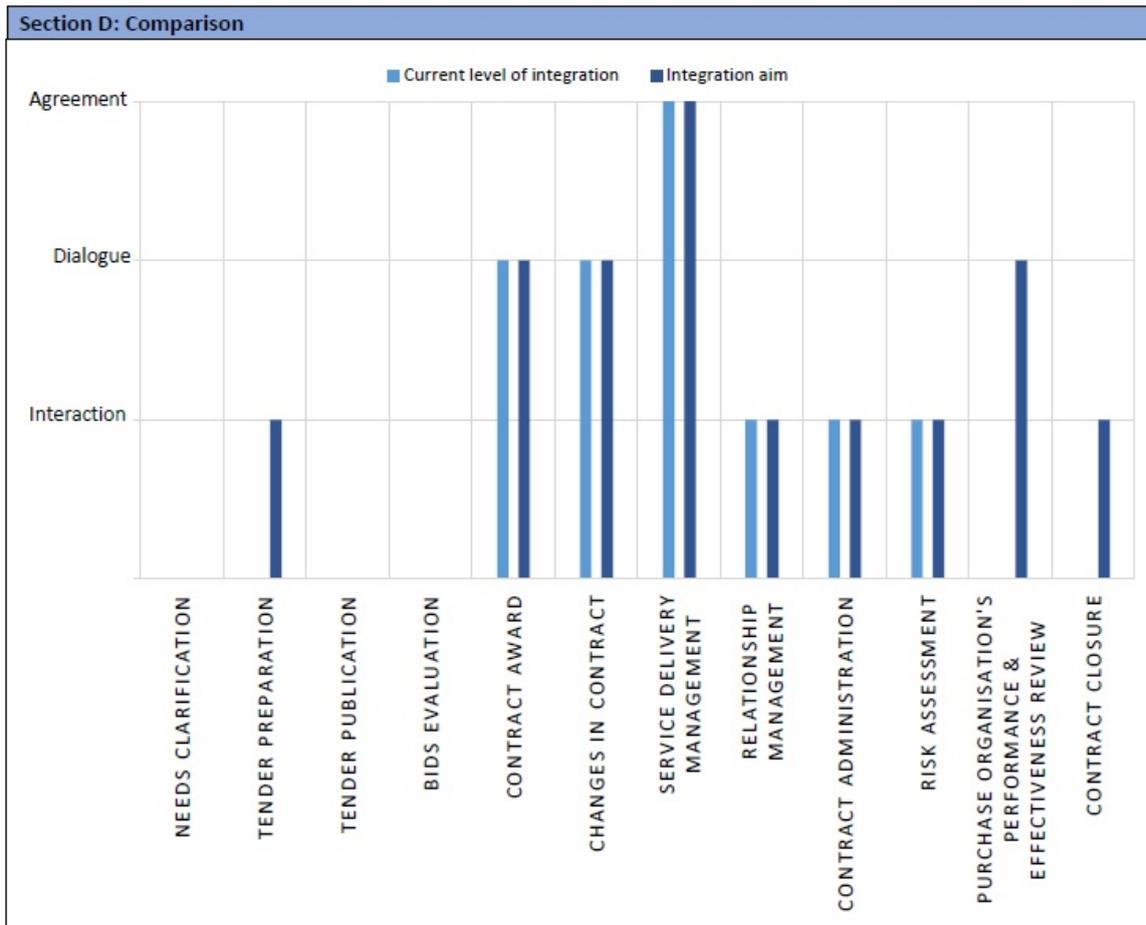


Figure 8.14: A graph used to identify opportunities for integration

private sector functions or may have some biases about the private sector. For example, the public sector may assume that delayed payments is a small risk for the private sector because the private sector generates substantial profit.

The same subjectivity may occur when the majority of the stakeholders represent the private sector. It is therefore important that there are representatives from both the private and public sector during the assessment and, if possible, half should be from the private sector. In addition, there should be consensus amongst the stakeholders on the risk and benefit ratings.

8.5 Chapter 8 Conclusion

In this chapter the illustrative case study that was conducted, in order to demonstrate how the framework works, what results the framework produces and to identify opportunities for further improvement, is presented. The scope of the case study is discussed, followed by a brief literature review that provides

context to the case study. Next, the case study is carried out and discussed in a step-by-step manner. Finally, three opportunities for further improvement are identified.

Chapter 9

Conclusion & Future Work

This chapter concludes the study by providing a summary of each chapter's research findings in Section 9.1 and follows on with a discussion in Section 9.2 on how each research objective was met. The limitations of the study are also discussed (Section 9.3), followed by a set of recommendations for future work (Section 9.4). Lastly, the implications that the framework may have on policy is discussed in Section 9.5.

9.1 Research Summary

This section discusses the research findings of each chapter.

Chapter 1: The background, context and problem statement of the study is provided, from which the research aim and objectives were established. The chapter further provided a discussion on the scope of the study, an outline of the document contents as well as an indication of where each research objective is met.

Chapter 2: This chapter presents the research methodology of the study. The research purpose is established as exploratory and reasons there for are provided. The chapter also discusses the research approach and the reasons for selecting the specific research methodology. The chapter further details how each phase of the selected methodology will be carried out.

Chapter 3: This chapter serves as the literature review of the study. The chapter starts with a discussion of the problems that occur in public health supply chains and the current methods used to address these problems. Pharmaceutical supply chains are then investigated with regard to their importance, structure, functions and how these supply chains are managed. Next, the reasons for engaging with the private sector are investigated, along with the challenges of public-private engagements and how these challenges can be overcome. Furthermore, the types of public-private engagements are investigated and examples of public-private engagements in health supply chains are

provided. The chapter concluded with the investigation of supply chain integration and the introduction of public-private health supply chain integration.

Chapter 4: The purpose of this chapter was to review frameworks and methodologies that aim to identify opportunities for public-private engagement. Additionally, the chapter aims to identify whether or not the research aim has been achieved by another author, what the research gaps are and how they can be adapted to the framework criteria. Four frameworks and methodologies were identified for the review and four framework criteria were formulated.

Chapter 5: Chapter 5 provides a discussion of the methodology used to develop the framework from the criteria formulated in Chapter 4. The chapter then discusses how the framework criteria are met and the individual steps of the framework are selected. The chapter concludes by integrating the criteria solutions and individual steps, and presenting the preliminary framework.

Chapter 6: The purpose of this chapter is to validate the preliminary framework developed in Chapter 5. The chapter first discusses how internal validation was carried out to ensure that the Excel[®] part of the framework functions properly. The framework is then externally validated by SMEs through the use of a questionnaire. Subsequent improvements were made to the framework, based on the feedback from SMEs, to establish the final framework (See Appendix E and the USB accompanying this thesis)¹. The chapter concludes with the presentation of the final framework.

Chapter 7: This chapter presents the final framework (contained in Appendix E and the USB accompanying the thesis) by discussing each step of the framework and presenting some examples from the framework guide and Excel[®] file. Lastly, the dashboard, which summarises the results of the assessment, is briefly discussed.

Chapter 8: In this chapter an illustrative case study is carried out to illustrate how the framework can be used and to illustrate the possible outcomes of using the framework. In addition, the chapter identifies further opportunities for improvement and future work. The scope of the case study is discussed, after which a small literature review is carried out to provide some context to the case study. The framework is then applied to a real-world scenario with the help of an SME. Each step and outcome of the case study is discussed. Lastly, the chapter discusses the areas in which the framework can be further improved, as identified during the case study.

Chapter 9: Chapter 9 presents the conclusion of the study by discussing the research findings, how the objectives were met and elaborating on the research limitations and recommendations of future work.

¹Alternatively use the link provided in Appendix F

9.2 Outcomes of Research Objectives

The research aim of this study is to develop a framework that can be used to facilitate the evaluation of public and private pharmaceutical supply chains in order to identify the said opportunities for synergies that will support improved access to medicine. In order to achieve the research aim, five research objectives were established in Section 1.4 to guide the development of the framework. Table 9.1 discusses how the research objectives were addressed in the study.

9.3 Limitations

The development of the framework and the validation thereof has some limitations which should be taken into account:

- (i) Public-private supply chain integration is still an emerging field. Hence, the range and scope of benefits that can be attained from such integration is still largely unknown.
- (ii) As the integration of public-private pharmaceutical supply chains is an emerging field of research, the framework developed is exploratory in nature. Therefore, the framework is not all-encompassing, and will need to be improved with further research.
- (iii) SMEs have agreed that such a framework is needed and have given feedback on how it can be improved. Although the feedback was used to improve the framework, more input is required from experts in both public and private sectors, as well as various areas from health supply chains to ensure it optimally achieves its stated aims. Therefore, a limitation of this study is that a limited number of subject-matter experts were part of the validation of the framework. As a result, the framework improvements are limited to their perspectives, experience and insights. Furthermore, the feedback from SMEs is mostly given with a South African perspective, despite the intention of it being applicable in any LMIC. Therefore, the improvements and amendments made to the framework are solely based on a South African context/perspective.
- (iv) The application of the framework was limited to an illustrative case study due to time constraints. Therefore, the usability of the framework could not be tested and the framework could not be further validated. In addition, the case study was limited to the Excel[®] part of the framework as well as the contract management function and was carried out with the assistance of a single SME. Therefore, insight gained during the case study might be limited.

Table 9.1: Discussion of addressed objectives

Objective	Outcome	Chapter
<p>Objective 1: Review literature relevant to the study</p>	<p>The scope of the study (Section 1.5) focused on three research fields, as shown in Figure 2.2. Literature was reviewed within these three research fields. As stated in the research objectives, the following literature was reviewed: (i) health supply chain problems and proposals to address the problems; (ii) pharmaceutical supply chains; (iii) public-private engagements in pharmaceutical supply chains; (iv) supply chain integration; and (v) framework and methodologies used to identify opportunities for public-private engagement. The review of the literature enables a deeper understanding of the research problem and how it may be addressed.</p>	<p>Chapter 3 Chapter 4</p>
<p>Objective 2: Develop a conceptual framework to evaluate pharmaceutical supply chains for opportunities of integration</p>	<p>This objective is met by developing a framework using the insight obtained during the literature review as well as new information gathered during the development process. The framework was developed using the CFA methodology proposed by Jabareen (2009).</p>	<p>Chapter 4 Chapter 5</p>
<p>Objective 3: Validate and improve the developed framework</p>	<p>The framework was validated by engaging with four SMEs who have practical experience in the health and pharmaceutical supply chain field. The SMEs provided feedback on the framework via a questionnaire. The feedback was subsequently used to improve the framework.</p>	<p>Chapter 6</p>
<p>Objective 4: Perform an illustrative case study by applying the framework to the South African context</p>	<p>This objective was met by applying the framework to the contract management supply chain function in South Africa. The case study illustrated how the framework can be used and the results that the framework produces. The case study was also used to identify further opportunities for improvements that the framework may have.</p>	<p>Chapter 7</p>
<p>Objective 5: Discuss the impact of the research and opportunities for future work</p>	<p>The research findings, limitations of the study and recommendations for future work are discussed</p>	<p>Chapter 8</p>

- (v) As discussed in Section 8.4.2, the framework may miss the identification of some integration opportunities because it only assess supply chains at an aggregated level. Further research and a more detailed approach would be required to identify opportunities for integration when the current level of integration and the integration aim are the same for a supply chain activity.

9.4 Future Work

The limitations discussed in Section 9.3 can be adapted to recommendations for future work.

- (i) The scope of the benefits of integration may be currently unknown. However the possible improvements, not only to supply chains, but to health outcomes and patients' lives that may be achieved through integration makes it imperative that further research be carried out on public-private integration. Through further research, the full extent of the benefits, risks and applications of the framework can be understood.
- (ii) Although the framework is exploratory in nature, through further research on public-private integration and assessing supply chains to identify opportunities for integration, the framework can be iteratively improved such that the classification of the framework can be transformed from an 'exploratory' framework to an 'applicable' framework that can be practically implemented to improve pharmaceutical supply chains.
- (iii) The framework was validated through four SMEs, however it would be beneficial to further validate the framework with input from professionals from various countries, with various supply chain and pharmaceutical backgrounds such as public and private representatives, national, provincial, district and community representatives as well as personnel who work in different areas of the supply chain. Validation from the various professionals will further improve the framework and may enable the development of frameworks that are suited to specific country contexts. In addition, further validation may instill trust in the results of the framework and lead to the formalisation and adoption of the framework by governments.
- (iv) The author proposes that the framework be applied to a number of case studies as this will further validate the framework and can be used to provide practical evidence of the benefits that may be achieved through the use of the framework. The application of the framework to case studies will also enable the framework to be refined.

- (v) Further research may be required in cases where more detailed analyses of the supply chain functions are desired. The framework may serve as a basis for the development of frameworks that assess each supply chain function in an in-depth manner. Such a framework would be ideal for decision makers who want to increased private sector integration in a specific supply chain function.

9.5 Implications for Policy

The implementation of the points listed in Section 9.4 may assist policy makers and decision-makers in developing countries with the implementation of universal health coverage as many countries will need the help of the private sector to successfully implement universal health coverage (UHC). During the validation of the framework, SMEs expressed their interest in the framework as a possible tool to bridge the gap of national health insurance (the term used in South Africa to describe UHC) in South Africa. In addition, the developed framework serves as a foundation from which policy makers and decision makers can adapt or develop their own framework to achieve public-private integration as part of their own strategic endeavours. Although the framework does not facilitate an in-depth assessment of any particular pharmaceutical supply chain area, it can serve as a best-practice point of departure for discussions around the role that integration can play to improve supply chains and can lead to the further development and implementation of detailed frameworks per area. Discussions with SMEs have indeed indicated that there is a definite need for this tool to assist with the improvement of supply chains and complex relationship of the public and private sector.

9.6 Chapter 9 Conclusion

This chapter summarises the research findings of each chapter and discusses how each research objective is addressed in the study. Furthermore, the limitations of the study are discussed and subsequently adapted to recommendations for future work. Lastly, the implication that the framework may have on policy is discussed.

Appendices

Appendix A

Data Collection Tool: Integration Matrix

This Appendix briefly describes how the data collection matrix, used during data collection, is developed.

The supply chain functions, that were selected to meet Criteria 3 (Section 5.2), are integrated with the levels of integration (Section 3.4.2) to form a matrix. This matrix will facilitate the assessment of pharmaceutical supply chains and is included in the Excel[®] data collection tool (See the USB accompanying this thesis). A condensed example of the matrix is shown in Table A.1.

Table A.1: Condensed data collection matrix

Supply Chain Function	No Engagement	Interaction	Agreement
Selection			
Procurement			
Distribution			
Use			
Management Support			

The current level of integration can therefore be determined by filling in the matrix. This can be done using the information gathered during the review or by interviewing stakeholders. The same matrix can be used to establish what level of integration the supply chain is capable of, i.e. the integration capability.

Appendix B

Risk-Benefit Prioritisation

Before the identified opportunities for integration can be prioritised according to the risks and benefits, a list of risks and benefits needs to be compiled. In Section B.1 a list of the risks and benefits of engagement are compiled, whereas Section B.2 explains how integration opportunities are prioritised.

B.1 Risks and Benefits of Public-Private Engagement

This section is divided into benefits (Section B.1.1) and risks (Section B.1.2).

B.1.1 Benefits

The following benefits may be realised when the public sector engages with the private sector (UN Commission, 2015; O’Hanlon and Jeffers, 2013):

Close the resource gap: Partnerships attract private capital which can be used to fund services and procure assets or to supplement the public sector’s resources or by freeing up resources that can be used elsewhere.

Improve access and efficiencies: Partnerships can improve access to health services and products by providing health services and products at affordable costs. Partnerships can also improve efficiencies by rationalising the use of existing resources, such as staff and infrastructure, across the public and private sector. Private sector engagements can also improve supply chain operational efficiencies, for example economies of scale can be leveraged to improve access to pharmaceuticals.

Innovation: The private sector is more equipped to invest in innovative methods and technologies than the public sector, therefore engaging with the private sector could lead to the adoption of innovative technology, management approaches and health operations. In addition, innovative approaches, solutions

and ideas will be generated when staff from different sectors and disciplines work together. The private sector also benefits by introducing new markets, having access to investment opportunities and generating goodwill.

Expand and retain human resource: One of the biggest challenges in Sub-Saharan Africa is the incidence of “brain drain”. By encouraging the growth of the private sector human resources can be retained since it boosts business opportunities within the country. The private sector can also provide access to new technologies which expands career opportunities in the health sector.

Build capacity: The private sector can increase the public sector’s coverage and increase capacity by engaging with private providers which will increase the number of service delivery points as well as the number of skilled human resources. The private sector has the skills and expertise to overcome supply chain challenges. Their skills and expertise can help build the public sector’s capacity, thereby allowing the public sector to better manage its own supply chain. For example, public organisations have used private sector training programmes to train staff; the public sector has also engaged with the private sector to assist with the optimisation of supply chains. Private sector engagement can not only increase the public sector’s coverage, but also the coverage of the private sector (MIT-Z ILP, 2008).

Shared risk: There is a lot of risks involved when the public and private sectors engage, including financial, security, political, human resources and infrastructure risks. Effective engagements share risks between the public and private sector which means that each sector accepts a share of the engagement risks for which they are best suited. By sharing risks both sectors are more willing to engage.

B.1.2 Risks

According to Tennyson (2011) and UN Commission (2015) both sectors need to understand the risks and rewards that the other sector faces in order to develop a successful engagement. Therefore, the risks of public-private engagements can be divided into two groups, namely the risks of the private sector engaging with the public sector and the risks of the public sector engaging with the private sector (UN Commission, 2015). The risks of public-private engagement is discussed in Section 3.3.2 and is replicated below for convenience. The public sector faces the following challenges when engaging with the private sector (UN Commission, 2015):

Conflict of interest and misalignment of motivations: The private sector usually measures its performance with performance metrics such as return on investment and profit. Conversely, the public sector’s main concern is not

about how much profit it makes but rather ensuring the availability, affordability, accessibility and acceptability of medicines (MSH, 2012). This difference results in a misalignment of the two sector's motivations and raises concerns regarding the sharing of information which could be exploited. The public sector has to address a few concerns such as conflicts of interest, competition and the fear that projects might not be completed within budget and time constraints due to a lack of transparency during the bidding process.

Limited capacity to engage with the private sector: The public sector usually has limited experience regarding contract management. Inexperience in contract management could result in badly written contracts which could place the public sector in a vulnerable position and limits the public sector's capacity to manage, develop, enforce and monitor contracts. These factors increase the possibility of corruption and conflict of interests.

Regulatory issues: Often regulatory bodies are responsible for defining contracts between the public and private sectors, which means the public sector can be restricted by the contract structure. The private sector mostly only invests in new engagements when the contract length is long enough to spread their risks over time in addition to providing enough benefit. If the public sector sets unrealistic terms, KPIs or lengths for contracts, it could drive up costs and cause the engagement to seem unattractive to the private sector.

Sharing information: The public and private sectors receive consumption data from different sources. In the pharmaceutical industry, the private sector receives data from retail outlets, distributors and health providers, whereas the public sector uses consumption data that is usually manually collected at health facilities.

External constraints: Public-private engagement opportunities will be influenced by external constraints such as: (i) the economic and political climate; (ii) hidden complexities of donor structures in projects and national agencies; and (iii) the likelihood that the development and management of public-private engagements will be more expensive than internal government processes.

The private sector has the following challenges when engaging with the public sector (UN Commission, 2015):

Lack of control: During a public-private engagement the contractual requirements may stipulate the timing of processes as well as how resources should be allocated and used. Requirements can be influenced by the political climate and may increase the time and costs of the project since the private sector has to compensate for having limited control over the resources required to complete expected activities.

Delayed decision making by public sector: In the public sector the decision making process is often drawn out as a result of the government's structure

or the contractual processes that need to be followed. This increases the private sector's costs which is often not taken into consideration by the public sector during initial engagement cost evaluations.

Contracting challenges: Not all governments have transparent and standardised tendering processes, which could lead to corruption and extended contract negotiations. In addition, governments often want to enter short-term contracts which is too short for the private sector to make a return on their investment. Furthermore, government contracts may request the private sector to take responsibility for the risk rather than sharing the risk.

Payment terms: In order for the private sector to continue its support during the engagement, payments must be made on-time. However, budgetary challenges and governmental processes often delay payments to the private sector. Therefore, payment terms should be addressed early on to prevent the engagement from failing.

Sharing information: Often frameworks and standards are not timeously shared with the private sector. In addition, the private sector may not fully understand how the public sector operates or the responsibilities concerning affordability and universal health coverage. Also, data compilation is not centralised which means that each sector is unaware of what has been contributed.

B.2 Risk-Benefit Prioritisation

The list of benefits and risks as well as the supply chain functions can now be integrated into a table where the risks and benefits of engagement can be rated on a scale from 1 to 5 (See Figures B.1 and B.2). The benefit and risk ratings of each supply chain function is summed which results in an overall benefit and risk score. However, due to the fact that the number of risks are greater than than the number of benefits, the overall ratings are converted to percentages to allow for a more accurate comparison. For each function, the benefit-risk ratio is calculated by dividing the benefit percentage by the risk percentage. This means that if the risks outweigh the benefits the ratio will be smaller than 1, if the benefits outweigh the risks the ratio will be greater than 1. The supply chain functions can then be arranged from highest to lowest after the benefit-risk ratios have been calculated. Figure B.3 gives an example of how functions are prioritised, where the last column indicates the position of each supply chain function in the prioritisation list.

	Benefits (Scale from 1 - 5)					
	Close the resource gap	Improve access and efficiencies	Innovation	Expand and retain human resources	Build capacity	Shared risk
1. Selection						
Reviewing prevalent health problems						
Identifying treatments of choice						
Choosing individual medicines & dosage						
Deciding which medicines will be available at each level of the health care system						
2. Procurement						
Quantifying medicine requirements						
Selecting procurement methods						
Managing tenders						
Establishing contract terms						
Assuring pharmaceutical quality						
Ensuring adherence to contract terms						
3. Distribution						
Clearing customs						
Stock control						
Stores management						
Delivery to drug depots & health facilities						
4. Use						
Diagnosing						
Prescribing						
Dispensing						
Use by patient						
5. Management support						
Organization of system						
Financing & sustainability						
Information management						
Human resource management						

Figure B.1: The resulting table where the benefits of engagement can be rated

	Risks (Scale from 1 - 5)									
	Risks of engaging with the private sector					Risks of egaging with the public sector				
	Conflict of interest	Limited capacity to engage with the private sector	Regulatory issues	Sharing information	External constraints	Lack of control	Delayed decision making by public sector	Contracting challenges	Payment terms	Sharing information
1. Selection										
Reviewing prevalent health problems										
Identifying treatments of choice										
Choosing individual medicines & dosage										
Deciding which medicines will be available at each level of the health care system										
2. Procurement										
Quantifying medicine requirements										
Selecting procurement methods										
Managing tenders										
Establishing contract terms										
Assuring pharmaceutical quality										
Ensuring adherence to contract terms										
3. Distribution										
Clearing customs										
Stock control										
Stores management										
Delivery to drug depots & health facilities										
4. Use										
Diagnosing										
Prescribing										
Dispensing										
Use by patient										
5. Management support										
Organization of system										
Financing & sustainability										
Information management										
Human resource management										

Figure B.2: The resulting table where the risks of engagement can be rated

	Benefits (Scale from 0 - 5)						Risks (Scale from 0 - 5)										Priority of functions	
	Close the resource gap	Improve access and efficiencies	Innovation	Expand and retain human resource	Build capacity	Shared risk	Risks of engaging with the private sector					Risks of egaging with the public sector						
							Conflict of interest	Limited capacity to engage with the private sector	Regulatory issues	Sharing information	External constraints	Lack of control	Delayed decision making by public sector	Contracting challenges	Payment terms	Sharing		
Selection																		
Review prevalent health problems	5	2	1	0	3	1	4	5	3	0	1	2	4	5	2	3	3	
Identify treatments of choice	0	2	1	4	5	2	3	2	1	4	5	2	1	2	0	3	2	
Choose individual medicines & dosages	5	2	3	0	1	5	2	3	5	4	1	2	3	0	2	3	1	

Figure B.3: An example of prioritising supply chain function according to risks ad benefits

Appendix C

Validation Questionnaire

Framework Questionnaire

Name & Surname: _____

Date: _____

Please answer the following questions and forward the completed questionnaire to 16496698@sun.ac.za or jessicab0712@gmail.com . If you have any questions, please feel free to contact me via one of these e-mail addresses or phone me on 072 785 1122.

Background Questions

1. What is your occupation?
2. What is your role in the organisation you are currently working for?
3. Please elaborate on your exposure to health supply chains.
4. Please elaborate on your exposure to public-private engagements in the health sector.

Framework Questions

1. Is there a need to identify opportunities for integration between the public and private sectors in pharmaceutical supply chains?
2. Do you believe this framework would be a useful assessment tool to identify integration opportunities?
3. Are there other frameworks that have the same purpose and results that you are aware of? Please elaborate.
4. Are there any shortcomings or feedback on the methodology employed by the proposed framework? (Or what are the strengths and weaknesses?)
5. In your opinion, how can the framework be improved?

Appendix D

SME Completed Questionnaires

Framework Questionnaire

Name & Surname: Florian Menold, DSV Healthcare

Date: 04.07.2018

Please answer the following questions and forward the completed questionnaire to 16496698@sun.ac.za or jessicab0712@gmail.com . If you have any questions, please feel free to contact me via one of these e-mail addresses or phone me on 072 785 1122.

Background Questions

1. What is your occupation?
2. What is your role in the organisation you are currently working for?
General Manager – Projects & Engineering
GM for BU Centralized Dispensing for chronic medication – public sector
3. Please elaborate on your exposure to health supply chains.
We deliver medication to public healthcare facilities in SA.
We do this on 2 fronts, first as a wholesale / bulkd delivery to replenish stock levels, either to medical depots or as DDV's to clinics in the whole country
Secondly we dispense medication for chronic patients in 5 provinces (WC, EC, NW, GP and FS) to service the needs of about 2 Million patients a month.
4. Please elaborate on your exposure to public-private engagements in the health sector.
As DSV is a private company – we do service the public sector.

Framework Questions

1. Is there a need to identify opportunities for integration between the public and private sectors in pharmaceutical supply chains?
YES, there definitely is.. areas of concern are
 - Management of Stock in Facilities
 - Data Integration / Data Accuracy
 - Basic Supply chain procedures

2. Do you believe this framework would be a useful assessment tool to identify integration opportunities?

YES ! There are some technical Excel issues still there.. think that needs rework

Some questions – e.g. around customs clearance, I think are not relevant.

3. Are there other frameworks that have the same purpose and results that you are aware of?

Please elaborate.

No, not sure – but maybe you want to check online ? Maybe see what the plans on NHI are and what is covered in that white paper ?

4. Are there any shortcomings or feedback on the methodology employed by the proposed framework? (Or what are the strengths and weaknesses?)

I think it is well thought through. Question for me would be, who is the audience ?

Some people will not have the time to go through all your documents and guides in detail. I would think about employing 2 methods here.

One detailed and one “short” version. IT has its pros and cons, but you might only get 5 responses out of 100 participants / target people ?

5. In your opinion, how can the framework be improved?

See above

Framework Questionnaire

Name & Surname: Jaco Stokes

Date: 2 July 2018

Please answer the following questions and forward the completed questionnaire to 16496698@sun.ac.za or jessicab0712@gmail.com . If you have any questions, please feel free to contact me via one of these e-mail addresses or phone me on 072 785 1122.

Background Questions

1. What is your occupation?

Consultant/Contract Manager

2. What is your role in the organisation you are currently working for?

Deputy Director: Contract Management & Availability Monitoring

3. Please elaborate on your exposure to health supply chains.

I focus mainly Supplier Contract Management post contract award and ensuring that Essential Medicines are available to Public and sometimes Private patients. I have exposure to all elements of the Medicine Supply Value Chain

4. Please elaborate on your exposure to public-private engagements in the health sector.

My exposure has been in the following areas:

- Relationship Management
- Contract Management
- Risk Management
- Local & International Sourcing
- Business Process Re-engineering
- System & Tool development
- Tendering
- Service Provider Licensing
- Central Chronic Medicine & Distribution
- Production Planning
- Demand Planning & Forecasting
- Financial Management
- Personnel Administration

Framework Questions

1. Is there a need to identify opportunities for integration between the public and private sectors in pharmaceutical supply chains?

Definitely, thinking along the lines of:

- Universal system integration
 - Supply Chain visibility & logistics management in our move towards NHI
 - Increase in Direct Deliveries
 - Contracting, broader than pharmaceuticals, Consumables & Surgicals, but also Private institutions providing services & systems to public patients and institutions
 - Improvement of Demand & Supply planning
 - Improving supply capacity visibility
 - Establishment of Early Warning Systems to avoid stock-outs or shortages
2. Do you believe this framework would be a useful assessment tool to identify integration opportunities?

I do. Challenges referred to are relevant. We need to overcome quite a lot of these for NHI to function optimally. Capacity remains a challenge and we need to leverage more on best practices in the private sector. We need to work together and share resources for optimisation of a country supply value chain.

3. Are there other frameworks that have the same purpose and results that you are aware of? Please elaborate.

Not that I'm aware of

4. Are there any shortcomings or feedback on the methodology employed by the proposed framework? (Or what are the strengths and weaknesses?)

It is structured in a way that make capturing easy. The methodology is sound and it will improve compliance.

5. In your opinion, how can the framework be improved?

Consider the following:

- The public sector have very strong processes related to the development of STGs. As we need to move towards NHI, formularies will need to be strengthened.
- I miss a few elements linked to Contract Management, Demand Planning as well as Supply Planning. Parallel importation of key medicines need to be investigated as the pressure on the bid process often put pressure on available medicines required on the STGs.

Framework Questionnaire

Name & Surname: SME 3

Date: 1 July 2018

Please answer the following questions and forward the completed questionnaire to 16496698@sun.ac.za or jessicab0712@gmail.com . If you have any questions, please feel free to contact me via one of these e-mail addresses or phone me on 072 785 1122.

Background Questions

1. What is your occupation? **SUPPLY CHAIN MANAGER**
2. What is your role in the organisation you are currently working for? **SUPPLY CHAIN MANAGER**
3. Please elaborate on your exposure to health supply chains.
4. Please elaborate on your exposure to public-private engagements in the health sector.

Framework Questions

1. Is there a need to identify opportunities for integration between the public and private sectors in pharmaceutical supply chains? **Yes. The public sector, as managed by the DOH endeavours to buy the cheapest medicines so they can treat the most patients. This often leads to murderous competition and import replacement, which in turn results in job losses. By providing integration between public (customer base) and private (supply) sectors, local supply will become more sustainable, more jobs retained, an improved balance of payment and more SA based taxed levied.**
2. Do you believe this framework would be a useful assessment tool to identify integration opportunities? **Yes**

3. Are there other frameworks that have the same purpose and results that you are aware of?
Please elaborate. I am not aware of any.
4. Are there any shortcomings or feedback on the methodology employed by the proposed framework? (Or what are the strengths and weaknesses?) I think the framework will be very useful to be used as a checklist to confirm supply chain readiness before orders are placed and business execution starts. Working through such a checklist will also help to facilitate debate in an objective way between parties who represent different constituencies with varying business objectives.
5. In your opinion, how can the framework be improved? I think the framework is great. One could possibly revisit some of the terminology but in essence, semantical changes would not add value to the already developed framework, so I suggest you leave the framework the way it is.

Framework Questionnaire

Name & Surname: SME 4

Date: 2 July 2018

Please answer the following questions and forward the completed questionnaire to 16496698@sun.ac.za or jessicab0712@gmail.com . If you have any questions, please feel free to contact me via one of these e-mail addresses or phone me on 072 785 1122.

Background Questions

1. What is your occupation?

Consultant/Pharmacist

2. What is your role in the organisation you are currently working for?

3. Please elaborate on your exposure to health supply chains.

Our project focusses mainly on supply chain, but includes all elements of the medicine supply value chain. The main elements of the value chain are:

- Selection
- Contracting
- Supply Chain
- Contract Management
- Use

We do also consider the supporting or enabling functions within this value chain including:

- Governance and policy creation
- Technology and data management
- Human resources and workforce planning
- Financial management
- Sustainability – change management, communications and training

4. Please elaborate on your exposure to public-private engagements in the health sector.

Framework Questions

1. Is there a need to identify opportunities for integration between the public and private sectors in pharmaceutical supply chains?

Absolutely. For the following reasons:

- To increase direct delivery
- As we move to NHI, the lines between public and private sector will become more blurred
- To allow for the contracting of private sector institutions to provide public sector services and serve public sector patients
- To improve planning processes – i.e., demand and supply planning. Improve visibility into supply capacity linked to public sector demand, allows for the establishment of early warning signals to avoid stock-outs or shortages.
- For selection and contracting purposes – if the public sector needs a certain pack size or strength of a medicine, improve integration can assist to shape the market to meet the needs of the public sector.

2. Do you believe this framework would be a useful assessment tool to identify integration opportunities?

I do. The challenges related to public-private engagements mentioned in the Framework Guide are real, but these need to be overcome if we are to succeed with NHI. Capacity is limited in the public sector and if private sector capacity can be used and leveraged. Improve collaboration can result in a very strong and robust supply chain.

3. Are there other frameworks that have the same purpose and results that you are aware of?

Please elaborate.

I am not aware of any.

4. Are there any shortcomings or feedback on the methodology employed by the proposed framework? (Or what are the strengths and weaknesses?)

I think the methodology is sound and structure in such a way that will make for ease of capture and improve compliance from stakeholders.

5. In your opinion, how can the framework be improved?

Just some points to consider:

- Selection: there is a very strong process in place within the public sector related to the establishment of Standard Treatment Guidelines – some private sector stakeholders do participate, but as we move closer to NHI the use of the STGs and resulting formularies across the entire sector will need to be strengthened. Market shaping is becoming critical as we are noticing more and more suppliers are not bidding on certain products, resulting in the need to source medicines through a Section 21 mechanism.
- Procurement: I would suggest including contract management. This is post-award of a tender and is closely linked to supply chain performance. It also provides a good opportunity for improving collaboration and planning. The idea of S&OP type meetings with key suppliers would be beneficial.
- Distribution: Clearing customs is not a major issue for the public sector. I would suggest adding something about Demand Planning and Supply Planning once the contracts have been awarded. Improved collaboration in these areas assists to avoid shortages.
- Information Management: this is crucial for both parties from a planning and execution perspective. Interoperability of systems is critical and the ability to share timely information to make decisions.

Appendix E

Final Framework - Guide

ASSESSING PUBLIC PHARMACEUTICAL SUPPLY CHAINS TO IDENTIFY OPPORTUNITIES FOR INTEGRATION

Jessica Botes

Framework
Guide

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Section 1: Introduction

Background

Well-functioning supply chains are the foundation of health systems (DGDA & MIT-Z ILP, 2008). The goal of public health supply chains is not only to deliver the right product, at the right time, but also to improve the country's health outcomes and achieve broad development goals (such as reducing poverty and increasing productivity) (Bornbusch, Dickens, Hart, & Wright, 2014; John Snow Inc., 2017). Supply chains are crucial to deliver effective health care across all sectors by enabling the availability and provision of affordable, quality products at locations that are accessible to the population.

However, health systems across the globe are struggling to deliver satisfactory health care (WHO, 2007). One of the key health sector challenges is the inequitable and discriminatory access to essential medicines (Matowe, 2015; World Health Organization, 2011). Health supply chains in low-medium income countries face a number of challenges such as staff shortages, geographically reaching all consumers, limited or no information for forecasting and supply planning, insufficient warehouse space and management, increased complexity and increased number of products (Allain, Goentzel, Bates, & Durgavich, 2010; DGDA & MIT-Z ILP, 2008; John Snow Inc., 2016; UN Commission, 2015). The improvement of pharmaceutical supply chains should be regarded as a top priority as a result of its effect on the affordability, availability and acceptability of medicines (Tetteh, 2009).

Many authors argue that public-private engagement should be a key aspect of any strategy aiming to improve the health system. While it is the government's responsibility to improve public health systems, the absence of public resources, the challenges faced by the public supply chains and the size of a growing private sector suggests that governments cannot optimally improve health systems without engaging with the private sector (IFC World Bank, 2011). Public-private engagement is not an easy task due to barriers such as conflicts of interest, different information systems and different governance structures to name a few (Axelsson & Axelsson, 2006; Nishtar, 2004; UN Commission, 2015). However, many believe that private sector engagement is imperative and unavoidable, and could lead to improved health care access, increased efficiency, reliability and effectiveness of supply chains as well as improves health outcomes (Bornbusch et al., 2014; DGDA & MIT-Z ILP, 2008; IFC World Bank, 2011; Kaboru, 2012; Nishtar, 2004; UN Commission, 2015).

Assessing Public Pharmaceutical Supply Chains to Identify Opportunities for Integration: Framework Guide was created in conjunction with a framework to identify opportunities, risks and challenges associated with public-private pharmaceutical supply chain integration. Governments and supply chain managers could utilize these opportunities to inform decisions regarding private sector engagements that may lead to the strengthening of pharmaceutical supply chains as well as the improvement of supply chain efficiency and effectiveness.

Important Definitions

In order for stakeholders and assessors to be able to use the framework, some definitions need to be clarified.

Integration

Before continuing with the guide, it is important to define the word integration due to the proliferation of meanings in both the public health and supply chain literature.

Definitions from Axelsson and Axelsson (2006), Foreman and Roberts (1991), National Research Council et al. (2000) and United Nations Commission on Life-Saving Commodities & Technical Reference

Team (2015) were combined to define integration. For the purpose of this framework integration is defined as follows: Integration occurs when two or more autonomous supply chains work together to (i) improve their collective efficiency and effectiveness; (ii) find synergistic combinations of resources; and (iii) find solutions to problems that each supply chain may not be able to achieve on its own. Integration is achieved by constructively exploring each supply chain's differences and combining expertise from different organisations within the supply chains. This type of integration can be visualised as a step-wise process that starts from complete autonomy (i.e. no integration) and progresses to interaction, to dialogue and finally to agreement (fully integrated).

Levels of Integration

The levels of integration are defined using the private sector engagement model (also known as the P3 Model) as defined by United Nations Commission on Life-Saving Commodities Technical Reference Team (2015).

The P3 Model consists of three phases (in this guide it will be called levels from here on forth) through which public-private engagements can go. Each level builds on the preceding level, in other words engagements move from level 1 to level 2, and then from level 2 to level 3 in a step-wise manner. However, it is not necessary for each public-private engagement to reach all three levels. As a private engagement progresses to level 3, so will the complexity and formality of the engagement increase. The levels are defined as illustrated in Figure 1. Each level is shortly discussed below.



Figure 1: Integration levels

Level 1 - Interaction

In public-private interaction, information is exchanged between the two sectors to align understanding and assist each other. For example, private sector providers could share data, such as case detections, with the public sector. An example of interaction from the public sector could be as simple as communicating with the private sector to ensure that new regulations have been received and understood. This type of engagement is usually short term with a duration of roughly one to two weeks or ongoing on a periodic basis.

Level 2 – Dialogue

Dialogue involves cooperation and negotiation between the public and private sectors around shared interests. Dialogue does not necessitate shared investments or formal agreements, it does however require that the two sectors cooperate and work together effectively. An example of a public-private dialogue is corporate social responsibility initiatives. These engagements usually last about two to four months or ongoing on a periodic basis.

Level 3 – Agreement

Public-private agreement is the most complex form of engagement that involves a formal contract between the public and private sectors which stipulates each sector's roles and responsibilities. The agreement should also specify each sector's investments and the conditions under which each sector will take over risks and receive benefits. Specific activities should take place during the agreement process, such as a request for proposal (RFP), contract negotiations and contract award, implementation and contract management. Public-private agreements are typically long-term engagements.

Table 1 summarises the characteristics of each integration level.

Table 1: Characteristics of each integration level

Integration Level	Timespan	Formality	Engagement Focus
Interaction	Short term (1 – 2 weeks)	Informal	Communication
Dialogue	Medium term (2 – 4 months)	Can be formal or informal; does not require formal agreement or shared investment	Cooperation
Agreement	Long term (unspecified how long)	Formal	Collaboration

Supply Chain Functions

The supply chain functions that are assessed in this framework include: selection, forecasting, supply planning, procurement, contract management, distribution, use, management support and information management (Management Sciences for Health, 2012). Each function is shortly described below (Management Sciences for Health, 2012):

Selection

A limited number of medicines are selected to improve the supply and rational use of medicines as well as to lower the costs of medicines. Medicine selection is determined by creating a list of common diseases that occur at each level of the health system. A multidisciplinary committee then determines the treatment of first choice (medicines), the formulary system and the treatment guidelines based on the list of common diseases. The supply chain is then required to supply the medicines that have been selected.

Forecasting

Each year data, such as consumption data, morbidity data, services data, demographic data and current performance data, are collected and used to estimate the quantities of products that are needed to meet the population's health needs. Forecasting uses historical data and assumptions of future demand to estimate product consumption for the next year.

Supply Planning

Supply planning involves estimating the total cost and product requirements by using the forecasts from the previous supply chain function to ensure supply chains will have sufficient stock and optimal delivery schedules. Factors such as stock levels, lead times, consumption data and desired delivery dates are taken into account.

Procurement

Procurement involves the process of purchasing medicines from international and national private suppliers as well as public suppliers. Purchases are made through global agencies, regional procurement systems or international procurement agents.

Contract Management

Contract management is the process of effectively managing the development, execution and assessment of contracts so that financial and operational performance is maximised and risk is minimised.

Distribution

The main goal of the distribution system is to maintain a continuous supply of medicines to health facilities and to ensure that resources are used effectively. This is achieved through the inspection, control, storage, delivery and dispensing of stock.

Use

The rational use of medicines require that patients receive medications appropriate to their clinical needs, in doses that meet their individual requirements, for an adequate period of time, and at the lowest cost to them and their community.

Management Support

The management support systems hold the pharmaceutical management framework together. These systems consist of organisation, financing and sustainability, and human resource management.

Information Management

Information management involves monitoring and evaluating performance targets as well as the progress of achieving objectives. Monitoring systems focus on inputs and short-term outputs and should be an integral part of day-to-day management. Evaluation is commonly discussed along with monitoring as part of an overall strategy. It refers to the periodic analysis of a program's progress toward meeting established objectives and goals. Information management requires the use of pharmaceutical management information systems which are organized systems for collecting, processing, reporting, and using information for decision making.

Purpose of the Framework and Guide

The framework is designed to assess public pharmaceutical supply chains in order to:

- Determine the supply chain's current level of integration
- Identify where there are opportunities to integrate with the private sector
- Determine the impact of the potential engagement in terms of the risks and benefits
- Prioritise areas where opportunities of integration have been identified

This framework will help supply chain managers determine where private engagements efforts should focus. This guide was written to help supply chain managers implement the framework. It gives an explanation of how to execute each step, how data is collected and includes templates that may be used by users.

Framework Introduction

The framework consists of five phases, namely: define scope, review, data collection, identify improvements and verify and prioritise. Figure 2 illustrates the framework process which is further discussed in Section 2.

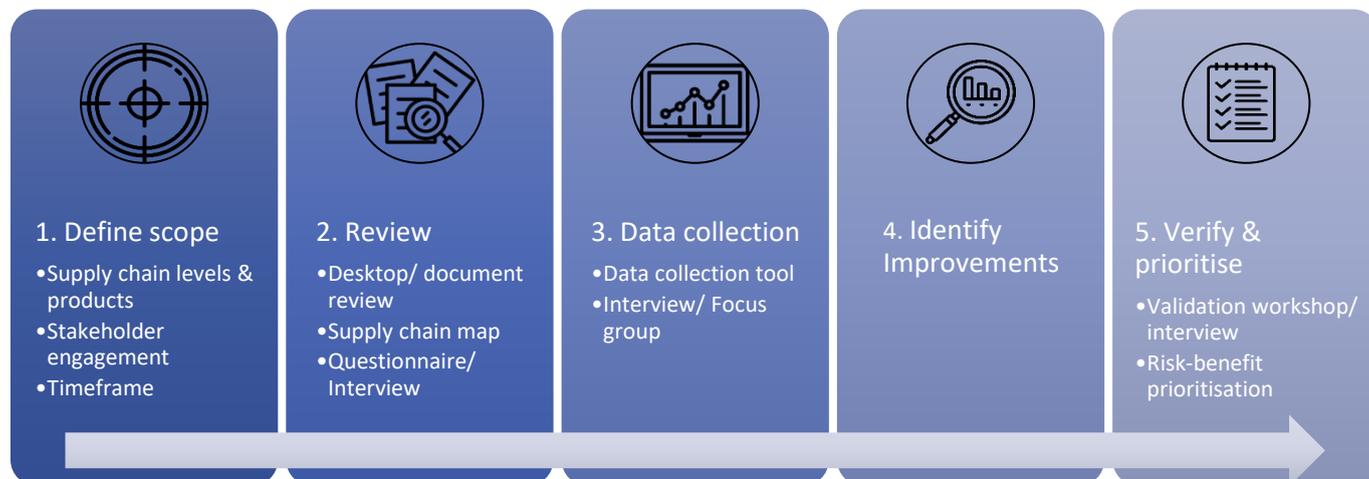


Figure 2: Framework process. Icons designed by Freepik and Smashicons on www.flaticon.com

The success of the framework relies on the involvement of stakeholders. Stakeholders are engaged and involved in the process from the first phase to the last as they are important for collecting data, identifying improvements, validating outcomes and prioritising identified opportunities. Stakeholder engagement is further discussed in Section 2.

Excel File

The framework is accompanied by an Excel file called *Integration Opportunities.xlsm*, which is used to simplify the data collection and prioritisation process. The file also contains a dashboard that displays the results of the assessment; this is further discussed in Section 3. Please note that the file does contain macros, therefore the macros need to be enabled when opening the file. When a framework step needs to be completed in the excel file, the text will appear in a grey box and the following icon will appear on the left side of the page:



Figure 3: Computer icon. Icon is designed by Prosymbols on www.flaticon.com

Outline of the Guide

The guide is organised as follows:

Section 1: Introduction – Section 1 provides background information regarding why such a framework may be needed. The definition of integration is also provided, along with the purpose of the framework and a short introduction of the framework.

Section 2: Framework – Section 2 provides the step by step process that describes how the supply chain assessment should be carried out.

Section 3: Dashboard – Section 3 provides an explanation of the Dashboard that is used to display the results of the framework.

Section 4: Conclusion – A conclusion of the framework is given.

Guide Users

This framework was designed for anyone who wishes to assess public pharmaceutical supply chains. Examples of people who may use the framework include supply chain managers, government officials/organisations, donors, etc.

Section 2: Framework

This section gives a description of each phase of the framework.

Phase 1: Define Scope

Before starting with the assessment, it is important to determine the scope of the supply chain and assessment. By defining the scope assessors will be informed of the supply chain being assessed, which stakeholders to engage with as well as the required data that needs to be collected and analysed. The scope definition constitutes four parts: supply chain levels and products, stakeholder engagement, timeframe and budget.

Supply Chain Levels and Products/Programmes

Public health supply chains typically consist of three or more levels, including national, regional, district and community levels. The number of levels are often determined by the health system structure which depends on the administrative and political structures (UNICEF, 2016). Not only do public health supply chains have different levels, they also serve various different health programmes, each of which require unique groups of pharmaceuticals (for example TB, essential medicines, vaccines, etc.). Each country defines health programmes differently, some may be integrated across products (i.e. one supply chain is used for many pharmaceuticals), whereas others tend to be more vertical (i.e. each product or group of products have their own supply chain).

A decision must be made as to which supply chain levels and which pharmaceutical products/programmes will be included in the assessment. Supply chain levels and products/programmes that will be included in the assessment should also be considered based on who is carrying out the assessment (and their authority) as well as where the intended results are required. For example, if a regional supply chain manager wishes to identify opportunities for integration in the essential medicines supply chain, then the regional level and essential medicines should be included in the assessment. A list is provided in Appendix 1 that can be used to select the supply chain level and products that will be included in the assessment.

Stakeholder Engagement

As previously mentioned, the success of the framework depends on the involvement and support of stakeholders. Stakeholders should be identified and contacted during Phase 1 of the framework since they will be involved in the assessment process from Phase 2 and onwards. Stakeholders should include but not be limited to people who have expertise in various health supply chain areas and have an impact on the assessed supply chain. Examples of stakeholders include:

- Government (e.g. Ministry of Health ministers or stakeholders from other departments such as finance, treasury, etc.)
- Private sector organisations and businesses involved in health supply chains
- Donors (e.g. WHO, USAID)
- Local government
- Public pharmaceutical supply chain stakeholders (e.g. medical stores manager, procurement unit, logistics manager)
- Committees and coordinating bodies (e.g. regional drug and therapeutics committees, formulary and treatment guideline committees, national drug committee)
- Regulatory bodies

Timeframe

Submission dates for each of the assessment activities should be decided upon in order to inform stakeholders when specific assessment tasks will take place, to ensure that the all deliverables are completed and to prevent the assessment from being extended too long. A timeframe template is provided in Appendix 2 that may be used to determine the submission dates.

Budget

The last task of the scope definition is to set up a budget in order to ensure that there is sufficient funding to carry out the assessment.

The following should be taken into consideration when setting up the budget:

- Available funds for the assessment.
- Travel costs that may be incurred to get stakeholders and assessors to the location where the assessment will be carried out (e.g. flights, transport, car hire).
- Time and costs associated with the assessor(s) taking time off work to carry out the assessment.
- Venues that may need to be hired for meetings and/or workshops.
- Materials and equipment that may be used during the assessment (e.g. projectors, printed materials, stationery).
- Refreshments during the assessment.

Phase 2: Review

The second phase of the assessment is to collect and review information about the chosen supply chain in order to gain a better understanding of the supply chain context, especially with regards to current public-private engagements. Phase 2 consists of three components, namely a document review, a supply chain map and a questionnaire or interview.

Document Review

Background documents about the relevant supply chain should be collected and reviewed. These documents may provide insight about current private engagements, problems that affect the supply chain, potential integration opportunities, gaps in information, supply chain constraints as well as the general context of the supply chain. Reviewing background documents will also help stakeholders understand the supply chain and ensure that everyone is on the same page.

The following documents should be considered for the review:

- Previous assessment reports
- Documents that relate to public-private engagements in the relevant supply chain
- Documents related to the supply chain functions
- Supply chain stakeholder and process maps

Identified documents should be collected and distributed to all stakeholders and assessors. Documents can be reviewed individually in each person's own time or in groups. It is important that a list of the documents be kept. If any information from one of the documents is used, the relevant document must be cited in case any questions are raised or information needs to be verified.

Questionnaire/Interview

In cases where information from the review is missing, insufficient or unclear, stakeholders may need to complete a questionnaire or be interviewed in order to acquire the required information. It is subject to the assessor's discretion whether enough information was acquired during the document

review. In the case where it has been decided that additional information is required, the assessor can either collect information from the stakeholders who are currently involved in the assessment process or additional stakeholders may be identified for this part of the assessment.

The following table can be used when identifying potential stakeholders to complete the questionnaire or interview:

Stakeholder Name	Organisation	Department	Information that may be provided by the stakeholder

A template for the questionnaire is provided in Appendix 3. The questionnaire may be adapted as required and the questions can serve as a guide when interviewing stakeholders.

Supply Chain Map

Once all the information has been collected, stakeholders are required to map the supply chain based on the collected information. Mapping the supply chain leads to a common understanding of the supply chain and provides a visual representation of the supply chain. Assessors should decide how much detail should be included in the supply chain map. However, a more detailed map may provide insight to current private sector engagements as well as opportunities for new engagements.

Phase 3: Data Collection

A description of the data collection methodologies are given, after which the steps to collect the data are explained.

Data Collection Methodology

There are two main methods that are used to collect the data, namely: interviews and focus groups. Either method can be used depending on how detailed the information should be and the resources that are available.

Focus Groups

Focus groups are used to get information from as many as 12 people at a time. Focus groups allow the assessor to collect information from many people at once which is useful when data collection time is limited. Focus groups are also useful to collect data by consensus, however data may not be as detailed as that collected from interviews. Participants of focus groups usually have similar characteristics, for example they may all be from one organisation or have expertise on a specific supply chain function.

Interviews

Interviews are usually conducted with one person at a time. Interviews are useful when more detailed data is required for the assessment, however it may take longer to collect enough data.

Data Collection Tool

Data is collected using the excel file (*Integration Opportunities.xlsx*) as well as paper-based data collection forms which are provided in Appendix 4. Please note that for the excel file to work, the macros need to be enabled. Each supply chain function is assessed separately in different sheets in the excel workbook. When first opening the excel file, a number of tabs will be visible at the bottom of the file. For the data collection step of the framework the following tabs will be used: *SC Function*

1 – Selection, SC Function 2 – Forecasting, SC Function 3 – Supply Planning, SC Function 4 – Procurement, SC Function 5 – Contract Management, SC Function 6 – Distribution, SC Function 7 – Use, SC Function 8 – Management Support and SC Function 9 – Information Management. When collecting data via focus groups one form can be filled in per supply chain function. If collecting data via interviews, each interviewee needs to fill in a form for each supply chain function. Before starting the data collection, forms for each of the supply chain functions should be printed and handed out.

The data collection steps are described below. Start with the first supply chain function tab, namely *SC Function 1 – Selection*.

Step 1:

Stakeholders should read the descriptions of the supply chain functions under *Section A* of the data collection forms in order to understand what each supply chain function entails.



Step 2:

Open the *SC Function 1 – Selection* tab if it is not already open. Stakeholders should read *Section A* of the sheet. Section A gives an explanation of the activities that are carried out in each supply chain function.

Step 3:

Stakeholders should fill in the tables in *Section B* of the data collection forms.



Step 4:

Under *Section B* of the excel sheet, stakeholders need to fill in the matrix based on the information collected in Section B of the data collection forms. Below is an example of the matrix:

Section B: Current Level of Integration				
Supply Chain Function Activity	No Engagement	Interaction	Dialogue	Agreement
Review prevalent health problems				
Identify treatments of choice				
Develop STGs and formularies				
Choose individual medicines & dosages				
Decide which medicines will be available at each level of the health care system				

In the matrix the current level of integration must be chosen for each supply chain function activity. This is determined by looking at the engagement types in section B of the data collection form and selecting the one that occurs most. For example, if the supply chain activity *Identify treatments of choice* has three public-private engagements at the interaction level and one at the dialogue level then the overall level of that supply chain activity is at interaction. In the matrix insert an X in the appropriate column for each supply chain function activity. Please note that only one level can be chosen per supply chain activity (i.e. one X per row). An example of a completed matrix is provided below.

Section B: Current Level of Integration				
Supply Chain Function Activity	No Engagement	Interaction	Dialogue	Agreement
Review prevalent health problems	X			
Identify treatments of choice	X			
Develop STGs and formularies				
Choose individual medicines & dosages			X	
Decide which medicines will be available at each level of the health care system		X		

Step 5:

Under *Section C* of the excel sheet is a similar matrix to the one in Section B. For this matrix, stakeholders need to identify the level of integration that they think each activity should achieve in the medium term in order to support the most optimal operational efficiency and effectiveness by filling in an X in the appropriate space.

Step 6:

Stakeholders should fill in *Section C* of the data collection form.

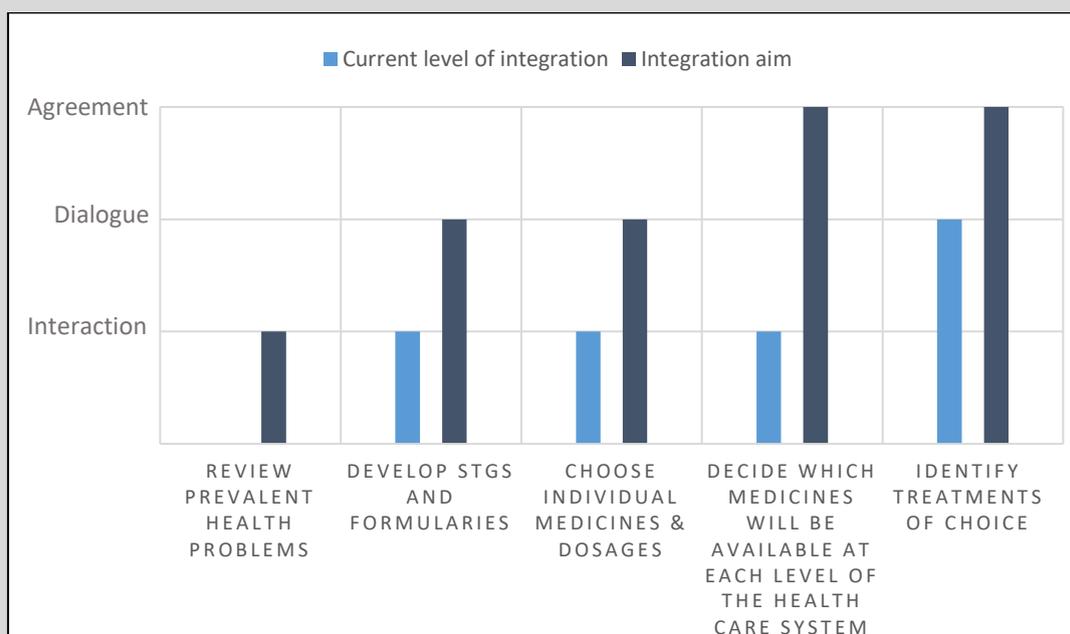
These steps are repeated for each supply chain function.

Phase 4: Identify Opportunities

Opportunities for integration are identified by comparing the current level of integration with the integration aim as determined in Sections B and C in the excel file.



The levels of integration can be compared by creating graphs of the integration levels and looking at the difference between them. These graphs are automatically created in Section D of each supply chain function's excel sheet. Below an example of the graph is shown for the selection supply chain function. In the example it is clear that the integration aim is higher than the current level of integration, therefore there is an opportunity to further integrate/engage with the private sector.



Phase 5: Verify and Prioritise

The last phase of the framework involves the validation of the data and findings of the previous phases, prioritising the identified integration opportunities according to the risks and benefits of engaging with the private sector, and lastly validating the prioritisation of the supply chain function activities by means of a validation workshop or interviews.

Data Validation Workshop/Interview

Before continuing with the prioritisation of the supply chain function activities, it is important that the data collected thus far is validated and agreed upon. The validation workshop is intended for stakeholders to:

- Review and resolve any questions, issues or disagreements that reoccurred during the assessment
- Discuss and validate the findings of the assessment
- Provide input on the findings

In some cases, specific information or findings may need to be validated; or remaining questions need to be answered. In these cases where the issue cannot be solved in the workshop, stakeholders may need to be interviewed again to resolve the issue.

Two types of stakeholders should be included in the workshop, namely: those make decisions (for example the MOH) and those who will be responsible for taking the findings further.

Risk-Benefit Prioritisation

In the last phase, supply chain activities with opportunities for integration were identified. In this phase these activities are prioritised in order to determine which supply chain activity shows the greatest potential and should be focused on first. This is achieved by examining the risks and benefits of private engagement in the particular supply chain activity.



On the *Prioritisation* sheet of the excel file, the supply chain activities that have opportunities for integration are automatically listed under their respective supply chain functions (Column A). A list of benefits and risks are provided at the top of the page. Explanations of the risks and benefits are provided in Appendix 5 which can be distributed to stakeholders to ensure that everyone understands each risk and benefit (DGDA & MIT-Z ILP, 2008; O’Hanlon & Jeffers, 2013; UN Commission, 2015).

In order to prioritise the supply chain activities, stakeholders need to rate the impact each benefit and risk will have on the engagement on a scale from 0 – 5, where 0 = no impact and 5 = very high impact. Once the risks and benefits ratings of each supply chain activity have been completed, the supply chain activities will be prioritised. Supply chain activities are prioritised by calculating the benefit-risk ratio for each activity and then ranking each activity from the highest benefit-risk ratio to the lowest. The ratios are automatically calculated and each activity is ranked in the last column of the sheet (called *Priority of functions*). Supply chain activities should be further investigated according to ascending rank. In other words, the supply chain activity with a rank of 1 has the most benefits and least risks and should therefore be pursued/focused on first. Next would be the activity with a rank of 2, and so on. At the bottom of the *Prioritisation* sheet is a results section where the total risk and benefit of each supply chain activity is plotted on a graph to allow for a visual comparison of the risks and benefits.

Prioritisation Validation

After the supply chain function activities have been prioritised, the risks and benefits of private sector engagement, as selected in the previous step, as well as the prioritisation results can be validated by

taking part in another validation workshop or interview with stakeholders. These validation workshops/interviews have the same format as the previous validation workshops/interviews.

Section 3: Dashboard

The dashboard is the landing page of the excel file. It summarises the results of the steps that are carried out in the excel file. It is divided into the following four sections which are shortly described below: level of integration, percent integrated, prioritisation and risks and benefits.

Percent Integrated

In this graph the current level of integration and the integration aim for each supply chain function is compared. The levels of integration for each supply chain function is averaged and converted to a score out of 100. This shows how integrated each supply chain function is, where 100% indicates that all supply chain activities, in the specific supply chain function, are at the agreement level and that the supply chain function is fully integrated.

Risks and Benefits

This section contains two graphs, one for the risks and one for the benefits. Each graph indicates how much a risk/benefit impacts each supply chain function, where 100 indicates a very high impact.

Prioritisation and De-integration

Under the prioritisation section the supply chain activities with opportunities for integration are listed according to their rank (i.e. from highest priority to lowest priority). The de-integration section lists the supply chain activities that should de-integrate, i.e. engagements should go from a higher integration level to a lower integration level. Although identifying supply chain de-integration possibilities is not the aim of the framework, it is included as it may be interesting to stakeholders and may prompt important discussions.

Section 4: Conclusion

The guide provided the step-by-step process that assessors need to follow in order to identify opportunities for integration with the private sector. The framework only focuses on identifying opportunities for integration in the pharmaceutical supply chain, therefore implementing public-private engagements in the identified opportunities is outside of the scope of this guide. There are many useful guides and documents that assist with determining the feasibility of public-private engagements as well as identifying potential partners for engagement and implementing public-private engagements. A list of useful documents is provided in the table below.

Author(s)	Title
South African National Treasury	PPP Manual
Tennyson	The partnering toolbook: An essential guide to cross-sector partnering
United Nations on Life-Saving Commodities	Private Sector Engagement: A Guidance Document for Public Health Supply Chains
O’Hanlon and Jeffers	Reference Guide for Development of Public Private Partnerships in the Health Sector for Countries in the SADC Region
Herzberg and Wright	Public-Private Dialogue: The PPD Handbook – A Toolkit for Business Environment Reformers
Smith, Brugha and Zwi	Working with Private Sector Providers for Better Health Care: An Introductory Guide

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Appendices

Appendix 1: List of Supply Chain Levels and Products/Programmes

The following table provides a list of supply chain levels and products that can be used during Phase 1 of the framework in order to define the scope of the supply chain being assessed.

Supply Chain Levels	
	National
	Regional
	District
	Community
Products/Programmes	
	HIV
	Malaria
	Immunisation
	Maternal & child health
	TB
	Essential medicines

Appendix 2: Timeframe Template

Below is a template that can be used to determine the start and submission dates of the assessment framework. The template can be adapted as required by the assessors.

Assessment Phase	Task	Start Date	Submission Date
Phase 2	Document Review		
	Supply Chain Map		
	Questionnaire/Interview		
Phase 3	Supply Chain Function 1		
	Supply Chain Function 2		
	Supply Chain Function 3		
	Supply Chain Function 4		
	Supply Chain Function 5		
	Supply Chain Function 6		
	Supply Chain Function 7		
	Supply Chain Function 8		
	Supply Chain Function 9		
Phase 4	Identify Opportunities		
Phase 5	Data Validation Workshop/Interview		
	Prioritisation		
	Prioritisation Validation		

Appendix 3: Review Questionnaire

The following questionnaire can be used to obtain background information from stakeholders on the supply chain that is being assessed. The questionnaire is used to collect information in cases where the information collected during the document review is missing, insufficient or unclear.

Assessing Public Pharmaceutical Supply Chains to Identify Opportunities for Integration – Review Questionnaire

Name: _____

Organisation: _____

Title/Position: _____

Your assistance is required for a supply chain assessment that is currently being carried out. The public (assessor to fill in the specific supply chain that is being assessed) supply chain is being assessed to identify opportunities for public-private engagement.

In order to assess the supply chain, information is required regarding the background of the supply chain as well as current public-private engagements. Your response will be used during the assessment of the supply chain.

1. Do you have any past supply chain assessment reports regarding the supply chain in question that you can share?

2. If your answer to the above question is no, do you know of any persons who may be able to share past supply chain assessment reports? If so, please fill in the table below.

Stakeholder Name	Organisation	Department	Information that may be provided by the stakeholder

3. Are there any current public-private engagements in the supply chain that you are aware of? If so, please fill in the table below.

Short description of the engagement	Supply chain function where the engagement occurs	Organisations that are involved in the engagement	Relationship between the public and private organisations

4. Do you have any background documents relevant to the following supply chain functions that you may share?

- Selection
- Forecasting
- Supply Planning
- Procurement
- Contract Management
- Distribution
- Use
- Management Support
- Information Management

5. Do you have any stakeholder or process maps of the supply chain in question that you can share?

Appendix 4: Data Collection Forms

The following data collection forms are used in conjunction with the excel file to collect data during the supply chain assessment. A data collection form is provided for each of the supply chain functions.

Data Collection Form: Supply Chain Function 1 - Selection

Names of participants: _____

Section A: Short description of supply chain function

A limited number of medicines are selected to improve the supply and rational use of medicines as well as to lower the costs of medicines. Medicine selection is determined by creating a list of common diseases that occur at each level of the health system. A multidisciplinary committee then determines the treatment of first choice (medicines), the formulary system and the treatment guidelines based on the list of common diseases. The supply chain is then required to supply the medicines that have been selected.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Review prevalent health problems

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Identify treatments of choice

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Develop STGs and formularies

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Choose individual medicines & dosages

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Decide which medicines will be available at each level of the health care system

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

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Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Review prevalent health problems

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Develop STGs and formularies

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Choose individual medicines & dosages

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Decide which medicines will be available at each level of the health care system

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Identify treatments of choice

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 2 - Forecasting

Names of participants: _____

Section A: Short description of supply chain function

Each year data, such as consumption data, morbidity data, services data, demographic data and current performance data, are collected and used to estimate the quantities of products that are needed to meet the population's health needs. Forecasting uses historical data and assumptions of future demand to estimate product consumption for the next year.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Organise, analyse and adjust data

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Build forecasting assumptions

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Calculate forecasted consumption for each product

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Compare and reconcile results for different forecasts

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Organise, analyse and adjust data

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Build forecasting assumptions

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Calculate forecasted consumption for each product

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Compare and reconcile results for different forecasts

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 3 – Supply Planning

Names of participants: _____

Section A: Short description of supply chain function

Supply planning involves estimating the total cost and product requirements by using the forecasts from the previous supply chain function to ensure supply chains will have sufficient stock and optimal delivery schedules. Factors such as stock levels, lead times, consumption data and desired delivery dates are taken into account.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Organise, analyse and adjust data

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Build supply planning assumptions

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Estimate total commodity requirements

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Develop supply plan

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Compare costs to available funding

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Organise, analyse and adjust data

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Build supply planning assumptions

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Estimate total commodity requirements

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Develop supply plan

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Compare costs to available funding

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 4 - Procurement

Names of participants: _____

Section A: Short description of supply chain function

Procurement involves the process of purchasing medicines from international and national private suppliers as well as public suppliers. Purchases are made through global agencies, regional procurement systems or international procurement agents.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Select procurement methods

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Assure pharmaceutical quality

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Select procurement methods

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Assure pharmaceutical quality

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 5 – Contract Management

Names of participants: _____

Section A: Short description of supply chain function

Contract management is the process of effectively managing the development, execution and assessment of contracts so that financial and operational performance is maximised and risk is minimised.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Needs clarification

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Tender preparation

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Tender publication

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Bids evaluation

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Contract award

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Changes in contract

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Service delivery management

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Relationship management

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Contract administration

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Risk assessment

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Purchasing organisation's performance & effectiveness review

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Contract closure

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Needs clarification

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Tender preparation

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Tender publication

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Bids evaluation

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Contract award

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Changes in contract

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Service delivery management

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Relationship management

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Contract administration

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Risk assessment

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Purchasing organisation's performance and effectiveness review

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Contract closure

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 6 - Distribution

Names of participants: _____

Section A: Short description of supply chain function

The main goal of the distribution system is to maintain a continuous supply of medicines to health facilities and to ensure that resources are used effectively. This is achieved through the inspection, control, storage, delivery and dispensing of stock.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Stock control

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Stores management

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Deliver to drug depots & health facilities

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Stock control

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Stores management

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Deliver to drug depots & health facilities

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 7 - Use

Names of participants: _____

Section A: Short description of supply chain function

The rational use of medicines require that patients receive medications appropriate to their clinical needs, in doses that meet their individual requirements, for an adequate period of time, and at the lowest cost to them and their community (Management Sciences for Health, 2012).

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Diagnose

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Prescribe

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Dispense

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Use by patient

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Diagnose

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Prescribe

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Dispense

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Use by patient

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 8 – Management Support

Names of participants: _____

Section A: Short description of supply chain function

The management support systems hold the pharmaceutical management framework together. These systems consist of organisation, financing and sustainability, and human resource management.

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Organisation of system

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Finance & sustainability

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Human resource management

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Organisation of system

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Finance & sustainability

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Human resource management

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Data Collection Form: Supply Chain Function 9 – Information Management

Names of participants: _____

Section A: Short description of supply chain function

Information management involves monitoring and evaluating performance targets as well as the progress of achieving objectives. Monitoring systems focus on inputs and short-term outputs and should be an integral part of day-to-day management. Evaluation is commonly discussed along with monitoring as part of an overall strategy. It refers to the periodic analysis of a program's progress toward meeting established objectives and goals. Information management requires the use of pharmaceutical management information systems which are organized systems for collecting, processing, reporting, and using information for decision making (Management Sciences for Health, 2012).

Section B: Current supply chain integration

Please identify any public-private engagements in the following supply chain function activities and fill in the tables below.

Supply Chain Activity: Data selection

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Data collection

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

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Supply Chain Activity: Data visibility

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Digital LMIS

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Data use

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Supply Chain Activity: Data quality

Short description of engagement	Organisations involved	Describe relationship between organisations	Citation (if applicable)	Type of engagement

Section C: Supply chain integration aim

Please provide the required information regarding why specific engagement levels were chosen in Section C of the excel file in the tables below.

Supply Chain Activity: Data selection

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Data collection

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Data visibility

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Digital LMIS

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Data use

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Supply Chain Activity: Data quality

What integration level have you chosen?	Why have you chosen that level?	How will this benefit the health system/supply chain/public sector?

Appendix 5: Explanations of Risks and Benefits

Explanations of the risks and benefits of public-private engagements are provided below.

Benefits of public-private engagements

Close the resource gap: Partnerships attract private capital which can be used to fund services and procure assets or to supplement the public sector's resources or by freeing up resources that can be used elsewhere.

Improve access and inefficiencies: Partnerships can improve access to health services and products by providing health services and products at affordable costs. Partnerships can also improve efficiencies by rationalising the use of existing resources, such as staff and infrastructure, across the public and private sector. Private sector engagements can also improve supply chain operational efficiencies, for example economies of scale can be leveraged to improve access to pharmaceuticals.

Innovation: The private sector is more equipped to invest in innovative methods and technologies than the public sector, therefore engaging with the private sector could lead to the adoption of innovative technology, management approaches and health operations. In addition, innovative approaches, solutions and ideas will be generated when staff from different sectors and disciplines work together. The private sector also benefits by introducing new markets, having access to investment opportunities and generating goodwill.

Expand and retain human resource capacity: One of the biggest challenges in Sub-Saharan Africa is the incidence of "brain drain". By encouraging the growth of the private sector human resources can be retained since it boosts business opportunities within the country. The private sector can also provide access to new technologies which expands career opportunities in the health sector.

Build capacity: The private sector can increase the public sector's coverage and increase capacity by engaging with private providers which will increase the number of service delivery points as well as the number of skilled human resources. The private sector has the skills and expertise to overcome supply chain challenges. Their skills and expertise can help build the public sector's capacity, thereby allowing the public sector to better manage its own supply chain. For example, public organisations have used private sector training programmes to train staff; the public sector has also engaged with the private sector to assist with the optimisation of supply chains. Private sector engagement can not only increase the public sector's coverage, but also the coverage of the private sector.

Shared risk: There is a lot of risks involved when the public and private sectors engage, including financial, security, political, human resources and infrastructure risks. Effective engagements share risks between the public and private sector which means that each sector accepts a share of the engagement risks for which they are best suited. By sharing risks both sectors are more willing to engage.

Risks of public sector engaging with the private sector

Conflict of interest: The private sector usually measures its performance with performance metrics such as return on investment and profit. Conversely, the public sector's main concern is not about how much profit it makes but rather ensuring the availability, affordability, accessibility and acceptability of medicines. This difference results in a misalignment of the two sector's motivations and raises concerns regarding the sharing of information which could be exploited. The public sector has to address a number of concerns such as conflicts of interest, competition and the fear that projects might not be completed within budget and time constraints due to a lack of transparency during the bidding process.

Limited capacity to engage with the private sector: The public sector usually has limited experience regarding contract management. Inexperience in contract management could result in badly written contracts which could place the public sector in a vulnerable position and limits the public sector's capacity to manage, develop, enforce and monitor contracts. These factors increase the possibility of corruption and conflict of interests.

Regulatory issues: Often regulatory bodies are responsible for defining contracts between the public and private sectors, which means the public sector can be restricted by the contract structure. The private sector mostly only invests in new engagements when the contract length is long enough to spread their risks over time in addition to providing enough benefit. If the public sector sets unrealistic terms, KPIs or lengths for contracts, it could drive up costs and cause the engagement to seem unattractive to the private sector.

Sharing information: The public and private sectors receive consumption data from different sources. In the pharmaceutical industry, the private sector receives data from retail outlets, distributors and health providers, whereas the public sector uses consumption data that is usually manually collected at health facilities.

External constraints: Public-private engagement opportunities will be influenced by external constraints such as: (i) the economic and political climate; (ii) hidden complexities of donor structures in projects and national agencies; and (iii) the likelihood that the development and management of public-private engagements will be more expensive than internal government processes.

Risks of private sector engaging with the public sector

Lack of control: During a public-private engagement the contractual requirements may stipulate the timing of processes as well as how resources should be allocated and used. Requirements can be influenced by the political climate and may increase the time and costs of the project since the private sector has to compensate for having limited control over the resources required to complete expected activities.

Delayed decision making by public sector: In the public sector the decision-making process is often drawn out as a result of the government's structure or the contractual processes that need to be followed. This increases the private sector's costs and is often not taken into consideration by the public sector during initial engagement cost evaluations.

Contracting challenges: Not all governments have transparent and standardised tendering processes, which could lead to corruption and extended contract negotiations. In addition, governments often want to enter short-term contracts which is too short for the private sector to make a return on their investment. Furthermore, government contracts may request the private sector to take responsibility for the risk rather than sharing the risk.

Payment terms: In order for the private sector to continue its support during the engagement, payments must be made on-time. However, budgetary challenges and governmental processes often delay payments to the private sector. Therefore, payment terms should be addressed early on to prevent the engagement from failing.

Sharing information: Often frameworks and standards are not timeously shared with the private sector. In addition, the private sector may not fully understand how the public sector operates or the responsibilities concerning affordability and universal health coverage. Also, data compilation is not centralised which means that each sector is unaware of what has been contributed.

Appendix F

Excel File

The following link contains the Excel[®] file:

<https://www.dropbox.com/sh/3c3qn9bpdzi2a45/AABW3vdoPDt8E0ZKOBKoa2Iea?dl=0>

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