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THE DEVELOPMENT OF A FRAMEWORK FOR IMPROVEMENT OF INTENSIVE CARE DELIVERY: A SYSTEMIC INTERVENTION

Juanett Scribante

A thesis submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in fulfilment of the requirements for the degree of Doctor of Philosophy.

September 2018

Declaration

I declare that this thesis is my own, unaided work. It is submitted in fulfilment of the requirements of the degree of Doctor of Philosophy in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other university.

_____

Juanett Scribante

September 2018

This research is dedicated to my fathers:

Dave Francis

Pieter Scribante

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There is an African proverb that states that it takes a village to raise a child. A thesis is like a child – I am indebted to and deeply grateful to those who have helped me raise this child. A sincere thank you to:

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Preface

Health care delivery, and more specifically intensive care delivery, in South Africa is challenged by various limitations due to multiple factors, both historic and current. It was known that there were problems with intensive care delivery, but the extent of the problem was not known. In view of this, I, with a small team of researchers, was asked in 2005 to undertake a national audit of critical care resources, an extensive research project on behalf of the Critical Care Society of Southern Africa. The aim was to objectively quantify existing resources in the public and private intensive care units in South Africa.

All the public and private intensive care units in South Africa were included in the research project. The results not only quantified the shortage of intensive care resources, especially human resources, but also the disparity of the distribution of these resources. The disparity occurred at various levels, such as between the public and private sector, the different provinces, adult and paediatric patients and the transfer of patients to intensive care units. The results from this research culminated in six publications (Bhagwanjee & Scribante, 2007, 2008; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d) as well as various international and national presentations.

Although the results of the research yielded important information, the understanding of how intensive care is delivered in South Africa remained limited. It became clear during the data collection period that the delivery of intensive care is more complex than just quantifying resources and that traditional approaches to the improvement of intensive care delivery had limited impact. Further, the extensive communication of the results (publications and presentations) was received with great interest by the intensive care and health care community, but resulted in very limited action for improvement of intensive care delivery. This prompted me to undertake this research to obtain a more comprehensive understanding of intensive care delivery and to develop a framework for the improvement of intensive care delivery.

Abstract

Intensive care is a small but complex system; context-specific and continually confronted by dynamic changes and challenges in the environment. Initiatives following the traditional reductionist approach to improve the delivery of intensive care has had limited success. The aim of this research was to develop a systemic framework for the improvement of intensive care delivery.

The factors affecting the delivery of intensive care – in South Africa and internationally – were elucidated by a comprehensive review and analysis of intensive care literature. A further understanding of intensive care delivery in South Africa was obtained by "making sense of the mess" using a systems approach. Systemic intervention served as the meta-methodology and methods and techniques from interactive planning, critical systems heuristics, soft systems methodology and the viable system model were employed. Making sense of the mess emphasised the complexity of intensive care delivery, on both a situational and a cognitive level. It became clear that a single methodology would not suffice, but that a pluralist methodology was required to guide improvement in intensive care delivery.

Based on this understanding, nine principles were formulated to guide the development of a framework for the improvement of intensive care delivery. Systemic intervention was used as the meta-methodology. Interactive planning was identified as the key methodology, incorporating methods and techniques from critical systems heuristics, soft system methodology and the viable system model to build a systemic framework for the improvement of intensive care delivery.

Embedded in the proposed framework are matters relating to systemicity, complexity, flexibility, empowerment, and transformation of intensive care delivery. The proposed framework allows for multiple-perspectives, including that of marginalised stakeholders, the mitigation of multi-vested interests and power relationships. It is both flexible and adaptable to promote learning about the complex problems of intensive care delivery and it accommodates the strengths of various relevant approaches to complex problem solving. The proposed framework aims to facilitate sustainable improvement of intensive care delivery and to ensure the "just-use" of resources to foster distributive justice. It acknowledges the trajectory of intensive care delivery – the patient comes from the community and returns to the community and intensive care delivery functions on a continuum that ranges from basic to highly sophisticated.

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List of abbreviations

CAS	Complex adaptive system
CCSSA	Critical Care Society of Southern Africa
CEO	Chief executive officer
CSH	Critical systems heuristics
ECMO	Extracorporeal membrane oxygenation
GDP	Gross Domestic Product
ICU	Intensive Care Unit
MEC	Member of the Executive Council
NHI	National Health Insurance
PISA	Prevalence of Infection in South Africa
SANC	South African Nursing Council
SSM	Soft systems methodology
VSM	Viable systems model
WHO	World Health Organisation

Chapter 1: Overview of the study

1.1 Background to the problem

A national health system encompasses various subsystems of which intensive care is one such subsystem. Intensive care is a small but complex system; context-specific and is continuously confronted by dynamic changes and challenges in the environment. It is also one of the most expensive subsystems of a national health system.

Intensive care is a multidisciplinary health care speciality that cares for patients with an acute, life-threatening illness or injury in a separate area of the hospital (SCCM, 2009).

The development of intensive care, internationally and nationally, has been fragmented and reactionary to social circumstances. The development and current functioning are further complicated by the prevailing influence of the Newtonian approach of reductionism in intensive care. The background to the problem will be illustrated by a brief discussion of the development of intensive care – illustrating this fragmented development. This will be followed by a brief discussion of intensive care functioning as Newtonian machines and the limitations of this approach.

1.1.1 International and national development of intensive care

The first person who implemented the concept of intensive care was Florence Nightingale (1820 - 1910), during the Crimean war (1853 - 1856). She placed the sickest and worst-injured soldiers in an area closest to the nurses' station where she could keep a constant eye on their condition and intervene immediately when needed (Grenvik & Pinsky, 2009; SCCM, 2009). Florence Nightingale is widely regarded as the founder of modern nursing and the first nursing theorist as well as a systems thinker. Of note is her holistic approach or systems approach, for example, she believed that people were multi-dimensional, composed of biological, psychological, social and spiritual components. Furthermore, she advocated that patients should be put in the best condition for nature to act upon

them; that there should be an empowering partnership with clients in the community – “we must not talk to them or at them but with them” (McDonald, 2006, p. 607). She also acknowledged that there could be powerful unintended consequences from the best intentions (McDonald, 2003; Selanders, 2010). Although Florence Nightingale laid the groundwork with her systemic approach for intensive care to develop in a holistic manner, unfortunately, due to various earlier societal influences, the development of intensive care followed a more fragmented path.

The next documented development took place only in 1929 when Doctor Walter Dandy (1886 - 1946) established a special postoperative unit for neurosurgical patients at the Johns Hopkins Hospital in 1929 (Grenvik & Pinsky, 2009; SCCM, 2009).

In 1930, Doctor Martin Kirschner (1879 - 1942), of the University of Tübingen’s Surgical Hospital in Germany, identified the need for a special department where critically ill and post-operative patients could be cared for. Kirschner believed that care would be improved if the most experienced nurses worked in these departments. Furthermore, an experienced physician had to be responsible for the coordination of patient care (Adler & Shoemaker, 1979). These beliefs survived the test of time and are the concepts on which modern intensive care units (ICUs) should ideally be organised.

“Shock wards” were established during World War II to care for soldiers injured in battle or undergoing surgery (SCCM, 2009). During the 1950s, there was a worldwide poliomyelitis epidemic and this resulted in a breakthrough in the treatment of patients dying from respiratory paralysis. In Denmark, ventilation was accomplished through a tracheotomy and manual bag-ventilation by medical students. This approach resulted in a drop in mortality and the establishment of respiratory ICUs (Grenvik & Pinsky, 2009; SCCM, 2009).

Another development during the 1950s was cardiac surgery. Word of this new service spread rapidly. Patients with congenital and acquired heart defects flocked to medical centres that could provide these surgical interventions. Establishing a core of full-time nurses with special training became mandatory.

From the beginning, it was recognised that the patients' prognosis correlated with nurses' skills and experience. The attempt to establish a core of full-time nurses dedicated to working in intensive care resulted in bitter political battles (Adler & Shoemaker, 1979).

The early 1960s in South Africa saw the beginning of a variety of single-function ICUs for the post-operative ventilation of cardiothoracic patients, the ventilation of patients with respiratory problems in pulmonary units in Cape Town and a neonatal tetanus unit in King Edward VIII Hospital in Durban. The first multidisciplinary unit was established at the Addington Hospital in Durban in October 1970. Dr Neil Goodwin (born 1936) from Sweden was appointed as the first full-time intensivist on the African continent to manage this unit (CCSSA, 2009).

The South African Association of Anaesthetists approached the South African Nursing Council (SANC) in 1962 to consider the establishment of a post-registration course in intensive care nursing. The motivation for such a course was the international effort to improve post-operative nursing and casualty services. A further motivation was the sentiment that leading academic hospitals should create resuscitation units where medical and surgical patients with respiratory problems could be cared for (Fölscher, 1983; Parbhoo, 1993). In 1964, the SANC granted permission for the post-basic-diploma course in intensive care nursing. The first course was offered at the Johannesburg Hospital in 1966 (Ashton, 1983; Schreiber & Gillwald, 1990).

The development of dedicated ICUs continued to gather pace in South Africa and the need arose to organise this young discipline. In February 1978, a group of doctors held a meeting at the Baragwanath Hospital in Soweto at which the constitution for the Critical Care Society of Southern Africa (CCSSA) was officially accepted. The society was initially not recognised by the Medical Association of South Africa because it had opened its membership to nurses, it was multiracial and it represented Southern Africa and not just South Africa (CCSSA, 2009). Today the CCSSA is one of the largest medical societies in South Africa and offers a multidisciplinary home to doctors, nurses and other members of the intensive care team. Despite the official organisation of the CCSSA, disparity

amongst stakeholders such as doctors, nurses, health insurance companies (will be referred to as funders) and policy-makers prevail at ground level and there is limited interaction with ICUs from Southern African countries.

Historically and currently, doctors working in intensive care in South Africa have varied professional backgrounds. These backgrounds range from medical officers, specialists from disciplines such as, but not limited to, medicine, surgery, obstetrics and gynaecology, emergency medicine and lastly, doctors with a subspecialist training in intensive care. It is important to note that the medical officers and non-intensive-care specialists have varying, and usually limited, education and training in intensive care. The only doctors with a comprehensive intensive care training in South Africa are intensivists. An intensivist is:

- a specialist doctor who had successfully completed a two-year training and education program in intensive care,
- passed a South African College of Medicine exam, and
- is registered with the Health Professions Council of South Africa in the subspeciality of intensive care.

The first official subspeciality exam was introduced as late in South Africa as 2002. The ideal is that the majority of doctors working in intensive care should be intensivists (Leapfrog Group, 2016), however, the opposite is true.

A more detailed discussion of the current South African intensive care system follows in section 2.8.

1.1.2 Health sub-systems such as intensive care functioning as Newtonian machines

As mentioned in section 1.1, a health sub-system such as intensive care is complex and context-specific and is continuously confronted to contend with dynamic changes and challenges. Health systems have traditionally been viewed as machines, with discrete inputs and outputs that operate with linear relationships between actions and results, in accordance with Newton’s laws of

cause and effect. This concept is known as Newtonian machines. This reductionist approach has resulted in the managerial focus of getting the pieces to fit together, predicting future outcomes of managerial actions and controlling behaviours of employees to perform as cogs in machines. However, it has become increasingly evident that health systems do not fit these mechanistic expectations and that they are much "messier" and more complex (Sibthorpe, Glasgow, & Duncan, 2004). For Begun, Zimmerman, and Dooley (2003), treating health systems as machines has not led to effective research and practice and they conclude that health systems "… continue to defy control – it is a 'machine' that appears to have a mind of its own." (p 254) This sentiment is echoed by Waldman (2007) who is of the opinion that "many of the endemic problems in Western health systems can be linked to the fact that they are *thinking systems acting on thinking systems*, while each is viewed and managed as a machine." (p 276)

For Cortese and Smoldt (2006), by not acknowledging the complexity of health systems, the health system in the United States of America are: "a myriad of health professionals and organisations provide health care, but no vision has ever been articulated for these disparate parts to function together and learn from each other" (p 492). They see health care as ailing, suffering from a devastating disease that needs a similar holistic approach that health professionals use to treat their patients' complex problems.

Health systems are arguably the most complex systems to manage. Golden and Martin (2004) see health leaders as "systems architects" who must look beyond the best structures and best incentive schemes to solve systems shortcomings. They must be effective "systems architects" that will recognise components of the health system as building blocks that are effective only to the extent that they are mutually reinforcing.

The World Health Organisation's (WHO) Health System Framework (WHO, 2007) identifies six key building blocks (service delivery, healthcare workforce, information, medical products and technology, leadership and governance, financing), necessary to ensure an effective health system. It is important to note that this framework follows a one-dimensional, linear approach, similar to what is

used to control Newtonian machines, and does not address the complex interrelationships and conflicting interplay of value systems between the different component parts of the overall system. In the WHO flagship report: Systems Thinking for Health Systems Strengthening (De Savigny & Adam, 2009) the value of the six building blocks to promote a common understanding of what a health system constitute is acknowledged, however, the report calls for a more comprehensive understanding of the complexity of health systems .

It is attractive and tempting not to acknowledge the complexity of health systems, but rather to identify one aspect of intensive care in isolation, for example the intensive care workforce, and attempt to “rectify” this subsystem. Such an approach is doomed to fail, as these subsystems do not function in isolation or as silos: everything is dependent on everything else and everything influences and impacts on everything else.

Scientific silos or compartmentalised knowledge, the result of a reductionist approach, has the potential to impede the understanding of the complex interrelationships among components of the intensive care system (Leischow et al., 2008). It might not be achievable or feasible to abolish these silos but there is a growing acknowledgment that they should be linked and recognised as representing components of a larger system. It is not possible to use knowledge of the individual elements of a system in isolation to predict the behaviour of a system as a whole. Previous attempts to address isolated aspects have failed and had the potential to jeopardise the overall intensive care system integrity (Gatrell, 2005; Grol, 2001; Plochg & Klazinga, 2002). Jackson (2001) argues that holism has proved a useful antidote to reductionism when tackling real-world problems.

Sturmberg, O'Halloran, and Martin (2012) draw attention to a real-world problem, the general agreement over the need for an accessible and well-functioning health system. However, there is no agreement between those responsible for its structure and funding, providing and receiving health care on how this should be accomplished. For the authors, the differences are most prominent in the ongoing health-reform discourse “… as the way one *talks* about health care *is* the way and *shapes* the way one *thinks* about health care” (p 202).

The understanding and acknowledgement of complexity in health systems is occurring at a slow pace. A probable explanation is given by Begun et al. (2003) "… it exists among traditional disciplines and not within. Academics accustomed to functioning with bounded theories within bounded disciplines resist embracing new cross-disciplinary perspectives, as has been the case throughout history." (p 260) It is therefore important that problems in intensive care should be identified and addressed from a holistic systems approach and the extent of the problems requires an unconventional and creative approach (Grol, 2001).

The problems associated with the traditional reductionist approach do not only occur at the level of the health system or intensive care system but also at the level of stakeholders who influence health systems at governing and policy level. According to the World Bank (2012), South Africa is one of the most disparate societies in the world. The degree of economic inequalities is tallied with substantial developmental challenges such as health inequalities. *The National Development Plan: Vision for 2030* (National Planning Commission, 2011) was launched to offer guidance to improve the situation. De Jager, Hofman, Khan, Volmink, and Jina (2012) highlight that one of the most significant oversights of the *National Development Plan* is the lack of integration among the chapters. According to the authors: "The Plan follows the organisational trend of vertical and compartmentalised government services with the health and other chapters being presented in 'silos'." (p 828) One of the predominant aims of the *National Development Plan* is to deliver a comprehensive, cross-departmental, inter-sectorial approach. Therefore, it needs to create a well-integrated plan with a shared theme to direct forthcoming departmental strategies.

Health care delivery plays an important to role in a society's well-being. Therefore, health care delivery is meant to serve society and insufficient delivery of health care services such as intensive care could contribute to societal problems.

The reductionist perspective of health systems will be further discussed in section 2.3.2.

1.2 Aim of the research

The aim of this research is to develop a systemic framework for the improvement of intensive care delivery. The context of this research will be South African, but because the framework will be generic in nature, it may also guide the improvement of intensive care delivery in other high-, middle- and low-income countries.

The national audit of critical care resources (Bhagwanjee & Scribante, 2007, 2008; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d) identified various shortcomings of intensive care delivery in South Africa, as highlighted in the Preface, and identified the need for the development of a framework for improving intensive care services in South Africa.

From the results of this audit, it became clear that a more holistic approach, such as systems thinking, should play a key guiding role in the development of the framework.

The aim of this research will be pursued through the following objectives:

- an investigation of the factors affecting the delivery of intensive care, both in South Africa and internationally. Included in this investigation will be the systemic synthesis of these factors and a critique of current approaches;
- an investigation and analysis of suitable methodologies and techniques from the field of systems thinking that can be applied to the understanding of intensive care delivery and that may contribute to the improvement of current intensive care delivery;
- the provision of an appropriate philosophical/theoretical justification for such a pluralist (mixing of suitable methods and techniques) approach to problem solving, especially within the systems-thinking context; and
- the development of a theoretical framework that will inform the improvement of intensive care delivery.

1.3 Assumptions, scope and delimitation of the research

Intensive care and c*ritical care* are two concepts that are internationally and nationally used interchangeably. However, it is important to note that *critical* in the intensive care context implies acute, life-threatening, or serious. In systems thinking, and especially in critical systems thinking, *critical* denotes critical reflection. Critical reflection, according to Simon (2009), entails: “to reflect upon relationships between different organizational and societal interests and the dominance of different systems theories and methodologies.” (p 3) Therefore, to avoid confusion, the concept *intensive care,* rather than c*ritical care,* will be used in this thesis.

In the literature, the terms of developed and developing countries, high-, middle- and low-income countries and resource-rich and -poor countries are used interchangeably. In this thesis the terms, high-, middle- and low-income countries as classified by the World Bank (2017a) will be used.

Health systems and *health care systems* are two further concepts that are used interchangeably in the literature. The review of the literature does not afford a distinct description of the emergence of the concepts of the *health system* and *health care system*. These two concepts are used in a confusing and fragmented way, resulting in different interpretations by stakeholders (Sambo, 2009). In this thesis the concept health systems will be used. This concept is further discussed in section 2.1.

This research comprises an understanding of the current intensive care delivery in South Africa. It concentrates furthermore on the relevant issues pertaining to the improvement of intensive care delivery. The research focuses only on the most appropriate systems methodology approaches for the improvement task.

The planning, design, deployment and commissioning of intensive care delivery is a process that depends on many stakeholders. Stakeholders include, but are not limited to, various government departments, health systems, education departments, private health care providers, funders and patients. It is not practical to engage in a comprehensive research project that will study the improvement

of intensive care delivery from conception through to evaluation. The process from the inception of a project to the commissioning of the recommended intensive care delivery will take several years. To monitor and evaluate the impact of the improvement will take an additional number of years. The scope of this thesis is to gain an understanding of the current intensive care delivery and to develop a framework for improvement. However, this research is by nature not observational but, in itself a systemic intervention that will facilitate change. This change will be on at least one level, as it will change the minds of key stakeholders taking part in the research.

Neither will it be feasible to engage in a comprehensive practical trial or evaluation of the entire framework developed in this thesis, i.e. going through the tasks of conception through to commissioning. This would be impossible given the time and financial constraints of such a study.

Although this research addresses the intensive care system, the discussion that follows in section 2.1 focuses on the discussion of health systems. The reason being that there is a paucity of literature discussing intensive care as a system. Intensive care is furthermore a subsystem of a health system and the same discussion will speak to intensive care and will offer a validation of the framework.

1.4 Research methodology

According to Checkland (1985), “Any approach to rational intervention in human affairs has to accept that, in studying purposive human action and in trying to bring about change in human situations, it is not simply a matter of setting to discover ‘laws’ governing the phenomena in question. Autonomous human beings could, in principle, deliberately act in a way which could either confirm or refute any supposed ‘laws’ of human affairs.” (p 757) Therefore, an intervention in human actions necessitates continual interaction between theory and practice in a process of enquiry. Research contains the elements illustrated in Figure 1-1.

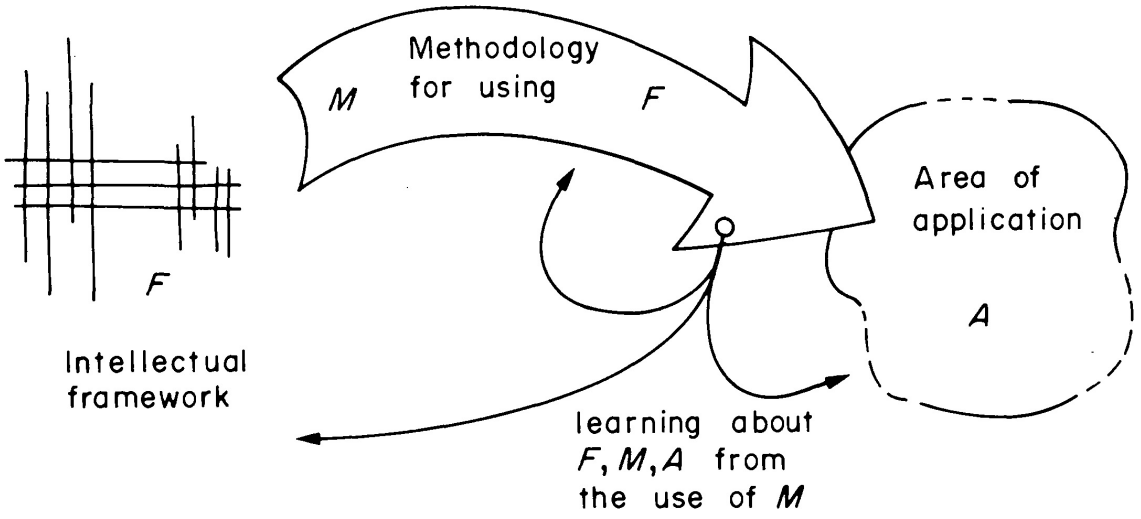


Figure 1-1 Elements contained in research (Checkland, 1985)

There must be a framework of ideas (F) in which knowledge concerning the area of research is articulated. This framework of ideas is embodied in a methodology (M) that encourages the use of various research methods and techniques that are appropriate to the framework of ideas for investigating the area of concern (A) (Checkland, 1985). Creswell (2009) states that the practice of research must combine philosophical and research assumptions and must be implemented using specific methods. The author emphasises that the purpose or aim of the research is the central intent of the study and from it, all other aspects of the research will follow.

The aim of this research is to develop a systemic framework for the improvement of intensive care delivery. Although the keywords include improvement and intensive care delivery, this research will not be confined to the traditional intensive care delivery improvement methods that are based on a positivistic experimental ideal of research. It became clear that the research methodological approach had to be diverse and had to cut across various disciplines.

Gibbons et al. (1994) distinguish between two different modes of research, namely Mode 1 and Mode 2 research. Mode 1 refers to traditional positivist hypothesis-testing research where the research bias is towards the researcher's framework of ideas. Mode 2 research is governed by the area of concern rather than the researcher's framework of ideas.

As Mode 2 research is organised around a particular area of concern, it is also generated in negotiation with those who will find the outcomes useful. This research addresses a real-world situation and it is unlikely that one discipline will provide an appropriate framework of ideas. Mode 2 is therefore transdisciplinary and more attention is given to methodology. This research should be more flexible in order to respond to the changing and transient nature of the problem it addresses. Since Mode 2 research addresses real-world problems, the researcher is more accountable to the public, therefore the quality of the research is judged on a wider set of criteria than just the contribution to the development of a specific discipline (Gibbons et al., 1994).

Etzkowitz and Leydesdorff (2000) draw attention to the fact that Mode 2 was actually the original format of science before the academic institutionalisation of science in the 19th century. The authors suggest that, "Mode 2 represents the material base of science; how it actually operates. Mode 1 is a construct, built upon that base in order to justify autonomy of science, especially in an earlier era when it was still a fragile institution and needed all the help it could get." (p 116)

It is important that Mode 2 research should not be seen as a replacement of Mode 1 and that these two modes should be in co-existence, "not only should theory inform practice, practice should [also] inform theory" (Worrall, Lubbe, & Klopper, 2007, p. 310). Mode 2 research is an example of the social distribution of knowledge (Nowotny, Scott, & Gibbons, 2003), and is therefore "pluralist" rather than "elitist" (Tranfield & Starkey, 1998, p. 352). Burgoyne in (Tranfield & Starkey, 1998) cautions against adopting just the Mode 1 research approach in knowledge production as this may result in academic fundamentalism (only working in one paradigm).

In *Re-Thinking Science*, a follow-up publication to "'Mode 2' Revisited: New Production of Knowledge", Nowotny, Scott, and Gibbons (2001) present a description of the dynamic relationship between society and science. According to the authors, there is an emergence of more open systems of knowledge production in a society (Mode-2 science) where there is increasingly more complexity and uncertainty. This complex, uncertain society can also be referred to as a Mode-2 society. These two phenomena are linked in a co-evolutionary

process where not only science speaks to society, but society also speaks to science. This reversed communication process is altering science, and contextualisation becomes key where science moves beyond the production of reliable knowledge to more socially robust knowledge. The result is that problem formulation and negotiation of solutions move from traditional domains of government, industry and universities into the *agora. Agora* is the public space where science speaks to society and society speaks to science. Of note is that in the *agora* the traditional role of expertise changes. Questions posed to experts are not equivalent to questions that occur from their specialist fields and experts have to use their knowledge more creatively. According to the authors, narratives of expertise are constructed with complexity and uncertainty. These narratives of expertise are "interrelated and will be brought together, often in conflictual and controversial forms in the *agora*".

The area of concern in this research is the understanding and improvement of intensive care delivery to the advantage of all stakeholders concerned. This research ultimately leads to the position that the understanding and improvement of intensive care delivery should be of a sociotechnical nature that should take place in the *agora.* The framework of improvement is not restricted to a particular paradigm, and the research approach to the development of the framework will be a qualitative approach.

The qualitative approach may be guided by positivist, interpretivist or critical epistemology (Neuman, 2006). The positivist approach – the research approach that is commonly followed in medicine – has two central requirements: objectivity and experimental control, which are not suited to researching the area of concern in the *agora*. A deeper understanding of intensive care delivery is required, a qualitative, interpretivist approach alone was inadequate to address the problem holistically. A meta research approach, systemic intervention approach, as developed by Midgley (2000), was followed in this research as the focus was on the understanding and improvement of the delivery of intensive care. Critical systems thinking is the underlying philosophy assumptions.

- Critique of boundaries and values. This entail reflecting and making choices between boundaries – identifying what issues ought to be

included, excluded or marginalised in analysis and who should be involved. The values adopted in any intervention will influence the boundary choices.

- Theoretical and methodologically pluralism – the creatively choosing and synthesising of appropriate theories methodologies and methods.

- Purposeful action – a systemic intervention should be about action for improvement (Midgley, 2008).

The research process was as follows. Factors affecting the delivery of intensive care in South Africa and internationally were elucidated by a comprehensive review and analysis of the intensive care literature. Systems thinking as an alternative for the improvement of complex intensive care problems was explored. Thereafter, making sense of intensive care delivery was done in two phases. In the first phase, the "mess"[1] was formulated with the use of rich pictures. In the second phase, based on the data generated from rich pictures in phase one, a diagnosis of viability of intensive care system was made using the viable system model (VSM). This was followed by deriving principles guiding the proposed framework for improvement. Lastly, based on all the findings a proposed framework for improvement was developed.

1.5 Ethical considerations

Approval was obtained from the Graduate Studies Committee of the University of the Witwatersrand Graduate School of Governance (formerly known as the School of Public Development and Management (Appendix 1).

Provisional approval (Appendix 2) to conduct the study was obtained from the Human Research Ethics Committee (Medical), University of the Witwatersrand, to conduct an initial interactive workshop that informed the research process.

[1] Making sense or formulating the mess is the first phase of Ackhoff's Interactive Planning. A background discussion of Ackhoff's Interactive planning is presented in Appendix 7.9.

Following this workshop, approval (Appendix 3) to conduct the remaining research was obtained.

A thorough process was used to ensure that key stakeholders participated in the research programme. Midgley (2006a) states that excluding certain stakeholders not only results in a flawed intervention, but should also be regarded as unethical.

Stakeholders were invited (Appendix 4) to participate on a voluntary basis; there was no discrimination or consequences if anyone chose not to participate in the workshops or interviews. Participants' acceptance of the workshop invitation indicated their consent to take part in the research and they were given the assurance that they could withdraw at any time during the workshop. Written consent was obtained from the participants to use the rich pictures generated during the workshops.

Intensive care patients and their families are important, albeit vulnerable, stakeholders. Admission to an ICU is a traumatic experience for patients and their families and this experience does not end when patients are discharged from ICU. A significant, but unidentified number of patients that survived intensive care and their family members manifest with post-intensive-care syndrome – patient and post-intensive-care syndrome – family. The onset, presentation and duration of these syndromes are individualised and vary from mild to debilitating and continue for weeks to years' after discharge from intensive care. It was deemed unethical and potentially harmful to engage with this stakeholder group in a workshop and therefore they were individually interviewed. The interviews were conducted in the participants' homes, which offered a safe environment for them. I am a trained intensive care nurse with an extensive research background and was therefore qualified to conduct a therapeutic interview. When participants were invited to take part in the study they were given information letters (Appendix 5 and Appendix 6) explaining the research project. The information letter also contained contact details of counsellors if they needed further support. Patients were recruited from intensivists who were willing to review their patients if necessary. Written informed consent was obtained from all participants.

The researcher has an ethical responsibility to intervene to improve situations where the research reveals inequities or illegitimate use of power (Midgley, 2006a). As part of this project, strategies that can improve the functioning of the intensive care system to maintain sustainable change will be identified. Findings of this research will be communicated to relevant authorities and the CCSSA. The results will also be communicated to the larger intensive care community by means of publications and congress presentations.

Information gathered was reported anonymously. The research was conducted according to the principles of the Declaration of Helsinki (WMA, 2013). The World Medical Association has developed the Declaration as a statement of ethical principles to provide guidance to physicians and other participants in medical research involving human subjects (WMA, 2013).

1.6 Importance of the research

This research will make contributions at various levels.

Margaret Chan (De Savigny & Adam, 2009) in the preface to the Flagship Report *Systems Thinking for Health Systems Strengthening* from the Alliance for Health Policy and Systems, emphasises that strong health systems are essential if we are to improve health outcomes and accelerate progress towards the Millennium Development Goals. The result is that health systems' strengthening is dominant in political agendas worldwide. Chan further highlights that, despite global census on the need to strengthen health systems, there is no established framework for doing so, and no formula to apply or package of interventions, especially in low-income countries. In the 2007 WHO report (WHO, 2007), she also draws attention to the fact that research in health systems has been seriously neglected and underfunded.

Leischow and Milstein (2006) are of the opinion that:

> Through studies grounded in an explicit systems orientation, we may recognise both the value of understanding health as a system of structured relationships and the value of the diverse methodologies that exist for learning how such

> systems are organised, how they behave over time and how they can be better governed in dynamic and democratic contexts (p 403).

There is progressively more acknowledgement of complexity, emergence and non-linearity in the health context, but very little empirical research on such systems. McDaniel, Lanham, and Anderson (2009) warn against accepting the findings from research where health systems were regarded mechanistically. Gatrell (2005) further suggests that there is a need to move beyond primarily metaphorical applications of complexity and to undertake research that uses the concepts of complexity in a meticulous manner. This study aims to address this void, specifically the understanding of the complex intensive care delivery.

Acknowledging the complexity of the South African intensive care delivery and studying it are consistent with the observation by Begun et al. (2003):

> a more realistic view of the future, in which surprise is anticipated rather than shunned; the focus on patterns of interaction rather than reified structures; and the continuing development of new concepts to study the emergence of novelty and the success of distributed control, all combine to produce a powerful addition to the theoretical complement of [the] health organisation theorist (288).

This research will give insight into the South African intensive care delivery. For the first time, the complexity of the "whole" intensive care system will be untangled – reflecting on the key stakeholders, their values and their interdependent patterns of interaction. This understanding will be applied to design and evaluate interventions that may improve intensive care service delivery and health equity. Also, an understanding of the South African intensive care system as a whole system should be a protective measure against "potentially dangerous decisions typically arising from either simplistic interventions or partial understanding of the system" (Sturmberg, O'Halloran, & Martin, 2010, p. 477).

Berwick (2003) identifies three preconditions to changing complex health systems such as the intensive care system, namely: face reality, seek new designs and involve everyone. Facing reality implies knowing the gap between

the current performance of the intensive care system and the expected performance of the system. This research intends to “make sense of the mess” or to construct an understanding of current intensive care delivery in South Africa, and to develop a framework for improvement. A systems-thinking approach will be used as the research approach and this has, to the best of my knowledge, never before been used in previous international or South African intensive care research. There will be comprehensive stakeholder participation in this research.

Adam (2014) makes the statement that, even though the number of publications focusing on systems thinking in health care have escalated in the last two decades, most of these publications speak to the concept of systems thinking or make the case for the use of the approach. But, there is “… still a dearth in practical guidance on how systems thinking concepts, approaches and tools can be applied in health systems research and practice to research sustainable solutions” (p 1). This research will also make a contribution to systems thinking and the practical application of systems thinking in health care. Systemic intervention has been applied in public health (Midgley, 2006a). However, to the best of my knowledge, this is first time that a clinical health system such as intensive care is researched using the systems thinking approach, systemic intervention. Also, the combination of methods used from the methodologies: interactive planning, critical systems heuristics (CSH), soft systems methodology (SSM) and VSM, has not, to the best of my knowledge, been used in health systems research.

The understanding of intensive care delivery presented in this research will be representative of key stakeholders. Furthermore, this understanding and the framework for improvement will inform the national Department of Health’s process of health system improvement.

Although the research reflects the delivery of intensive care contextually, the understanding of the intensive care delivery obtained in this research can contribute to the wider understanding of intensive care delivery. The framework of improvement of intensive care delivery is generic in nature and can be used in other intensive care contexts in high-, middle- and low-income countries. But, more importantly, the research approach and process of implementing systems

thinking will make a valuable contribution to health systems in general and intensive care systems in high-, middle- and low-income countries.

1.7 Overview of the thesis

In this chapter, an overview of the thesis is given and the remainder of the thesis will be structured as follows.

Chapter 2 provides a discussion of the concepts *health systems.* It is illustrated through a historical account of health systems and health systems thinking which shows that the evolution had been without sustained purpose, but rather as products of their time that emerged from specific discourses with strong political influences. The prevailing reductionist approach in the management of health systems is highlighted. Various other perspectives of health systems are discussed, namely: health care as a complex adaptive system (CAS), misaligned systems, thinking systems, rule-bound systems and “health in socio-ecological systems”.

A comprehensive discussion of intensive care is also presented in Chapter 2. The general challenges when engaging with intensive care is highlighted. The intensive care delivery in high-, middle- and low-income countries are elucidated, followed by a discussion on attempts to improve intensive care delivery. Lastly, intensive care delivery in South Africa is discussed against the background of the 2007 national critical care audit (Bhagwanjee & Scribante, 2007; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d).

In Chapter 3, the concept of systems thinking is introduced and the need for a different approach to address complex problems in health care is discussed. Systems thinking as an alternative approach to address these problems is presented. Lastly, the systems approach – systemic intervention – is elucidated as the meta-methodology for this research.

In Chapter 4, the methodology followed and a portion of the synthesis of the understanding of intensive care delivery or making sense of the mess is presented. There is no dedicated discussion section in the thesis. Due to the

complex nature of the data and its analysis, the discussion was embedded in the synthesis reflected as six different stories in this chapter.

Chapter 5 offers the philosophical and theoretical justification of using systemic intervention as a meta-methodology guiding the development of the framework for the improvement of intensive care delivery. The nine principles under-pinning the development are presented as well as the proposed framework and the validation thereof.

Chapter 6 concludes this thesis by reflecting on the realisation of the aim of the research, the theoretical and practical contribution of the research and makes suggestions for possible further research agendas.

Appendix 7 provides a historical description of the systems approaches. As mentioned in section 3.7, a comprehensive presentation of systems approaches is beyond the scope of this research. Thus, only systems methodologies relevant to this research are discussed, in particular, systemic intervention, interactive planning, CSH, SSM and VSM.

Appendix 8 affords a brief discussion of the realities and challenges when engaging with the public as a stakeholder in intensive care. The vulnerability of patients and their families taking part in research of this nature is highlighted.

Appendix 10 contains the remaining portion of the synthesis of the understanding of intensive care delivery.

Appendix 1 to Appendix 6 and Appendix 9 provide supporting information to the thesis. Appendix 11 and Appendix 12 contain two rich pictures generated during the making-sense-of-the-mess phase.

Chapter 2: An understanding of health systems and the factors influencing intensive care delivery

The intensive care system forms an integral part of health systems. This chapter provides a discussion of various aspects of health systems to render insight into this perplexing concept of health systems and therefore also the intensive care system. The concepts of health systems and health systems, the development of health systems thinking and perspectives of health systems with a special focus on health systems as CASs are presented.

As mentioned in section 1.1, intensive care is a very complex system and any attempt to improve the system needs a comprehensive understanding of the system. Garland (2005a) aptly describes intensive care delivery as “important, expensive, and problematic” (p 2152) resulting in several challenges to intensive care service delivery. Firstly, the general challenges that one needs to be cognisant of when engaging in developing a framework for intensive care delivery improvement will be highlighted. Secondly, intensive care delivery in high-, middle- and low-income countries will be elucidated. Thirdly, a discussion on attempts that have been made to improve intensive care delivery will follow. Lastly, intensive care delivery in South Africa will be discussed against the background of the 2007 national intensive care audit (Bhagwanjee & Scribante, 2007; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d).

2.1 Health systems

The review of the literature does not offer a distinct description of the emergence of the concept of the *health system* as a system. This is confirm by Sambo (2009) who was of the opinion that the concept of a health system is used in a confusing and fragmented way, resulting in different interpretations by various stakeholders.

The WHO (2007) defines a health system as a system that: “Consists of all organisations, people and actions whose primary intent is to promote, restore or maintain health.” (p 2) The goals of the health system are “improving health and

health equity in ways that are responsive, financially fair, and makes the best, or most efficient, use of available resources". The WHO Health System Framework (WHO, 2007) further sees a complete health system consisting of six clearly defined health system building blocks. The question arises: do these building blocks alone constitute a functional health system? The WHO acknowledges that just as a pile of bricks does not comprise a functional building, it is the multiple relationships and interactions among the blocks that change the blocks into a system (De Savigny & Adam, 2009).

Health systems can be seen as interdisciplinary ecologies of interrelated actors and institutions. In order to maintain the full extent of the scope of a health system, a wide lens, such as the WHO definition, is needed. The afore-mentioned actors not only refer to the pyramid of publicly and privately owned facilities that deliver personal health services but also to an array of health-contributing actors, such as mothers caring for sick children, health insurance agencies and health policies (Brailsford, Harper, LeRouge, & Payton, 2012; WHO, 2007).

The global health system consists of the network of health systems nationally. The health systems nationally are diverse and vary from country to country with regard to their performance and level of realising health goals. It is important to note that Brailsford et al. (2012) emphasised that no ideal health system model exists.

2.2 Fragmented development of health systems and health systems thinking

The concept *health systems thinking* is not the same as *systems thinking*. In health systems thinking the concept of "system" portrays the reality of a physical system. Whereas in systems thinking, "system", according to Flood and Jackson (1991), "is not used to refer to things in the world but to a particular way of organising our thoughts about the world" (p 2).

Although there is an extensive body of literature such as the Health Systems Knowledge Network (KN) Discussion Document no.1 (Doherty, Gilson, & EQUINET., 2006), on various aspects of health systems there is limited literature

available on health systems thinking. The way health systems thinking has evolved, the “bifurcations and choices made along the way” (p 3) will influence the delivery of health care (Paina & Peters, 2011). In order to gain an understanding of the unfolding of health systems thinking a comprehensive overview of Van Olmen, Marchal, Van Damme, Kegels, and Hill (2012) is presented. This overview uses the 1948 conception of the WHO as departure point, taking into account the changing perspectives on health systems in the political context. The authors argue that:

> frameworks on health systems are products of their time, emerging from specific discourse. They are purposive, not neutrally descriptive and are shaped by agendas of their authors. The evolution of thinking over time does not reflect a progressive accumulation of insights. Instead, theories and frameworks seem to develop in reaction to one another, partly in line with prevailing paradigms and partly in response to the very different needs of their developers. (p 2)

The agendas range from supporting the strengthening of comprehensive health services and empowerment of communities to advocating integration of targeted disease programmes or stimulating free markets. The authors further conclude that the debate of theories and methods for health systems analysis and for their strengthening relates almost exclusively to low-income countries and that health systems frameworks are designed to serve a specific purpose. The overview focuses on the following general observations:

- Alma Ata – linking health systems to social action;
- prioritising the “possible” – selective primary health care;
- the 1990s – globalisation, marketisation, the rise of AIDS; and
- 2000 onwards – system performance, new actors and engaging complexity.

Alma Ata – linking health systems to social action. During the decade following the Second World War, international health issues were primarily in the domain of the WHO and the United Nations Children’s Emergency Fund. In this period,

the WHO became more closely associated with the United States of America's health policy viewpoints due to the Cold War withdrawal of the Soviet Union and its allies. The United States of America's health policy accentuated disease prevention and control depending on new technologies to do so (Van Olmen et al., 2012).

The 1960s was characterised by personal and societal development marked by the decolonisation of the southern hemisphere and economic growth and social revolution on the northern hemisphere. The perception of health was broadened to include more than the traditional medical and technical focus; the management of health and health care resources has since been acknowledged as a public obligation (Van Olmen et al., 2012).

The World Health Assembly, whose member states guided the WHO, in 1969 appealed to its members for the development of rural health systems and general health services. The reconsidered WHO basic health service strategy was reflected in the WHO health reports, especially "Health by the People" and encouraged advocacy within the WHO to challenge social issues associated with health. The then WHO director, Halfdan Mahler, with the assistance of senior WHO personnel, drove the process that led to the 1978 Alma Ata conference in the former Union of Soviet Socialist Republics, a significant event in the development of primary health care. The Alma Ata declaration and the subsequent "Health for All" agenda called for every nation, including low-income countries, to be responsible for health services for their whole population. The underlying values of the declaration included universal access, equity, participation and inter-sectoral action. According to the authors, this approach placed "health in a human rights agenda, claiming health as a condition for human well-being in harmony with other human needs, thus balancing efficiency and effectiveness, and with the objective to stimulate people's autonomy and participation in the long term". (Van Olmen et al., 2012)

Prioritising the "possible" – selective primary health care. There was no agreement amongst the member states on how to implement the ambitious Alma Ata declaration as many members regarded the declaration as unrealistic and unattainable. Implementation of the Alma Ata principles was further hamstrung

by the 1973 oil crisis and the resulting global recession, resistance from health professionals and the absence of political will to implement social change (Van Olmen et al., 2012).

The Ford and Rockefeller foundations, both known for their support of vertical disease programmes, with the assistance of the World Bank, organised a congress in Bellagio, Italy. At the congress, attended by among others, influential United States of America-based development agencies, Walsh and Warren (1979) introduced the concept of “selective primary health care” (p 967). This approach promoted a limited selection of “vertical” or “disease control programmes” (p 968) in low-income countries. The focus of these programmes were on expeditious results rather than realisation of long-term objectives and also setting aside the concepts of participatory decision making and community approaches to health (Van Olmen et al., 2012).

Selective primary health care could have become the predominant approach as it suited the agenda of several prominent stakeholders. However, the economic recession, with pressures for macro-economic reform and structural adjustment programmes, resulted in prevailing health policies focusing on national and local health sustainability (Van Olmen et al., 2012).

Regardless of this background, some low-income countries managed to have considerable improvements in health status. Another conference was organised in Bellagio in 1985 by the Rockefeller Foundation: Good Health at Low Cost, with a focus on how these countries could do so. It appears that in these countries there was a shift to build the health systems from the bottom up, with a focus on health at community and district level. The Harare conference followed in 1987 and resulted in a renewed interest by low-income countries in primary health care. The framework for health systems development focused “heavily on the district as the organising unit for primary health care” (Van Olmen et al., 2012, p. 4) Operational research programmes were set up to improve health service organisation in resource-limited settings, with many programmes strongly based on the paradigm of comprehensive primary health care and striving for effective, integrated, continuous and holistic care (Van Olmen et al., 2012).

The conceptualisation of national health systems models elsewhere, however, continued to have a strong health care delivery focus. Van Olmen et al. (2012) draw the attention to some of these models, of which the most important is the seminal work of Donabedian published in the early seventies. His linking of process and interrelations in health care with quality and outcomes was innovative and his basic model linking input, processes and outcomes still underlies many current analytic frameworks (Donabedian, 1972).

The 1990s: globalisation, marketisation, the rise of AIDS and the re-conceptualisation of health systems. From the mid-1980s, the World Bank became an increasingly more important stakeholder in global health and health care financing in low-income countries. At the same time, inadequate leadership and reduced budgetary funding lead to the weakening of the WHO as a prominent stakeholder. The Disability-Adjusted Life Year, or DALY, developed by Harvard University in 1990 to measure burden of disease, became the main process of prioritisation in global health. The emerging HIV/AIDS epidemic and the reactions it provoked had a significant influence on global health. “The paradigm of AIDS exceptionalism and the strong framing of treatment as a human right led to the acceptance of HIV/AIDS as an exceptional disease requiring exceptional responses, which would indeed be organised.” (Van Olmen et al., 2012, p. 5)

2000 onwards: system performance, new actors and engaging complexity. During this period, health systems thinking was influenced by three key inherently associated developments:

- the change of the actor landscape in global health,
- WHO’s attention to health performance, and
- awareness of the complexity of health systems. (Van Olmen et al., 2012)

The formulation of the Millennium Development Goals resulted in an increase in the number of Global Health Initiatives to more than 70. During the same period, philanthropic contributions to health proliferated with the contributions of inter alia the Bill and Melinda Gates, Clinton, Rockefeller, Ford and W.K. Kellogg foundations. Van Olmen et al. (2012) conclude that: “The realisation that weak

health systems constrained the effectiveness of many of their interventions increased attention for HSS [health system strengthening].” (p 5) The authors regard the publication of *Health Systems: Improving Performance* (WHO, 2000) a landmark event in health systems thinking. Key health systems functions such as the health workforce, were recognised as constraints and health systems strengthening became the new catchphrase. In reaction to the need for strengthening health systems, the WHO (2007) published *Strengthening Health Systems to Improve Health Outcomes: A Framework for Action*; also known as the framework with six building blocks.

The result was an increased acknowledgment of the complexity of health systems and the challenges of the Millennium Development Goals compelled the prevailing mechanical health system representation to transform. The development of health systems thinking and illustrative publications against the general and health policy context are illustrated in Figure 2-1.

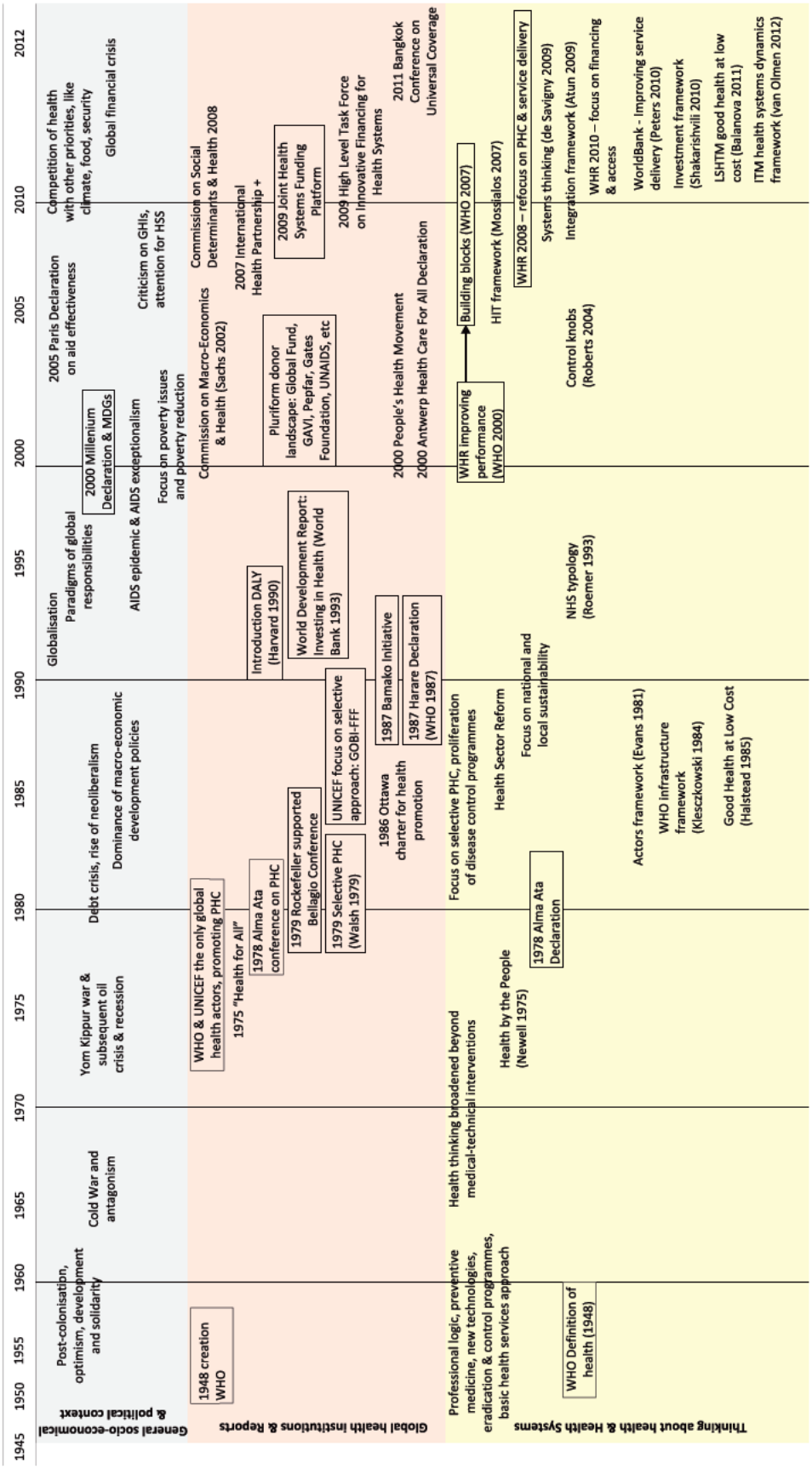


Figure 2-1 Development of health systems thinking (Van Olmen et al., 2012)

It is evident from this historical account of health systems and the development of health systems thinking that the evolution has been without sustained purpose, but rather products of their time that emerged from specific discourses with strong political influences. The evolution was neither natural, it was reactionary depending on which stakeholder was salient, nor was there any progressive accumulation of insights or learning which is necessary for the development of health systems and ultimately improvement of service delivery.

It is also notable that the reductionist approach prevailed and that there was no acknowledgement that health systems were complex adaptive systems: open, self-organising and with a mind of their own (autopoiesis).

There is a need for an alternative approach: a new way of conceptualising health systems development. Systemic intervention, the guiding meta-methodology of this thesis emphasise the importance of multiple perspectives. Therefore, a discussion of perspectives of health systems by various health care stakeholders, will follow to obtain an understanding of these systems. First, a discussion of general perspectives of health systems are presented, followed by a discussion of the prevailing reductionist perspective. Health systems will be discussed as complex adaptive systems, misaligned systems, thinking systems, rule-bound systems and “health in social-ecological systems”.

2.3 Perspectives of health systems

Intensive care, as mentioned before, is regarded as an integral part of health systems. It is therefore important to understand how health systems are perceived as this will reflect prevailing perspectives of intensive care as a system.

2.3.1 General perspectives of health systems

Health systems are perceived to be in trouble, and their reformation has become a priority. It is interesting to note that Brailsford et al. (2012) highlight that there is no ideal health system. Although the WHO (De Savigny & Adam, 2009) acknowledge that there is global consensus on the need for health systems strengthening, the authors state that “there is no established framework for doing

so in developing countries" (p 19). This statement leaves the impression that such a framework exists for high-income countries.

However, measured against the definition of a health system, Cortese and Smoldt (2006) are of the opinion that there is no health system in the United States of America, just "a myriad of professionals and organizations that provide health care, but no vision has ever been articulated for these disparate parts to function together and learn from each other. (p 492)"

Edgren (2008) echoes the view of Brailsford et al. (2012): in his view European health systems are in general "fragmented and poorly equipped to take care of patients with composite needs" (p 1) and that patients and/or their relatives have to take it upon themselves to integrate the fragmented health care services. According to the author, the problem of fragmented health care services is the result of the prevailing mindset.

For Leape et al. (2009), many health care organisations within health systems fit the "sick system syndrome" (p 424) or "vulnerable system syndrome" (p ii21) as defined by Reason, Carthey, and De Leval (2001). Health care organisations with sick system syndrome are hierarchical, lack mutual respect, teamwork and transparency. Blame remains the core solution. Mechanisms for ensuring accountability are weak and ambiguous. The organisations do not have the ability to learn and change – a characteristic of high-reliability organisations. These organisations further see safety as a priority and not a precondition and do not understand that patient and personnel safety contribute to higher productivity and profitability.

2.3.2 Reductionist perspectives of health systems

Health systems as Newtonian machines

Begun et al. (2003) state that it is tempting to consider health systems as receiving inputs, transforming them and producing outputs, such as health improvement. The authors are of the opinion that the machine metaphor frames the beliefs about how a system can be studied and improved. To study the system, one examines the parts separately to understand their mechanics. On

the other hand, to improve the system, the authors highlight that a certain approach is followed: “If the system is not working as planned, then identify the broken part and replace it. If the system is too costly, then work to economies of scale. If the system is not working in a coordinated fashion, then tighten the interconnections between the parts of the system.” (p 253) From this metaphor, one can draw the conclusion that that there is always an “operator” in control.

Health services are generally designed to function according to the principles of scientific management and terms such as rationality, objectivity, stability and predictability are often associated with this approach. Change is seen as linear and a predictable process managed and assessed from the top down. Edgren (2008) emphasise that in such a system there is no ability to adapt when the unexpected happens as all solutions have been preprogramed and the system then collapses.

Industrialising of health systems

This reductionist thinking that framed health care services as machines also led to the industrialising of health system management. In 1911 Taylor introduced the concept of scientific management – the study of time and motion in work – and the result was vast increases in productivity (National Research Council, 2001).

Rastegar (2004) concludes that there was and is an attempt, as in the motor industry, to industrialise health care. Industrialisation or Taylorism was implemented with great success by Henry Ford in the motor industry and by Ray Kroc of Mc-Donald’s in the restaurant industry. The ideas of industrialisation, according to Plesk (National Research Council, 2001), are even today a continuing and deeply held paradigm. However, the complex and unpredictable nature of health and illness does not lend itself well to industrialisation as this will result in fragmentation and standardisation of work and the creation of a managerial superstructure. The author is of the opinion that the care of patients can rarely be squeezed into a pre-cast mould. This holds true in current practice where the implementation of guidelines in health care is deemed the silver bullet to solve an array of problems and it is often pointed out by critics of this approach

that patients do not read guidelines. Rastegar (2004) warns that the threat of assembly-line medicine hangs like a dark cloud over health care and the prospect of depersonalised and fragmented health care is disconcerting.

One can understand the desperate need of the various role players, such as government and health care managers, to be “in control” when confronted with the overwhelming task of understanding health and health systems. In order to be in control, they follow reductionist and industrialised approaches. Today, however, it is evident that these approaches are failing as health systems are not machines that can be managed in an industrialised manner, but complex adaptive systems.

2.3.3 Health systems as complex adaptive systems

To understand health systems as CASs a brief discussion of CASs will be provided.

Complex adaptive systems

Even though there exists a variety of systems, most people evoke the common and comforting machine metaphor when thinking of systems (Begun et al., 2003; Edgren & Barnard, 2012). When engaging with systems, it is important to differentiate between traditional or mechanical systems and CASs. This is confirmed by Begun et al. (2003, p. 255) “The messy open systems of complexity science are immensely different from closed, well behaved systems”. According to Edgren and Barnard (2012), CASs have more in common with living organisms than with machines. The understanding of a CAS is often over-simplified and erroneous and this creates problems for decision makers who attempt to manage and control these systems (Paina & Peters, 2011).

Rouse (2008) argues that the success of traditional systems “depends on being able to decompose and recompose the elements of the system and, most importantly, on someone or some entity having the authority and resources to design the system” (p 18). In the traditional system, the reaction of each element can be predicted in great detail (National Research Council, 2001).

In contrast with traditional systems, Cilliers (2004) describes the characteristics of CASs as follows:

- they comprise a large number of elements;
- that dynamically interact with one another;
- the interactions in CASs are rich, non-linear, have a short range and feedback loops;
- they are open systems that operate far from equilibrium and have histories; and
- each element in the system is unaware of the performance of the system as a whole.

CASs comprise a large number of elements (Cilliers, 2004). The number and diversity of the elements contribute to the complexity of the system and can be seen as a densely connected web of interacting elements (Begun et al., 2003). When there is a large number of elements in a system, the behaviour of the elements can no longer be described in conventional terms. Not only is it impractical to do so, but the conventional terms also cease to assist in any understanding of the system (Cilliers, 2004). This does not imply that CASs are complicated, on the contrary, they follow a set of a few simple rules (Edgren & Barnard, 2012).

The elements in a CAS interact in a dynamic manner with the result that a CAS changes over time. The interactions of the elements are not necessarily physical; they can also be thought of as the transmission of information (Cilliers, 2004). Rouse (2008) sees the elements or agents of CASs as independent and their behaviour as constructed around physical, psychological or social rules rather than around the demands of the system. Furthermore, the needs of the agents as indicated by their rules are not homogeneous and their goals and behaviours may conflict. The consequence of this conflict or competition is that agents tend to adapt to each other's behaviour.

The interactions in a CAS are quite rich as every element in the system influences and is influenced by several elements (Cilliers, 2004). Begun et al. (2003) describe the interactions or relationships between elements as “complicated and enmeshed or massively entangled” (p 256). The precise number of element interactions does not determine the behaviour of the system, but the pattern of interactions does. For example, one richly connected element can perform the same function as several scantly connected elements. Of note is that the interactions have specific characteristics.

- Interactions are non-linear, the result is that small changes can have large results and large changes can have small results (Cilliers, 2004). The phenomenon of small changes that can have large results is often referred to as the “butterfly effect” a metaphor first described by the meteorologist Edward Lorenz (Lorenz, 1972).

- Interactions usually have a short range; information is predominantly received from neighbours. Even though interaction over a long range is not possible, a wide range of influence is possible. This is attributed to the rich interactions of elements but it is noteworthy that interactions can be enhanced, supressed or altered in numerous ways (Cilliers, 2004).

- Interactions have direct or indirect feedback loops; this is referred to as the recurrence of the CAS. The feedback loops can be positive with an enhancing or stimulating effect or negative with a detracting or inhibiting effect (Cilliers, 2004). In addition, Paina and Peters (2011) refer to dead-end feedback loops that lead to repetitive behaviour; that feedback loops strengthen common perceptions and that feedback loops are used to describe vicious circles such as poor health and poverty.

A CAS interacts with its environment and therefore is regarded as an open system. It is difficult to define the borders of a CAS; Tsasis, Evans, and Owen (2012) refer to “fuzzy” boundaries. Cilliers (2004) states: “Instead of being a characteristic of the system itself, the scope of the system is usually determined by the purpose of the description of the system and is thus influenced by the position of the observer. This process is called framing.” (p 24) The author also

makes the differentiation that a closed system is merely complicated rather than complex.[2]

There is a constant flow of energy in a CAS to maintain the organisation of the system and this ensures the survival of the system. Therefore, equilibrium does not exist in a CAS and would imply death (Cilliers, 2004).

A CAS evolves over time and has a history that is co-responsible for its current behaviour. If a CAS is analysed, it is vital to acknowledge the dimension of time for a more comprehensive understanding thereof (Cilliers, 2004). Paina and Peters (2011) refer to this concept as path dependence. For the authors, outcomes are "not only sensitive to initial conditions but also to bifurcations and choices made along the way" (p 3). They illustrate their argument with an example of the British National Health Service that is a product of a specific cultural heritage and that this service could not be copied in another country that did not have the political processes or institutions in place that made the National Health Service work. Christens, Hanlin, and Speer (2007) perceive path dependence in a system as "a way of understanding much of the power and some of the irrationalities of systems" (p 236).

It is essential to be cognisant of the fact that each element in a CAS is ignorant of the behaviour of the system as a whole. Cilliers (2004) explains:

> "If each element 'knew' what was happening to the system as a whole, all the complexity would have to be presented in that element. This would entail either a physical impossibility in the sense that a single element does not have the necessary capacity, or constitute a metaphysical move in the sense that 'consciousness' of the whole is contained in one particular unit. Complexity is

[2] Complexity and complicated have different meanings in systems thinking. "… the main difference between **complicated** and **complex** systems is that with the former, one can usually predict outcomes by knowing the starting conditions. In a **complex** system, the same starting conditions can produce different outcomes, depending on interactions of the elements in the system." (Sargut & McGrath, 2011, p. a 10)

> the result of a rich interaction of simple elements that only respond to the limited information that each of them is presented with. When we look at the behaviour of a complex system as a whole, our focus shifts from the individual element in the system to the complex structure of the system. The complexity emerges as a result of the patterns of interactions between the elements." (p 24)

Tsasis et al. (2012) draw attention to the fact that in CAS change cannot be enforced and endeavours to control or prescribe innovation are often counterproductive. The authors suggest change as an evolving, learning process rather than a series of programmatic steps. Change in CAS depends strongly on the empowerment of diverse role players with little control from the top. Holden (2005) refers to "direction without directives ... listening to the front-line people … support along the way … getting out of their way" (p 565).

According to Rouse (2008), adaptation and learning result in self-organisation in CAS, behaviour patterns emerge from CAS and cannot be designed into the system. Self-organisation is creating order without help from the outside and one way to do so is improvising; this implies a balance of structure with flexibility (Edgren & Barnard, 2012). The authors suggest that self-organisation does not function in a system where there is constant change; the system needs some degree of stability to accommodate rapid change.

Self-organisation therefore leads to inherent order and not to central control or hierarchy of command (Edgren & Barnard, 2012; National Research Council, 2001). For Begun et al. (2003) there is no central body, master neuron or chief executive officer (CEO) that controls the agent's or element's individual moves. Rouse (2008) claims that the elements in CAS are: "sufficiently intelligent to game the system, find 'work arounds' and creatively identify ways to serve their own interests" (p 18). Therefore, the system can be more easily influenced than controlled. In machine model thinking, anxiety, paradox, tension and uncertainty are seen to be harmful, whereas in CAS, these notions are embraced (Edgren & Barnard, 2012).

Rouse (2008) suggests that the concept of management should be viewed differently when engaging with CAS. According to the author, traditional systems

are managed to minimise cost, but with CAS, the management emphasis should be on maximising value. For Rouse, value focuses on outcomes, and specifically the benefit of outcomes, rather than the outputs of the system.

Plesk (National Research Council, 2001) proposes that it might be more useful to think like a farmer rather than an architect or an engineer when engaging with CAS. In general, architects and engineers are mostly tasked with designing predictable systems where it is necessary to design every detail of the system. In contrast, the farmer desires an optimum crop, but knows that he can only do so much. He merely creates conditions under which a good crop is possible by drawing from knowledge and evidence from past experience.

It is important to be aware that “because the context for each CAS is unique and each CAS is context-dependent, each CAS is unique” (Begun et al., 2003, p. 256). Kochevar and Yano (2006) refer to a need-driven approach where context is acknowledged rather than a solution-driven approach where context is ignored.

When engaging in managing complex systems, it is essential to understand the difference between complexity and established science: a summary by Begun et al. (2003) illustrating the differences is presented in Table 2-1.

Table 2-1 Complexity science versus established science (Begun et al., 2003)

Complexity science	Established science
Holism	Reductionism
Indeterminism	Determinism
Relationship amongst entities	Discrete entities
Quantum physics • influences through iterative non-linear feedback • expects novel and probabilistic world	Newtonian physics • influences as a direct result of force from one object to another • expects predictable world
Understanding, sensitivity analysis	Prediction
Focuses on variation	Focuses on averages
Local control	Global control
Behaviour emerges from the bottom up	Behaviour specified from the top down
Metaphor of morphogenesis	Metaphor assembly

Edgren and Barnard (2012) draw attention to the fact that the CAS approach makes change viable by clarifying how human systems develop as they do. However, the authors warn that: "CAS is not a tool for making interventions or a toolbox for change. CAS does not have all the answers to organising. Nor does it exclude other organisational metaphors which may be useful in understanding more predictable processes." (p 50) CAS offers a model of thinking that prepares one for action.

Health systems as CAS

It is generally acknowledged that health systems are CASs as they comprise multiple components or agents that demonstrate diversity, interconnectedness, interdependence and adaption to input (Sturmberg et al., 2010). For Sturmberg et al. (2010), a health system is not only a CAS but should be a complex,

adaptive, people-centred health system, with the patient's experience of health as the core and the author use the image of a vortex to illustrate the concept.

For Begun et al. (2003, p. 253), health systems " …continue to defy control – it is a 'machine' with a mind of its own". This phenomenon elucidates why health systems, when there is an attempt to strengthen them, do not respond to "blue print approaches" (Paina & Peters, 2011, p. 7). The imperative therefore is to be cognisant of the fact that no organisation design can be enforced on a health system.

The question arises what the best approach is to manage a health systems that is a CAS. Rouse (2008) suggests the following approach:

- human-centred approach that addresses abilities, limitations and inclinations of all stakeholders;
- use of leadership and influence rather than power: command and control must be replaced by incentives to behave appropriately; and
- because most stakeholders in health systems are independent and beyond observation, the focus should change from efficiency to agility.

When engaging with the literature addressing health systems as CASs, it becomes clear that there are several shortcomings. Not all of the fundamental principles of CASs are acknowledged and concepts of complexity theory are misinterpreted. Begun et al. (2003) draw attention to an important point: "As with any body of new ideas there is a danger that complexity science will be over-generalized, overextended, exploited and abused by those enamoured of everything new." (p 261)

Paley (2010) points to the "received interpretation" (p 61) of complexity in health care. Most authors writing in this domain refer to influential articles in the British Medical Journal (Fraser & Greenhalgh, 2001; Plesk & Greenhalgh, 2001; Plesk & Wilson, 2001; Wilson & Holt, 2001) that followed the Institute of Medicine's report – *Crossing the Quality Chasm: A New Health System for the 21st Century* (National Research Council, 2001). According to Paley (2007, 2010), the authors

of these four articles acknowledge one of the three fundamental principles of complexity, but fail to understand that complexity provides a form of explanation and their discussions apply more to general systems theory than to CASs.

Two misconceptions in the health care literature, namely self-organising and *attractor* of CAS, will be briefly highlighted.

In the case of self-organising, Paley (2007) suggests that, although it may give the impression of intentional planning, it is not. This is a mistake authors, for example Cooper, Bray, and Geyer (2004); Minas (2005); Plesk and Wilson (2001); Rowe and Hogarth (2005), often make when referring to systems consisting of humans. For these authors, self-organising is when individuals other than management "get together, discuss things, agree on some goals, plan a strategy" (p 235); this is essentially in contrast to what self-organisation entails. Self-organisation, according to Paley (2007, p. 235), "simply emerges as a result of each individual doing their own thing independently".

The term *attractor* is a mathematical concept that refers to an end state and is often mistakenly perceived by authors in the colloquial sense of "attract" (Paley, 2007). The following are examples of this misconception in the health care literature of the term attractor:

- intrinsic motivation (Plesk & Wilson, 2001);
- a sense of purpose, direction or vision embraced by the organisation (Sweeney & Mannion, 2002); and
- values or behaviour that motivate professionals (Rowe & Hogarth, 2005).

To Paley (2007) these misconceptions are "roughly equivalent to thinking that π has something to do with baking and tan (trigonometry) has something to do with colour" (p 235).

Not only health systems should be acknowledged as CASs but also disease entities, especially in intensive care. The treatment of severe sepsis and septic shock (both associated with high mortality) has for decades been hamstrung by a reductionist approach. Novel treatment has with limited success focused on the

blocking of individual mediators such as the tumour necrosis factor, the interleukins, etc. It is only now, with a better understanding of the bigger sepsis picture, that progress has been made in treating severe sepsis and septic shock. This is confirmed by Seely and Christou (2000) who concluded that following a CAS approach when treating and researching multiple-organ dysfunction syndrome will ensure valuable understandings of the syndrome.

2.3.4 Health systems as a misaligned system

Golden and Martin (2004) draw attention to health system misalignment. For the authors, system misalignment occurs when organisational strategy, structure, human resources, incentives, information and support systems are incompatible. Two common causes of system misalignment are identified, namely principal-agent and knowledge management problems. The authors propose that there are three tools to address these problems: allocation of decision-making authority, performance measurement and performance-based reward and/or punishment. The Star Model developed by the authors and shown in Figure 2-2, provides an "evidence-based" model to use these tools to guide system design and redesign of health systems. There are six core ideas that underpin the model:

- people problems are seldom the root cause of underperformance – poorly designed systems are more likely to be the cause,
- there is more than one way to design a system,
- all points on the star are not similarly important,
- change at any point in the system may create the need to alter others to regain alignment,
- culture and values can generate resistance to change, and
- the systems culture and values can only be changed indirectly.

The Star Model may be tempting for health system managers, but this model seems like an oversimplified approach to address complex health system problems.

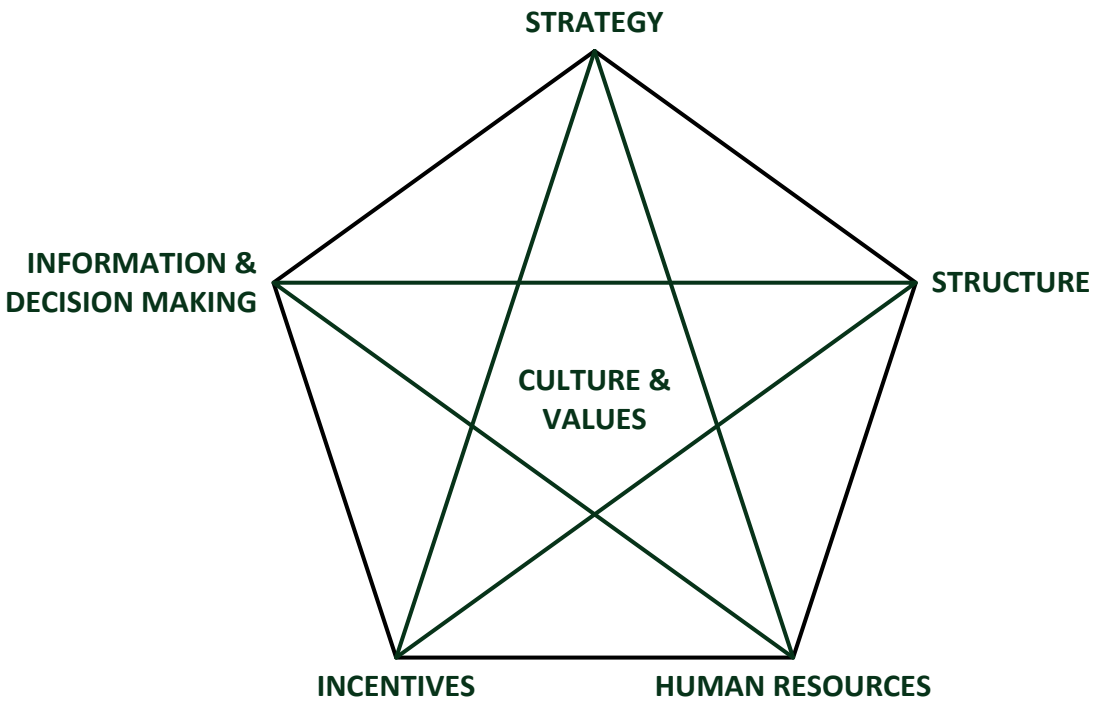


Figure 2-2 The Star Model (Golden & Martin, 2004)

2.3.5 Health systems as thinking systems

Waldman (2007) regards health care as a thinking system. This entails a CAS that also has goals separate from survival and that has the capability to structure its own learning and to innovate purposefully. In thinking systems, thinking humans are essential to make decisions where there are no established right answers.

A unique characteristic of thinking systems is that they can have various goals and envisage desired future results. Humans in a thinking system have individual, multiple and sometimes contradictory goals, which require manipulation and prioritisation to accomplish specific proposed results. A second unique characteristic is creativity, the ability to "figure out how to use what you already know in order to go beyond what you are currently thinking". (Waldman, 2007). The author sees the "thinking" in thinking systems as "the ability to create new ideas, to make things never seen before, to behave emotionally and/or illogically and to act purposefully, sometimes without regard for survival: selflessly such as

the New York firefighters on 9/11 or destructively such as the 9/11 hijackers." (p 273)

The external environment within which health systems function, constantly changes. For these systems to survive and/or improve, effective change is needed. A precursor to effective change is learning. For Waldman (2007) health system learning should result in judgement, adaptability, problem-solving ability and coping skills. Unique learning barriers exist in health systems. Health care professionals avoid admitting ignorance or insufficient understanding as they perceive this as a weakness or a personal failing. The health care culture is distinctly risk-averse and strongly protective of the status quo.

For Christens et al. (2007), the strategy for social change is to get the social organism thinking. According to the authors, lasting system change requires social imagination. Individuals in a system understand the system and it is their collective imagination that is essential to social change. This is particularly relevant for the authors in situations when problems stem from broad systemic problems, that create a feeling of powerlessness. The authors suggest that attention should be directed at people – the one aspect that can be affected.

Waldman (2007) argues that "many of the endemic problems in Western health systems can be linked to the fact that they are *thinking systems acting on thinking systems*, while each is viewed and managed as a machine" (p 276). Root causes for health care as a dysfunctional thinking system are described by Waldman and Schargel (2006) as follows:

- The time frame of causality in health systems, the long delay (often decades) between actions and their effects are problematic, for example the effect of preventative medicine and the long-term use of certain medications.

- The substrate upon which the health system acts is human and humans are wilful and cannot be completely controlled. It is not always acknowledged that the substrate should be a willing part of any process and the outcome of the process will in part be determined by the substrate

and therefore be emergent rather than predictable. The use of six sigma concepts (reduction of variance and control) often applied in health systems is fundamentally flawed.

- Health systems have risk-averse cultures that dissuade learning that in turn create environments that constrain innovation and limit improvement.

- Outcome measurement currently focuses on what we do not want, namely death and cost, rather than on what we aspire to: life, function and productivity.

- Micro-economic dissociation is another root cause as, “The person who consumes the service – the patient – is different from the person who drives the cost – the doctor – who is different from the entity who pays: the government or an insurance company.” (Waldman, 2007)

- Incentives and accountability are contradictory. The authors refer to Kerr (1975) that asked the question: what do you get when you want ‘A’ but reward ‘B’? In a health system, patients want care, but the system rewards throughput. The authors conclude: “Is anyone surprised that *efficient* doctors spend little time with their patients?”

- Organisational structure and governance of health systems do not function as systems but rather as independent silos.

2.3.6 Health systems as rule-bound systems

Clayton and Gregory (2000) focus on rule-bound systems and are of the opinion that facilitating change in these systems can be problematic. In rule-bound systems few of the positive effects of bureaucracy prevail and many of the negative aspects seem to dominate. In these systems, the elements of the systems are bound together by the rules that guide possible relationships and the nature and extent of interactions of the different actors in the system. The authors further state that: “The notion of rule-boundness suggests that the performance of the system is constrained by these rules.” (p 141) It is important to note that the rules do not only include the formalised written rules but, more importantly,

the unspoken norms and codes of practice that guide and influence people's perceptions of what can and cannot be done in the system. Power relationships are significantly embedded in the rule-bound system.

Clayton and Gregory (2000) also draw attention to the "coping culture" that exists in rule-bound systems. The authors aptly describe the participants in a British prison service's coping culture as follows:

> "… everything works 90 per cent of the time, nothing is perfect, so what is the point of worrying about improvement – they were concerned with doing as, in their view, too much time was already wasted by processes of planning. Doing was perceived as more valuable than forward thinking and trying to make improvements, since in time, the improvements would be obsolete anyway." (p 146-147)

According to Clayton and Gregory (2000), problem situations within these systems appear to be constrained by the mindsets of the actors within them who exhibit rule-bound behaviours. Rule-bound behaviours often comprise the following:

- people who subscribe to some higher-level interests determined outside their sphere of influence, but without necessarily sharing other aspects of the higher-level viewpoint;
- people whose values and beliefs are likely to conflict;
- a view that both views and ends are outside the sphere of influence of the people, making compromise apparent rather than 'real';
- a sub-set of all people who are able to make decisions that are 'legitimated' and thus accepted by others'; and
- people who act in accordance with 'given' objectives, with no process recognised as being able to affect a genuine agreement under present systemic arrangements.

Health systems can be described as rule-bound systems. In the South African context, this will include both the public and private health systems as

bureaucracy prevails in both sectors. It is important to be cognisant of rule-bound systems as Clayton and Gregory (2000) point out that change in these systems can be challenging. It is especially the coping culture that is of concern in health systems. The scenario that the authors depict holds true for many health systems: “Changes were constantly imposed from the outside of an individual’s sphere of control, and they do not wish to be involved in a process which only promised still more changes, even though they were to be involved in deciding on the nature of the changes themselves.” (p 147)

2.3.7 From “one medicine” to “one health” to “health in social-ecological systems”

Zinsstag, Schelling, Waltner-Toews, and Tanner (2011) acknowledge not only the human but also the animal health system and note that these two health systems have been progressively challenged by complex issues of global change. The authors state that:

> Faced with these complex, often rapidly changing patterns, the inextricable interconnection of humans, pet animals, livestock and wildlife and their social and ecological environment is evident and requires integrated approaches to human and animal health and their respective social and environmental contexts. (p 149)

Integrative thinking on human and animal health is not a new concept and Zinsstag et al. (2011) give a brief history of this synergy. Priests were ancient healers that cared for both humans and animals. The Egyptian Papyrus of Kahun, ca. 1800 BCE, describes both human and animal diseases. Egyptians further considered humans and animals as the “flock of God” and had chimeric creatures in their mythology. The beliefs of transmigration and reincarnation between humans and animals influenced early understanding of medicine in India. One of the first examples of an integrated public health system that included doctors and veterinarians is described in the Zhou Dynasty. The authors quote an 18th century text by Xu Dachun that states, “The foundations of veterinary medicine are as comprehensive and subtle as those of human medicine and it is not possible to place the one above the other.” The scientist, Rudolf Virchow, in the 19th century

with the beginning of cellular pathology research, had a strong awareness that human and veterinary medicine were comparative based on the discovery of similar disease processes in humans and animals. It is interesting to note that the early incentive for medical research in South Africa was often not human epidemics but rather animal diseases such as rinderpest.

The concept of “one medicine” was first used by William Osler, a student of Virchow’s, but it was Schwabe who in 1976 acknowledged the close systemic interaction between humans and animals as quoted by Zinsstag et al. (2011). “One medicine” recognises that humans and animals share the same paradigm and that each domain plays a part in the other’s development. A subsequent and more comprehensive approach to health has resulted in the “one medicine” concept evolving to that of “one health”. More recently, multifaceted ecological thinking that encompasses more than just humans and animals has emerged and resulted in the “eco-health” concept. However, Zinsstag et al. (2011) also recognise that humans and animals have a close relationship to their social environment giving rise to the concept of health in a social-ecological system. The authors describe health in a social-ecological system as

> … an inter- and transdisciplinary study of complex interactions in all health-related fields. Health in a social-ecologic system moves beyond “one health” and “eco-health”, expecting to identify emerging properties and determinants of health that may arise from a systemic view ranging across scales from molecules to the social culture context, as well from the comparison with different disease endemicities and health structures (p 148).

The concept of “health in a social-ecological system” is relevant and important to intensive care delivery. One example is that of antibiotic use. Antibiotics are an important treatment modality in the ICU. The WHO (2017) news release in reaction to the Lancet Planet Health meta-analyses (Tang et al., 2017) states that the inappropriate and over-use use of antibiotics is adding to antibiotic resistance. Essential antibiotics are used in food producing animals to encourage growth and prevent disease in healthy animals. To conserve effectiveness of antibiotics for both animals and humans, the WHO recommend the cautious use of antibiotics in animals.

2.4 Summary of health systems perspectives

When engaging with the improvement of health systems or subsystems such as intensive care it is important to be aware of and acknowledge the path dependence or history as referred to by Paina and Peters (2011). The way health systems thinking has evolved, the “bifurcations and choices made along the way ...” (p 3) will influence the development of an improvement framework. It is also imperative when developing an improvement framework to appreciate that the intensive care system functions as a CAS, but it is also a rule-bound system that does not function in isolation but as “health in a social-ecological system”.

The discussion will now focus on intensive care delivery. As mentioned before, intensive care is a very complex system and any attempt to improve the system needs a comprehensive understanding of the system. Firstly, the general challenges that one needs to be cognisant of when engaging in developing a framework for intensive care delivery improvement will be highlighted. Secondly, intensive care delivery in high-, middle- and low-income countries will be elucidated. Thirdly, a discussion on attempts that have been made to improve intensive care delivery will follow. Lastly, intensive care delivery in South Africa will be discussed against the background of the 2007 national intensive care audit (Bhagwanjee & Scribante, 2007; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d).

2.5 Challenges when engaging with the intensive care system

The intensive care system poses various challenges, in this section the following challenges: intensive care ascertaining its own identity, establishing a global burden of critical illness, the heterogeneity of intensive care patients, evidence-based medicine in the intensive care, the scarcity of appropriate trained intensive care health care workers, the intensive care organisation models and the ethical justification of intensive care will be discussed.

Adhikari, Fowler, Bhagwanjee, and Rubenfeld (2010) in their publication: “Critical Care [intensive care] and the Global Burden of Critical Illness in Adults”, highlight important aspects that give valuable insight into the difficulties when engaging

with the discipline of intensive care. Firstly, intensive care is a relatively young discipline that has been confronted with ascertaining its own identity, “unlike other specialities of medicine defined by organ system, disease process or procedure” (p 1339). Evolving definitions attempt to “broaden the focus of critical care [intensive care] to include the patient’s complexity of illness, severity of organ dysfunction and risk of imminent death” (p 1339). The establishment of an own identity is further hamstrung by an ongoing deliberation of its organisational characteristics, for example, general ICUs versus speciality ICUs.

Secondly, establishing a global burden of critical illness poses an enormous challenge. There are “no reliable international comparative epidemiological data of critical illness syndromes such as acute lung injury, sepsis, and multiple-organ dysfunction available” (p 1340) as there are for numerous other diseases, for example cancer, tuberculosis and HIV/AIDS. Establishing a global burden of critical illness is made difficult by numerous fundamental challenges (Adhikari et al., 2010). Some of the challenges include:

- Critical illness syndromes cannot be diagnosed by a single test like malaria, for example, that is diagnosed with a blood smear. Critical illness syndromes, such as sepsis, nosocomial infection and acute lung injury are diagnosed using clinical, laboratory, radiology and physiology criteria that are developed by consensus panels and are continually debated and revised.

- These syndromes have rapid onsets and high short-term mortality that make them more difficult to study than long-term chronic diseases.

- Existing administrative databases make it difficult to study critical illness syndromes as these syndromes are not defined by procedure or correctly portrayed by hospital coding.

- The epidemiology of critical illness and intensive care resources are reliant on the accessibility of other health services.

The authors draw attention to the fact that “these challenges imply that the global burden of critical illness might never be possible to define. Even the less

ambitious goal of defining the global capacity to deliver critical care is difficult." (p 1341) The difficulty to determine global capacity to deliver intensive care is, for example, compromised by the lack of a standard definition of an ICU bed. This is illustrated by Wunsch et al. (2008) who determined that there was no standard definition for an ICU bed in the eight North American and European countries included in their research. Regardless of these challenges, Adhikari et al. (2010) are of the opinion that knowing the global burden of critical care illnesses is important to "allocate health-system resources, improve the quality of care for critically ill patients, and plan for unexpected surges, such as during a pandemic … [it will] … also provide impetus for initiatives to improve the outcomes of acutely ill adults in low-resource settings …" (p 1341).

Lastly, it is also important to be aware of emerging trends that will increase the burden of critical illness resulting in an escalating demand for intensive care delivery whilst the available resources are unlikely to keep abreast of such demands. For Adhikari et al. (2010) some of these trends include patient demographics, the expanding in-hospital demand for intensive care services, natural and human-generated events such as wars, acts of terrorism, pandemics and endemics such as HIV and trauma which will be discussed later.

There is an increasing expectation for intensive care services but there is also an increasing need to contain costs (Degoricija, Sefer, Kujundzic-Tiljak, & Gjurasin, 2002). The daily cost of caring for a patient in the ICU is six times more than in a general ward. ICU beds comprise 8% of the total number of acute care hospital beds but utilise 20% of the budget (Garland, 2005a). intensive care budgets consume 1% of the United States of America's GDP (gross domestic product) (Angus et al., 2006; Fowler, Adhikari, Scales, Lee, & Rubenfeld, 2009). The cost of intensive care service delivery is further complicated by inadequate patient health insurance. Fowler et al. (2009) make this important observation:

> Although it is a perpetual national issue that approximately one-third of Americans under the age of 65 years is without health insurance for some portion of any given year, in most of the least developed countries, there is no health insurance for any citizen for any portion of any year (p 743).

A further challenge is the heterogeneity of intensive care patients, including “age and sex of patients; type, trajectory, and duration of the disease process; comorbidities; and manner and severity of complications” (p 1354), all of which influence patient outcome. Where the intensive care patient is admitted from also has an impact on patient outcome, for example, a patient transferred from an emergency department or theatre has a better outcome than one transferred from a hospital ward. Intensive care patient outcome is further affected by the relationship between the severity of the disease and the lead-time to ICU admission. Patients admitted earlier when the disease is less severe usually have better outcomes (Vincent & Singer, 2010).

Intensive care patients have a poorer prognosis than patients with homogeneous diseases. Poor intensive care prognosis can be attributed to various reasons, such as:

- diagnosis of critical illness is often made late when organ dysfunction has already evolved;
- early warning scores that determine severity of illness that are not sensitive, reliable or valid;
- effective treatment for heterogeneous intensive care diseases is limited, however, even if it were available, widespread implementation of best practices is limited; and
- intensive care patients present with varying severities of illness and comorbidities (Adhikari et al., 2010).

The evolution of intensive care medicine and its impact on patient outcome have mostly been influenced by the development of monitoring and organ support technology and less by the development of much-needed therapeutic interventions. The slower development of therapeutic interventions is possibly due to the complexity of disease, intricacy of defining and diagnosing critical illness, the already-mentioned heterogeneity of intensive care patients and inconsistent acceptance and implementation of research results (Vincent & Singer, 2010).

Much emphasis is placed in medicine, including intensive care medicine, that practice must be guided by research findings – “evidence-based medicine”. For Vincent and Singer (2010, p. 1355), “The quality of available evidence in intensive care medicine, and its relevance to an individual patient, is still arguably less than in other disciplines.” The authors draw attention to the fact that the majority of reported, randomised, controlled trials in intensive care have been negative. Some of these randomised, controlled trials did not only have negative outcomes but also showed overall harm from theoretically advantageous interventions (Brunkhorst et al., 2008; Esteban et al., 2004; Finfer et al., 2009; Lopez et al., 2004; Takala et al., 1999). The insight of the intensive care practitioners into “underlying pathophysiological changes of critical illness, and the lack of diagnostic methods to rapidly identify suitable patients and appropriate timing for immunomodulatory or other therapies are still far from perfect” (Vincent & Singer, 2010, p. 1355).

The scarcity of appropriately trained intensive care health care workers remains a universal problem, especially in low-income countries (Adhikari & Rubenfeld, 2011; Vukoja et al., 2014).

As mentioned before, the model of intensive care organisation is still contentious. ICUs historically developed as speciality ICUs and there is an ongoing debate about the merit of general ICUs versus that of speciality ICUs, for example medical or surgical ICUs. Vincent and Singer (2010) suggest that the advantages of specialised ICUs include: it may be more cost-effective as different departments in a hospital may have their own budgets; the development of specialised skills in intensive care health care workers; patients are more homogeneous, and lastly, convenience, since surgical ICUs are often positioned close to operating theatres. The most important disadvantages of specialist ICUs are that intensive care is identical regardless of the initial cause of illness and intensive care personnel may be less skilled to care for patients that do not fit the classical speciality mould. Other disadvantages include that it may be more expensive as more equipment and personnel may be required and this model of intensive care organisation may contribute to burnout in intensive care.

Low-income countries pose even more problems for the delivery of intensive care services and some of these will be highlighted.

The ethical justification of intensive care services in low-income countries has been questioned based on the high cost involved. Engelhardt (1998) argues that imposing the American bioethical imperatives on low-income countries with different moral perspectives is inappropriate. The alternative argument is that “much of the burden of illness occurs among children and young adults with reversible illnesses that have a good potential for recovery” (Westcott, Martiniuk, Fowler, Adhikari, & Dalipanda, 2012, p. 1).

The care patients receive in intensive care includes superior monitoring, therapeutic interventions and organ support; these are not available in general wards (Vincent & Singer, 2010). The perceived high expenditure associated with intensive care provision in low-income countries may be misplaced. Riviello, Letchford, Achieng, and Newton (2011) note that intensive care is “not defined by expensive technology … At its core, critical care [intensive care] is simply healthcare for very sick people.” (p 860) Therefore, care for intensive care patients “may include oxygen administration or frequent nurse monitoring. Although these interventions may not be considered critical care [intensive care] in high-income settings, they are nonetheless important aspects of caring for critically ill patients and not universally available” (p 860).

Kerry and Sayeed (2014) believe that the development of intensive care in low-income countries is “often simplistically criticized as an ineffective use of scarce resources.” (p 265) The authors suggest that not all diseases that predicate intensive care admission is preventable and some diseases present “beyond the point of simple pill taking.” They further submit that intensive care services may improve a hospital’s capacity to render more effective care resulting in better outcomes. This may also change a commonly held popular perception in these countries that the hospital is the “place where one goes to die” (p 276) and consequently patients may seek care earlier and be treated more effectively. Circumventing preventable death will, besides decreasing mortality and the burden of disease, also positively influence life expectancy, birth rates and household productivity.

Recent publications suggest a renewed interest in intensive care delivery in low-income countries. However, available data are limited to a few epidemiological and outcome studies, mostly from academic centres (Adhikari et al., 2010; Riviello et al., 2011). There is an urgent need for an appropriate research agenda for low-income countries that will ethically and practically guide the development of intensive care delivery in these settings (Riviello et al., 2011).

International financial crises have major negative consequences for low-income countries and supersede the impact on high-income countries. The dual effect is to compromise the delivery of intensive care and increase the development of even more critical illnesses (Fowler et al., 2009).

Globally, sepsis and severe sepsis are leading causes of mortality and morbidity. Extrapolating data regarding sepsis and severe sepsis from high-income countries is ineffective because of the difference in age, aetiology, co-morbidities such as HIV, tuberculosis and malaria and prior health (Waitt et al., 2005). The high incidence of sepsis and the inability to diagnose and treat the condition have a major impact on outcome. Waitt et al. (2005), in assessing the mortality risk of adult patients with sepsis at the Queen Elizabeth Central Hospital in Blantyre, Malawi highlight the difficulty in using the benchmark diagnostic criteria used in high-income countries. The authors were limited to diagnosing sepsis using standard clinical criteria and unsophisticated laboratory tests.

The care of intensive care patients is often directed by guidelines developed in high-income countries. In a review of sepsis in vulnerable populations, Bhagwanjee and Ugarte (2014) highlight key limitations that make it impossible to adhere to the gold standard, the “Surviving Sepsis Guideline” authored by Dellinger et al. (2013) and updated by Rhodes et al. (2017). These challenges include the evolving definition of sepsis, the overwhelming burden of infectious diseases, the scarcity of human resources, infrastructure and sepsis research in high-income countries. The authors use the core principles of sepsis management, namely: early, effective fluid resuscitation, antimicrobial therapy and source control to illustrate why it is impossible in a low-income setting to adhere to the **“**Surviving Sepsis Guideline”. They conclude that “appropriate care must be guided by common-sense guidelines that are sensitive to local realities

and adapted as relevant data are acquired". This sentiment is echoed by Mer, Schultz, and Adhikari (2017) who made recommendations for fundamental treatment of severe sepsis in low-income countries. The authors conclude that, "The paucity of evidence from resource-limited settings underscores the urgent need for rigorous trials, since treatment effects may differ from trials in high-income settings." (p 5)

As highlighted before, determining the burden of critical illness is difficult. Buregeya et al. (2014) is of the opinion that estimates of the prevalence of acute respiratory distress syndrome fluctuate in high-income countries, possibly due to the disparity of available intensive care beds and the use of mechanical ventilation. In low-income countries there are very limited epidemiological data available regarding this syndrome. The authors call for the adjustment of the definition of acute respiratory distress syndrome:

> to allow a provision for environments without the capacity for positive pressure ventilation, and to allow for alternate diagnostic techniques … [this] may make it possible to quantify and describe the impact of ARDS [acute respiratory distress syndrome] in the global context. (p 289)

HIV has a significant impact on the already-compromised intensive care patients. Siedner (2014) states that although the prevalence of HIV in intensive care patients in low-income countries is unknown, rates of more than 50% have been reported in the wards of sub-Saharan-African hospitals. The care of HIV patients in ICU is difficult and requires a multidisciplinary team. However, it has been shown that intensive care patients with HIV that receive expert multidisciplinary intensive care have similar clinical outcomes to uninfected intensive care patients.

Intensive care risk prediction instruments are widely used in high-income countries to measure the impact of quality assurance programs, benchmarking and therapeutic interventions. These risk prediction instruments use sophisticated laboratory and intensive care technology that is not routinely available in low-income countries (Riviello et al., 2016). The authors undertook a study to assess the validity of the Mortality Probability Admission Model version

III in a low-income country. The authors concluded that the locally developed Rwanda Mortality Probability Model (using fewer variables) had more predictive power than the Mortality Probability Admission Model version III in two Rwandan ICUs.

It is important to know of emerging trends that will result in “the demand for critical care [intensive care] services to increase whereas the ability to pay will decrease” (Adhikari & Rubenfeld, 2011, p. 622). Populations are aging and hand in hand with an increase in age is the increase in comorbid diseases that contribute to critical illness. Advances in medicine have led to increased care for high-risk patients as seen in diabetics. Urbanisation has resulted in more than 50% of the world’s population migrating to cities where they will have easier access to intensive care services. In addition, high-density living in cities can contribute to an increase in communicable diseases that will further increase the need for intensive care services (Adhikari et al., 2010).

The demand for increased intensive care services is also influenced by the expanding role of intensive care health care workers in hospitals, for example as members of rapid-response teams. There is also an increase in the number of ICU beds in hospitals, for the period 1985 to 2000 there was a 25% increase in ICU beds in the United States of America (Adhikari et al., 2010). constrained

2.6 Intensive care delivery in various countries

In this section, the variability of intensive care delivery will be highlighted within and between countries. ICU delivery is primarily described through surveys. However, the number of such intensive care delivery surveys are limited, only conducted sporadically and only in a small number of countries. It must be noted that the surveys included in this discussion date from 2000 to 2016. Looking at the data trends over this period it can be concluded that intensive care delivery has seen low variability as there has been no substantial increase or decrease evident which validates the inclusion of early intensive care delivery surveys.

In a survey by Angus et al. (2006) conducted in the United States of America it was estimated that there were in total 5 980 adult noncardiac ICUs that were

heterogeneously organised and widely distributed throughout the country. Sixty-five per cent of the ICUs were combined medical-surgical units, 71% were located in non-teaching community hospitals, 53% had no intensivist coverage and of the remainder, 20% had some intensivist involvement. In-house doctor coverage outside office hours was poor: 12% during weeknights, 20% during weekend days and 10% during weekend nights. Only 4% of adult ICUs at the time complied with the Leapfrog standards (Leapfrog Group, 2016).

While international collaborative intensive care research in high-income countries has become the norm, the variations that exist among these ICUs are not known and this may influence the interpretation of research results. Wunsch et al. (2008) undertook a survey of intensive care services in eight countries (including the United States of America and countries from Western Europe) that often engaged in collaborative intensive care research. The survey revealed interesting results. There was no standard definition of what an ICU bed entailed. The number of adult ICU beds per 100 000 population and the number of ICU beds as a percentage of the total acute care hospital beds varied remarkably and are shown in Table 2-2.

Table 2-2 Adult intensive care services in eight countries (Wunsch et al., 2008)

Country	Adult ICU beds per 100 000 population	Adult ICU beds as % of all acute care beds
Unites States of America	20.0	9.0
France	9.3	2.5
United Kingdom	3.5	1.2
Canada	13.5	3.4
Belgium	21.9	4.4
Germany	24.6	4.1
Netherlands	8.4	2.8
Spain	8.2	2.5

The distribution and variation in intensive care delivery are important for the interpretation of research results. Of greater consequence is the varying ability to deal with unplanned events such as pandemics and environmental disasters. The influenza A (H1N1) pandemic highlighted the fact that “infectious outbreaks do not respect regional health boundaries” (p 6). Following the 2009 to 2010 influenza A (H1N1) pandemic, the Canadian Clinical Trials Group did a survey of all acute care hospital ICUs with the specific purpose of determining the number of ICU beds and ventilators and the ability to provide specialised support for respiratory failure. It was concluded that intensive care resources varied extensively across the Canadian provinces and that it might influence the ability of all regions in Canada to deliver equal care in these high-demand circumstances (Fowler et al., 2015).

The consequences of the variation in intensive care delivery between regions with dissimilar available resources were illustrated by a comparison of severely ill patients with H1N1pdm09 influenza admitted to ICUs in Mexico and Canada in the 2013 to 2014 season. The 90-day mortality for patients in Mexico was 50% and in Canada 13.9%. The baseline severity of illness, vasopressor requirements and the ratio of partial pressure of oxygen in arterial blood to the fraction of

inspired oxygen were similar in both groups of patients. The Canadian patients were slightly older and had a few more co-morbidities, both of which were associated with a higher mortality rate. Suggested explanations for the mortality difference are that the patients in Mexico presented to hospital on average three days later, they were admitted to ICU two days later and received antiviral therapy two days later than patients admitted to Canadian hospitals. Mexican ICUs had fewer ICU beds, fewer personnel and less advanced oxygen support (Dominguez-Cherit et al., 2016).

Croatia is currently categorised as a high-income country. However, in 2001 it was regarded as a middle-income country. It has long been held that rising health care costs have to be balanced with increasing health expectations. At the time, according to Hensher, Edwards, and Stokes (1999), the Eastern European and former Soviet Union countries had an overdeveloped hospital sector. The Croatian Society of Intensive Care Medicine recognised that a more rationalised intensive care system had to be established and as a first step undertook a national survey to establish an intensive care register (Degoricija et al., 2002). The authors established that there were 123 ICUs in Croatia with a total of 900 ICU beds (3.3% of total hospital beds). The survey identified that 39.3% of ICUs were in the Croatian capital.

It must be emphasised that the dearth of data from low-income countries makes extrapolation across countries impossible (Dünser, Baelani, & Ganbold, 2006). Therefore, a variety of survey information from low-income countries is presented in an attempt to depict some of the realities.

Westcott et al. (2012) undertook a cross-sectional survey of intensive care resources in the Solomon Islands. The Solomon Islands, north-east of Australia, consists of 350 populated islands and has a population of 515 870 and is categorised as a “least developed country”. Health expenditure in 2009 was 5.4% of the GDP or 147 international dollars per person. There is one tertiary-care hospital, seven provincial hospitals, four privately funded hospitals and no dedicated ICUs on the islands. However, one of the provincial hospitals that was included in the survey had two “acute care” beds in a ward.

The most frequent treatment plan for intensive care patients was “to admit to a regular hospital bed for active medical care” (p 3). Participants stated that critical illness was common and malaria, respiratory disease, diabetes mellitus and tuberculosis were the diseases that most often lead to critical illness. General medical equipment was available, but basic and sophisticated technology associated with intensive care (such as pulse oximeters, oxygen concentrators, invasive pressure monitoring and haemodialysis) were not available. The situation was further complicated in that there were limited nurses and doctors available with intensive care expertise to care for the patients (Westcott et al., 2012).

Although this survey relied on the opinion of respondents rather than objective data (that does not exist for the islands), it nevertheless provided a first step toward the development of intensive care in the Solomon Islands. The authors conclude:

> Emphasis should be on the development and acquisition of simple and inexpensive tools rather than complicated equipment, to prevent critical care from unduly diverting resources away from other important parts of the health system. (Westcott et al., 2012, p. 8)

There is often a perception that it is the most sophisticated treatment modalities and equipment that saves lives and that intensive care needs or rather deserves a bigger slice of the health care budget. It is commendable that the survey respondents from a low-income country appreciate that basic intensive care interventions such as appropriately trained staff, basic monitoring and oxygen therapy would have a huge impact on the outcomes of critical illness.

In 2011 it was reported that Malawi had three public and one private, multidisciplinary, adult and paediatric ICUs each with four beds, for a population of 13 million people (approximately one bed per one million people) (Gondwe, Bhengu, & Bultemeier, 2011). A new paediatric wing is under construction at the Queen Elizabeth Central Hospital in Blantyre, and it will include the first designated paediatric ICU. It is estimated that this ICU will be opened early in 2017 ("Madonna visits hospital in Malawi to view paediatric unit," 2016).

Two retrospective, one-year audits of two tertiary hospitals were identified. In the first audit in 2002, 339 patients were admitted to the Queen Elizabeth Central Hospital ICU in Blantyre – an 82% bed occupancy (Size, Borgstein, & Haisma, 2005). At the time, the ICU had four ventilators, a basic electrocardiograph, pulse oximetry and blood pressure monitoring available. A minimum of two nurses (educational background not mentioned) were typically on duty and 24-hour medical cover was provided by clinical officers (non-physician trained) with support from an anaesthetic consultant. Only full blood count and blood glucose levels were available on a regular basis and serum sodium, potassium, urea and creatinine measurements were available sporadically from the laboratory service. Of the admissions, 45% were ventilated for an average of 3.5 days and a maximum of 29 days. The mortality rate was 38% for the year (71% for ventilated patients and 10% for non-ventilated patients). This is much higher than the 8% to 18% mortality rate in high-income countries. It was not possible to assess the severity of illness as intensive care patient acuity scores, such as APACHE II, require arterial blood gas analysis that could not be measured. It is therefore difficult to interpret the higher mortality rate.

The second audit was done in 2012 in the Kamuzu Central Hospital ICU in Lilongwe (Gundo et al., 2014). The ICU had five beds, three ventilators, five cardiac monitors with limited functionality, pulse oximeters, a capnometer, an oxygen concentrator and oxygen cylinders. Laboratory services were limited – similar to the 2002 audit. Although the ICU fell under the auspices of the anaesthesia department, there was limited medical input. Most of the care was rendered by clinical officers. The nurses working in the ICU had no specialised intensive care training. A total of 253 patients with a mean age of 29 years were admitted during the year. The majority of patients were admitted due to head injuries and polytrauma. A high mortality rate of 60.9% was reported, 76.5% of deaths were patients 40 years and younger and 39.6% was attributed to sepsis. The authors indicated that 56% of females and 82% of males in the age group 15 to 49 years were employed. The loss of such a high percentage of employed people is catastrophic for the economy of a country, especially for a low-income country.

In 2014, a survey was undertaken in an ICU and three high-dependency units in a Malawian referral hospital. Nurses' knowledge, competency and enteral feeding practices were determined (Mula, Ncama, & Maluwa, 2014). Enteral feeding is a basic intensive care nursing intervention and the survey revealed that nurses received only general nursing-school enteral-feeding training. Varying knowledge and competency reflected a lack of formal and informal intensive care training. Enteral feeding is regarded as a basic intensive care nursing intervention and it has potential detrimental consequences if not done correctly. Competent intensive care nurses are essential for safe delivery of intensive care; even more so in a low-income country. It is important to note that the challenges nurses faced with enteral feeding, such as a shortage of feed and enteral feeding tubes, hindered the quality of care patients received.

Jochberger et al. (2008) did a national survey of anaesthesia and its allied disciplines in the Republic of Zambia, one of the poorest countries in the world, in 2006. Of the 87 hospitals in Zambia, 78% took part in the survey and of these hospitals only 7% (n=5) had ICUs. The ICUs were located in four referral hospitals in provincial capitals and a tertiary hospital in Lusaka. A total of 29 ICU beds served a population of 12 million people. Anaesthesiologists were in charge of four of the ICUs and a specialist physician was in charge of the fifth ICU. The majority of patients admitted to ICU were children and young adults and the most common cause of death was sepsis. None of the ICUs had an up-to-date critical care textbook available on site.

Murthy, Leligdowicz, and Adhikari (2015) called for a central database in low-income countries; this may assist to "evaluate access to and outcomes from critical care [intensive care], both within and between countries" (p 8).

Although a central, intensive care database would be an important first step in understanding intensive care delivery, there is a need for a more in-depth understanding of intensive care delivery internationally.

2.7 Improvement in intensive care

To date, improving intensive care delivery has focused on aspects of service delivery and not on improvement of the system as a whole. The aspects that receive the most attention are patient safety and improvement of the quality of care delivery. Leape et al. (2009) highlight that “while efforts to improve patient safety have proliferated in the past decade, progress toward improvement has been frustratingly slow” (p 424). For the authors, a contributing factor to this slow progress is “the persistence of a medical ethos, institutionalized in the hierarchical structure of academic medicine and health care organizations, that discourages teamwork and transparency and undermines the establishment of clear systems of accountability for safe care” (p 424). This is true for many health systems such as intensive care but does not reflect the bigger picture of why patient safety remains a problem in health care and intensive care. The authors proceed by identifying five concepts: transparency, care integration, patient/consumer engagement, restoration of joy and meaning in work as well as medical education reform, to “provide vision and strategic direction for the patient safety work” (p 424). Six years later, in 2016, the original statement still holds true; very little progress has been made in spite of a great many initiatives.

The acknowledgement of using a systems approach for improvement is starting to surface in the intensive care literature. However, it is clear that systems thinking as a discipline and the complexity of intensive care are not always known or valued. Tropello, Ravitz, Romig, and Pronovost (2013) in an article, “Enhancing the Quality of Care in the Intensive Care Unit – A Systems Engineering Approach”, state the following key points as a summary of their article.

- Health systems must embrace a more formal process to deal with rising cost, complexity, and patient harms.
- Systems engineering methodologies have been applied successfully to solve other major industrial problems.

- The systems engineering process reproducibly formalizes defining system problems and goals and prioritizes development of a system to meet those goals.

- The Patient Care Program Acute Care Initiative project will use a holistic patient-centred systems engineering approach to reengineer the intensive care unit.

- Application of systems engineering principles to the Patient Care Program Acute Care Initiative project will help enhance the quality of care and reduce patient harm.

It is important to note that the authors did not systemically conceptualise the problem, but chose to use a reductionist approach were the machine metaphor dominated. The aim of the reengineering process was to develop a template for the universal intensive care, ignoring the context of the individual ICU. The authors also made unilateral decisions without input from the multiple intensive care stakeholders. The focus of the reengineering process was on “hard” issues such as the technology and the “soft” issues such as relationships and communication were disregarded. Tropello et al. (2013), by advocating a generic systems engineering approach, ask for quantification and optimisation of the intensive care system. The authors, in their attempt to develop a template for universal intensive care fail to understand that improvement is merely temporary and local whereas the aim is to ensure sustainable improvement as suggested by Midgley (2000).

Reflecting on what has been achieved in intensive care, it becomes clear that, despite investment of a vast “amount of time, energy, and resources, the search for a cure-all magic bullet has failed … there is a need for a greater understanding of basic processes involved in the care of sick patients, and how this greater understanding can be used to increase patient outcomes” (Moreno & Rhodes, 2010, p. 1275). This sentiment is echoed by Levy (2006) who states that it is now imperative to concentrate rather on the “process of care delivery than the model” (p 227).

Intensive care fulfils an important role in health systems, yet there are many shortcomings in intensive care delivery, and comprehensive attempts should be made to improve the delivery of intensive care. Garland (2005b) suggests that there should be a "shift from a paradigm that concentrates on individual performance, to a systems-orientated approach" (p 2165). Intensive care has been traditionally appraised based on intensive care patient outcomes, but Garland (2005a) suggests that many more domains should be appraised, i.e. medical, economic, psychosocial, ethical and institutional outcomes. According to the author, "judging ICUs based only on patients' health outcomes fails to recognize the larger social value associated with expert care of these patients" (p 2153). The primary focus of intensive care is to address the medical needs of critically ill patients, however, it also affords indispensable services to family and friends of intensive care patients, intensive care personnel, the hospital and society.

In an attempt to obtain a more comprehensive understanding of intensive care delivery, Halpern (2011) introduced the concept of *intensive care capacity strain*. The author defines intensive care capacity strain as: "A temporally varying influence on a given ICU's ability to provide high-quality care for everyone who is or who could become a patient in that ICU on a given day." (p 648) Quality care for the author is as defined by the Institute of Medicine (National Research Council, 2001) as care "that is safe, effective, patient-centred, timely, efficient, and equitable". The analogy that the ICU functions as a balloon is used; the ICU will be able to accommodate more and more patients with increasing acuity levels. Unfortunately, as we know, at a certain point the balloon will pop – this is when intensive care delivery will decline. The author draws attention to fundamental questions that arise:

- What factors strain an ICUs capacitance (what factors increase pressure inside the balloon?)
- What threats does high strain pose to patients who are or could be cared for in the ICU (what happens if the balloon pops?)

- What organizational characteristics of ICUs enable some to accommodate increasing strain better than others (why are certain balloons more elastic than others?) (Halpern, 2011).

Rastegar (2004) very eloquently stated: “The challenge for all of us is to ensure that our health system [intensive care system] is effective and caring, not just efficient.” (p 82)

The discussion will now focus on the status of intensive care delivery in South Africa as informed by the national audit of critical care resources (Bhagwanjee & Scribante, 2007; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d).

2.8 Current status of intensive care service delivery in South Africa

In the foreword to the 2007 World Health Organisation (WHO) document, *“Strengthening Health Systems to Improve Health Outcomes”*, Margaret Chan, director general of the WHO makes the following statement:

> The world never possessed such a sophisticated arsenal of interventions and technologies for curing disease and prolonging life. Yet the gaps in health outcomes continue to widen. Much of the ill-health, disease, premature death and suffering we see on such a large scale is needless, as effective and affordable interventions are available for prevention and treatment. The reality is straightforward. The power of existing interventions is not matched by the power of the health system to match them to deliver them to those in greatest need, in a comprehensive way and on adequate scale … The best measure of a health system’s performance is the impact on health outcomes. (WHO, 2007, p. iii)

This statement is made with regard to national health systems. The same yardstick used to measure the performance of a national health system can be used to measure the performance of a subsystem such as intensive care. This discussion will make use of the WHO’s *“Framework for Action”* (WHO, 2007), shown in Figure 2-3, to contextualise some of the problems that currently exist in South African ICUs. This framework for action consists of six “health system

building blocks" viz. service delivery, health workforce, information, medical products and technologies, financing, leadership and governance.

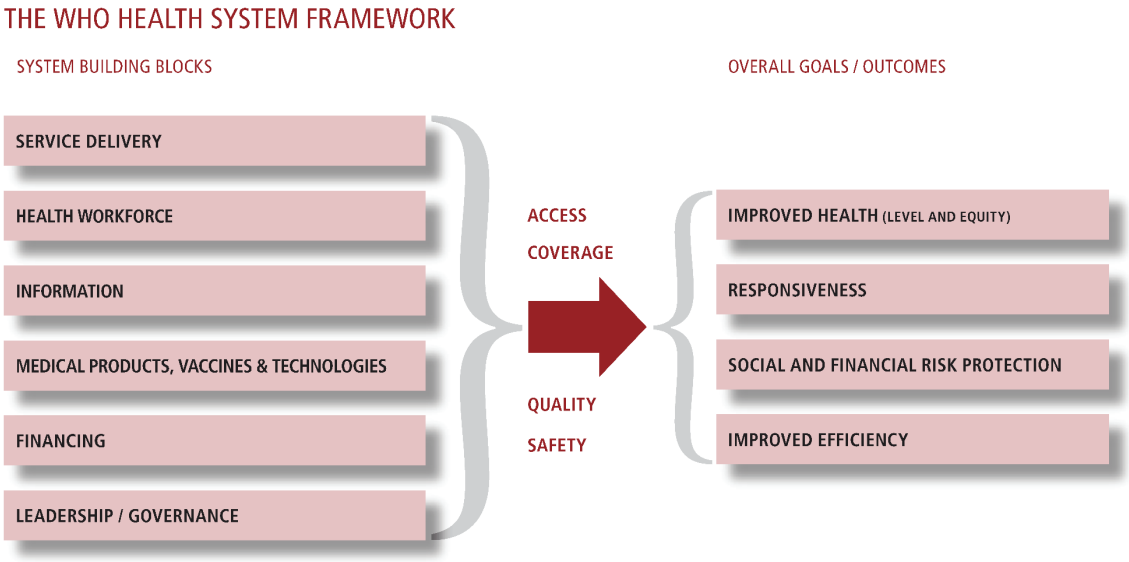


Figure 2-3 The WHO's Health System Framework (WHO, 2007)

2.8.1 Service delivery

> Good health services are those which deliver effective, safe, quality personal and non-personal health interventions to those that need them when and where needed, with minimum waste of resources. (WHO, 2007, p. 3)

Current status of intensive care resources in South Africa

In 2004 and 2005, a project was initiated under the auspices of the CCSSA to identify all (public and private) intensive care resources available in South Africa (Bhagwanjee & Scribante, 2007; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d) The major results from the first part of the audit as discussed below,

describe where public and private services (no differentiation is made) were rendered and the extent of physical resources available to the population.

For the purposes of this discussion, “ICU” will include ICU and “high care”. There is no formal definition of ICU and high care in South Africa. The majority of ICUs consist of both ICU and High Care beds and the beds are used interchangeably as determined by the demand (Scribante & Bhagwanjee, 2007b).

A total of 396 acute care public hospitals and 256 private hospitals were identified and a 100% sample was obtained. In the public sector, 23% of hospitals had ICU and/or high care facilities compared to 84% of hospitals in the private sector. In the public sector, there were a total of 210 units, compared to a total of 238 in the private sector.

There are two different models of care delivery in intensive care: open or closed units. In an open unit, the primary physician, regardless of his/her intensive care expertise, can admit and treat a patient. Conversely, in the closed unit a physician with formal training or experience in intensive care will be the head/director of the ICU and will take over and direct the admission and treatment of the patient. There is abundant evidence (Angus & Black, 2004; Gutsche & Kohl, 2007; Higgins et al., 2003; Robnett, 2006) supporting the superiority of the latter model as it is more cost-effective and ensures better patient outcomes. Ideally, the physician in charge of the closed unit should be an intensivist who has had formal training in intensive care medicine (Leapfrog, 2009).

Only 7% (15) of all public sector units complied with the ideal closed-unit model and less than 1% of units in the private sector did.

The study also found that there were 1 783 ICU beds in the public sector and 2 385 beds in the private sector. The private sector represented 57% of all beds (2 385/4 168). The majority of units and beds in both the public and private sectors were located in three provinces with Gauteng, Kwazulu-Natal and the Western Cape representing 86% (3 246/4 168) of all beds. The Eastern Cape and Free State had fewer than 300 beds each. The remaining four provinces

(Limpopo, Mpumalanga, North-West and Northern Cape) had 100 or fewer beds per province.

The population distribution significantly affected the bed to population ratio. The public-sector bed: population ratio in the Free State, Gauteng and Western Cape was less than 1:20 000. In the other provinces, the ratio ranged from 1:30 000 to 1:80 000. The majority of units were in Level 3 hospitals[3], but significant numbers of beds existed in Level 1 hospitals in the Free State and KwaZulu-Natal.

Neonatal and paediatric patients make up a significant percentage of the general population and neonatal and paediatric ICUs need specialised intensive care expertise (medical and nursing) to be able to render optimal cost-effective care for these patients. In the public and private sector combined, 19.6% of beds (8 15/4 168) were dedicated to paediatric and neonatal patients with a similar disparity across all provinces resulting in hospitals admitting children to mixed adult medical surgical units which is not ideal.

There was a significant under-utilisation of existing infrastructure; of all ICU beds across all provinces 2.3% (95/4 168) were commissioned but not being utilised because of a lack of staff or equipment.

The results from this audit are compelling and offer a framework on which future planning of intensive care in South Africa can be based. It would be naive to think that the solution to the problems identified in the audit is straightforward. Equally, it would be unjust to the patients we are meant to serve if we fail to act on such compelling objective evidence. To deny the need for action is untenable and will perpetuate the injustices of the past (Bhagwanjee & Scribante, 2008).

… effective, safe, quality health interventions …

There is a paucity of evidence in the South African intensive care community describing “how” effective, safe, quality health interventions and services are

[3] Level 1: Community hospital
Level 2: Regional hospital
Level 3: Tertiary/Academic hospital

delivered. One study that partly described the “how” of intensive care delivery is the second part of the national audit of critical care resources which addressed the “Prevalence of Infection in South Africa”, commonly referred to as the PISA study (Paruk et al., 2012). This study concluded that the prevalence of sepsis and the associated mortality was similar to that described in other international studies. Physicians tend to over-diagnose sepsis. Antibiotic prescribing practices were suboptimal with respect to selection, modification after microbiology data and duration of treatment. A major deficiency in diagnostic and therapeutic ability among physicians was identified in this study.

The death of six neonates in 2010 at an academic hospital in Johannesburg has drawn the attention to the question of “how” effective, safe, quality health interventions and services are rendered (Serrao, 2010).

… to those that need them …

There is a view that intensive care – a very scarce and expensive resource – is often rendered to patients that are either too ill or not sufficiently ill. The PISA study confirmed that a significant percentage of patients admitted to open units (that is primarily ICUs in the private sector and level 1 and 2 hospitals in the public sector) were less severely ill or were unsuitable intensive care patients (Paruk et al., 2012).

One motivation for admitting patients to ICUs is that the level of care in general hospital wards is commonly perceived as being sub-standard and that the patient will benefit from the specialist care and around-the-clock attention received in the ICU.

However, in reality this is not accurate. While the ICU renders a more focused service, it is also associated with an increased risk of adverse events, for example exposure to multi-resistant microbial organisms.

2.8.2 Demand for intensive care services

With an increase in the general public's awareness levels of specific health issues, as reflected by various recent press reports (Flanagan, 2009; Gerretsen, 2009) the demand for more comprehensive intensive care services will increase.

Health service delivery according to population needs

The health needs of a population evolve over time. Primary health care has been targeted as the main health service focus in South Africa and progress has been made in this regard (Gray & Pillay, 2006). However, according to the national Minister of Health, the delivery of primary health care is still not optimal (Motsoaledi, 2010). The consequence of this is that more patients who survive co-morbidities such as diabetes and HIV/AIDS at the primary health care level present for treatment at the secondary and tertiary health care levels, with complications of preventable diseases. The result of this is an increase in the demand for intensive care services. This is already evident and will increase further in future.

Organisation of intensive care health service network

The objective of an organised intensive care service provider is to render an effective quality service to the population on an equitable or reasonable access basis (Angus & Black, 2004). Currently, intensive care services are fragmented and very little integration exists between public sector institutions and even less between the public and private sectors (Bhagwanjee & Scribante, 2008).

2.8.3 Management of intensive care health service

In the preface of the South African Health Review (Gray & Pillay, 2006), Ijumba and Padarath state that the purpose of the review is to assist as a resource on the development of the national health system. The authors express the hope that the review will provide a practical resource for "health policy makers and planners, health workers, and other stakeholders interested in health system development in tackling challenges associated with provision of equitable health care" (p xi). As mentioned in the introduction to Chapter 2, the intensive care

system forms an integral part of the health system. Based on comments from the review and the National Audit of Critical Care Resources (Bhagwanjee & Scribante, 2007, 2008; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d) it is concluded that the aim of intensive care delivery should be to maximise service coverage, quality and safety and minimise waste. Management at all levels of intensive care lacks autonomy and delegated authority. There is no scope or encouragement for managerial innovation; no demand for programme consistency, accountability, and methods to monitor progress of intensive care delivery.

Health workforce

> A well-performing health workforce is one that works in ways that are responsive, fair and efficient to achieve the best health outcomes possible, given available resources and circumstances (i.e. there are sufficient staff, fairly distributed; they are competent, responsive and productive). (WHO, 2007, p. 3)

The intensive care workforce in South Africa consists of various members, inter alia nurses, physicians, physiotherapists and dieticians. The focus of the discussion will be on the two main members' viz. nurses and physicians. The information available on the intensive care health workforce is the result of the national audit of critical care resources and subsequent related academic research (Scribante & Bhagwanjee, 2007a, 2007b). No comprehensive database is maintained by any of the different role players such as the national Department of Health, the SANC or the South African Medical and Dental Council.

Nursing resources

Results from the national audit of critical care resources (Scribante & Bhagwanjee, 2007a) revealed alarming results.

Only 25.6% of nurses working in intensive care were intensive care trained and only 3.8% were trained as neonatal intensive care nurses. The remaining nurses were registered nurses (49.2%) and semi-professional nurses (21.4%). The majority of the nurses (65%) were working in the private sector.

A large proportion (42.8%) of the professional nurses had 0 to 5 years' experience. In intensive care, it is crucial that nurses have the ability to make accurate clinical judgements that guide safe practice. Nursing care without suitable training and experience may be associated with patient harm, especially when combined with poor motivation, staff shortages, inadequate supervision and lack of support staff.

The fact that 42.8% of professional nurses had 0 to 5 years' experience could imply that the nursing cohort working in intensive care is relatively young. A subsequent study looking at the motivations and expectations of postgraduate intensive care nurses at a Johannesburg nursing college revealed that the average age of the nurses joining the programme was 39 (27 to 52) years (Scribante, Gross, Kearns, & Perrie, 2008). The results from this study motivated the authors to undertake a national study to determine a profile of post-graduate intensive care nurses and educators. A concern in the United States of America is that 76% of the members of the American Association of Critical Care Nurses are 40 years or older; posing concerns for care provision by an aging population (Robnett, 2006). In South Africa, it appears that care is also delivered by older nurses, however by nurses with limited experience.

There are only 1.1 nurses per ICU or high care bed in South Africa. There is ample evidence that nurse: patient ratios directly influence patient mortality and morbidity and the cost-effective use of health care resources (Amaravadi, Dimick, Pronovost, & Lipsett, 2000; Dang, Johantgen, Pronovost, Jenckes, & Bass, 2002; Hugonnet, Harbarth, Sax, Duncan, & Pittet, 2004; Tarnow-Mordi, Hau, Warden, & Shearer, 2000). According to an international standard (Williams & Clarke, 2001) the ideal ratio is 6.7 nurses per ICU bed and 3.9 nurses per high care bed, provided that at least 50% of these nurses have an intensive care qualification. While it is acknowledged that a ratio of 6.7 might be the gold standard, it is also a standard that is not commonly achieved in other countries. This does, however, emphasise the magnitude of the intensive care nursing crisis in South Africa. Given the ICU bed supply in 2007 and using an average of three nurses per bed the national deficit was some 7 920 nurses.

Generally, and with slight variations, nurses in intensive care work an official 40-hour week in South Africa. No research or evidence is available on agency nursing staff working in intensive care in South Africa. Unpublished data from the National Audit of Critical Resources has shown that the use of agency staff has increased faster than the pool of intensive care nurses has expanded and that the majority of the agency nursing workforce comprises nursing staff permanently employed elsewhere and who are “moonlighting”, often without formal employer awareness or consent.

It is therefore believed that, on average, many ICU nurses work more than the recommended 40-hours per week, but how much more has not been quantified (Scribante & Bhagwanjee, 2007a). Intensive care nurses must generally be alert to subtle changes in their patients’ condition, be able to accurately perform clinical assessments under pressure and to respond and intervene accordingly. Long working hours result in a reduced level of alertness and commensurately lead to an increased probability of adverse events (Scott, Rogers, Hwang, & Zhang, 2006). Working back-to-back in different intensive care units also increases the probability of spreading multi-resistant microbial organisms from one unit to another.

The health status of the nursing workforce is also a major concern. A study conducted in two public sector hospitals in Gauteng found that the prevalence of HIV amongst nurses was 13.5%. A high proportion of the study sample had CD4 counts below 350 cells/μℓ (Connelly et al., 2007). The results from this study are consistent with previous research of the HIV/AIDS epidemic among health care workers in South Africa (Shisana, 2004). No later studies pertaining to the prevalence of HIV amongst nurses could be identified. The HIV prevalence amongst female adults in 2007 was 20.79% and 21.17% in 2017. The majority of nurses in South Africa are female (South African Nursing Council, 2017), it can therefore reasonably be assumed that the prevalence rate among nurses remains similar in 2017.

Studies have shown that the knowledge in a number of clinical areas of intensive care nurses in South Africa is lower than the acceptable standard. Perrie (2006) and Windsor (2005) showed that there was little difference between the

knowledge of intensive care trained and non-trained nurses; there was also a poor correlation between knowledge levels and years of experience. In South Africa, there is no on-going process of accreditation for intensive care educators or nurses practising in intensive care. A study conducted in a Johannesburg nursing college showed that nurses' main motivation for entering the postgraduate critical care diploma programme was because they lacked basic nursing skills (Scribante et al., 2008). This lack of basic nursing knowledge is confirmed in the evaluation of nurses in a large KwaZulu-Natal hospital where there is an on-going intensive care nursing outreach program to the general hospital wards. A basic vital sign is respiratory rate, a sensitive indicator of a patient's condition worsening was recorded by ward nurses in 77% of patients as "normal" – 20 breaths per minute (Carter, 2008).

Not only is the health and vigilance of the intensive care nurses a concern, but the nurses working in South African ICUs have low morale. A qualitative study (Scribante, Schmollgruber, & Nel, 2005) which posed the question *"How do you find working in ICU?"* had disturbing results. The nurses described a dichotomous, passionate nightmare of working in two worlds. Intra-personal experiences were very positive (passionate). On the other hand, inter-personal experiences and working experiences and conditions were experienced as being very negative (nightmare).

Migration of nurses is often given as the reason for the acute shortage of nurses in South Africa. The Democratic Nursing Organization of South Africa commissioned a report on nurse emigration from South Africa which was published in 2001. The report of Xaba and Phillips (2001) cautioned about the differences in emigration data collected by different institutions in South Africa. The authors of this report concluded that it was neither possible to determine the actual number of nurses leaving the country, nor to determine to which country they have moved.

Remuneration of nurses is a major concern and is a very emotive subject. Two qualitative studies (Scribante et al., 2008; Scribante et al., 2005) have shown that while remuneration is a concern, there are bigger problems that exist in nursing;

a substandard monetary remuneration nevertheless influences the calibre of applicants attracted to and – importantly – retained in the profession.

Medical resources

The ICU should be run by an intensivist (medical sub-specialist) who is responsible for taking the lead in developing and implementing guidelines and protocols and for developing a team approach to intensive care (Leapfrog, 2009). Gutsche and Kohl (2007) support the view that morbidity and mortality – as well as the total cost of care – increase in (a) open units and (b) units where a team approach does not exist. In 2007 the deficit of intensivists was estimated to be some 291 (Scribante & Bhagwanjee, 2007b).

No evidence is available that describes the working hours, health status, level of knowledge, morale, migration patterns and remuneration of physicians working in intensive care.

2.8.4 Health information system

> A well-functioning health information system is one that ensures the production analysis dissemination and use of reliable and timely information on health determinants, health system performance and health status. (WHO, 2007, p. 3)

No formal, on-going, national information system exists for intensive care in South Africa. Reporting systems vary between haphazard and non-existent and intensive care performance management is also non-existent. The CCSSA council in October 2017 acknowledged that the absence of a comprehensive national ICU health information knowledge base is problematic and therefore identified two projects to initiate the process to establish such a base.

Firstly, that the 2005 National Audit of Critical Care Resources yielded invaluable information and should be repeated as soon as possible and at regular intervals (frequency still to be determined). Secondly, the endorsement of an ICU outcome database that is currently being developed by members of the Society.

2.8.5 Medical products, vaccines and technologies

> 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 and cost-effective use. (WHO, 2007, p. 3)

Medical products and technologies available for use in intensive care are controlled by the Medical Control Council and are on the whole of good quality and safe to use.

Public sector ICUs are often constrained in their ability to access essential medical products and technologies as compared to private sector units.

The PISA study, the second part of the national audit of critical care resources highlighted that antimicrobials were not always used on a scientifically sound basis and in a cost-effective manner (Paruk et al., 2012; Scribante, Bhagwanjee, Paruk, & Perrie, 2007).

Anecdotally, this is also true for other medical products and technologies used in intensive care.

2.8.6 Health financing

> A good health-financing system raises adequate funds for health, in ways that ensure people can use needed services, and are protected from financial catastrophe or impoverishment associated with having to pay for them. It provides incentives for providers and users to be efficient. (WHO, 2007, p. 3)

South Africa is a middle-income country and spent 8.8% of GDP on health care in 2014, which compares favourably with the United Kingdom (9.1%) and Australia (9.4%) (World Bank, 2017a). However, on a per capita basis, adjusted for average exchange rates and purchasing power parity (constant 2011 US Dollars), South Africa spent on average US$1 148 per capita in 2014 as compared to the United Kingdom (US$3 377) and Australia (US$4 357) (World Bank, 2017b).

While there is an appropriate emphasis on primary health care, tertiary care (of which intensive care forms a part) has been prioritised as part of the modernisation of tertiary services by the national government (Department of Health, 2009).

In practice, the total budgets reaching intensive care service delivery are not adequate to achieve this modernisation. Furthermore, existing resources are often not optimally used in the current intensive care delivery system and addressing this problem will make a significant contribution to delivery of optimal intensive care.

It is alarming to note that there is a paucity of information with regard to the financing of intensive care. We posed the question: *"How much does it cost to treat an average patient in ICU?"* to a number of key role players. The only data that could be used to approximate the answer to the question were obtained from a large health insurance company which reported that 10% of their members made use of intensive care services and that some 35% of their annual budget is paid towards intensive care services (Confidential communication, 2009).

There are currently no accountability mechanisms in place to ensure transparent and effective use of resources.

2.8.7 Leadership and governance

> Leadership and governance involve ensuring strategic policy frameworks exist and are combined with effective oversight, coalition-building, regulation, attention to system design and accountability (WHO, 2007, p. 3).

This building block is the most complex and the most critical to ensure the effective functioning of intensive care as an integrated component of the overall health care delivery system. The broad array of problems and shortcomings highlighted in the previous sections underscore South Africa's multitude of failings in this regard at leadership and government level.

2.8.8 Political environment

Intensive care functions within a political milieu. The policy, financial and physical resources allocated to health care are influenced by political decisions. The purpose of this sub-section was to demonstrate that one must take into consideration political considerations when dealing with system that functions within a larger eco-system.

Minister Aaron Motsoaledi, national Minister of Health, declared on taking office in May 2009 that he was shocked at the state of the public health system. He admitted that media reporting of dirty and overcrowded hospitals, long waiting times and lack of medical supplies were largely true: “I don’t think it will be an exaggeration to say that some of our hospitals are death traps” ("Don't get ill," 2010). Minister Aaron Motsoaledi (2010) stated in a meeting with the CCSSA council that public health care had deteriorated in the last decade and if drastic measures were not taken before 2015, life expectancy in South Africa is likely to drop to that of 1955.

Ms Helen Zille (Zille, 2009), the previous leader of the official opposition party, in commenting on the mooted institution of a national health-insurance (NHI) scheme said: “It degrades our society when the poor and the sick are unable to get decent medical treatment … Reform of our health system must aim at correcting the failures in public health and spreading wider the success in private health.” (pa 1)

In an attempt to bridge the gap between private and public health care the government has proposed introducing an NHI scheme. The proposed national health-insurance scheme is surrounded by controversy, and it seems unlikely to be introduced in the immediate future ("Don't get ill," 2010). Ms Helen Zille is of the opinion that an NHI scheme would deepen the failure of public health care and reduce the benefits of private health care. She is also concerned that such a scheme will “spend a bigger proportion of health care funds on bureaucrats than on doctors” (Zille, 2009).

The problems in public health care are real and a valid concern. The problems are highlighted and politicised in the media and private health care is often portrayed as best practice. Private health care in South Africa has its own problems which, for various reasons, do not receive the same level of attention. Unfortunately, there are no South African-specific data, but a recent American survey (Carman et al., 2010) mirrors some of the problems of private health care in South Africa.

The survey found that patients believe that more care is better, that the latest and most expensive treatments are the best, that none of their doctors provide sub-standard care, and that evidence-based guidelines are a pretext for denying them the care they need and deserve (Carman et al., 2010). However, while possibly counter-intuitive, it is a given that more “medicine” is not always better, that evidence-based guidelines may in some instances translate into less but better care, that doctors are fallible and should be questioned, and that the cost of treatment does not always ensure quality of health care.

2.9 Summary of intensive care delivery

The complexity of intensive care delivery has been highlighted by elucidating the general challenges to intensive care delivery, the delivery of intensive care in , high-, middle- and low-income countries with specific emphasis on South Africa and attempts to improve intensive care delivery.

The Constitution of the Republic of South Africa (1996) states in section 27 that everyone has the right of access to health care services and that no one may be refused emergency medical treatment, that the state must further take reasonable legislative and other measures in terms of policies and programmes – within its available resources – to achieve the progressive realisation of these rights and that legislation, policies and programmes must be reasonable in both their conception and implementation (Gray & Pillay, 2006).

Based on the current status of intensive care in South Africa and the undertaking made in the South African Constitution that everyone has the right to access health services. It is essential that problems in intensive care delivery should be

identified and addressed and that the extent of the problems requires an unconventional, holistic and creative approach to develop a framework for improvement of intensive care delivery.

In the next chapter, systems thinking as an alternative approach to the improvement of complex health care and intensive care problems is introduced.

Chapter 3: Systems thinking as an alternative approach for the improvement of complex health care and intensive care problems

Descartes argued at the beginning of the scientific revolution that using the method of “reductionism” the world and its problems could be understood. Jackson (2000) argues that reductionism or scientific method is successful in producing knowledge and transforming our world through technologies, but problems occur when this method is used in complex, real-world problems set in social systems. This statement holds true for intensive care delivery: the scientific method has been essential to generate knowledge, but failed to address complex real-world problems. Systems thinking is proposed as an alternative approach to address the complex problems of intensive care delivery.

For Jackson (2000), systems thinking is not a discipline but rather a transdiscipline as it does not attempt to delineate a specific area of study in the manner that disciplines such as biology and chemistry do. The author also regards systems thinking as transparadigmatic as the main systems thinking ideas are “interpreted differently according to the paradigm from which they are viewed.”

Systems thinking, according to Stacey (2007), “ … seeks to understand phenomena as a whole formed by the interaction of parts” (p 40). There are different levels at which phenomena exist or need to be considered. The concepts of wholes, boundaries and levels are central distinguishing features of systems thinking.

Richmond (1994) defines systems thinking as “the art and science of making reliable inferences about behaviour by developing an increasingly deep understanding of underlying structure.” (para. 17)

According to Sanal (2004), systems thinking is a framework for seeing interrelationships rather than seeing things independently. The author refers to this framework as seeing the forest and the trees as systems-thinking

practitioners position themselves so that they can see both the forest and the trees.

The approach of systems thinking is fundamentally different from that of traditional research frameworks. Traditional research frameworks focus on separating the individual pieces of what is being studied. Systems thinking, in contrast, focuses on how the phenomena being studied interact with one another. This implies that, instead of isolating smaller and smaller parts of the system, systems thinking works by expanding its view to take into account larger and larger numbers of interactions of the system being studied. The results obtained in this manner often yield remarkably different conclusions to those generated by traditional research. This is especially true when the system that is being studied is dynamically complex or has a great deal of feedback from other sources, both internally and externally (Aronson, 2006).

Checkland (2007) refers to this attempt as searching for the holistic rather than the reductionist outcomes of the systems movement. The systems movement reflects for the author the “systems account of the observed world and the systems approach to its problems” (p 92) that are present in various disciplines.

The systems-thinking framework is extremely effective when there are:

- complex problems that involve many actors who see the “big picture” and not just their part in it;
- recurring problems or those that are made worse by past attempts to fix them;
- problems where an action affects (or is affected by) the environment surrounding the problem; and
- problems where the solutions are not obvious (Aronson, 2006).

First the need to address complex health care, including intensive care, problems with a different approach is discussed. Then systems thinking is offered as an alternative approach that acknowledges the interconnectedness of health care,

that can assist in the quest for quality health care and provide an additional health care research lens. The attention is drawn to the appropriate use of systems thinking in health care. Systemic intervention, as a meta-methodology for understanding the delivery of intensive care and the development of a framework for improvement, is introduced. Stakeholder identification and management and the methodologies with their relevant methods and techniques that were used in understanding intensive care delivery and the subsequent development of an improvement framework will be discussed.

3.1 The need for a different approach to address complex problems in health care

Smith, Halvorson, and Kaplan (2012) state that if the US health system status quo is left unchanged, the system will continue to deliver outstanding service to some while others will receive inferior service and encounter preventable harm. This is true for most other health systems. Increasing health care costs will continue to burden national, and local government, corporate and personal budgets. The authors pose the question that it is not whether or when to begin the overdue transformation, but how. This holds true for the improvement of intensive care delivery in South Africa.

Sturmberg and Martin (2009) are of the opinion that “If our reductionist approach to medicine is the cause of the crisis in patient care, can more of the same lead to its solution?” (p 543). Waldman (2007) believes that: “our society should move beyond the industrial revolution and embrace the implications of living in an information age. Unfortunately, our mental models, organisational structures and management philosophies are shackled by Newtonian (linear) ideation, assembly-line mentality, as well as hierarchical, command and control attitudes.” (p 271) The dynamic and unpredictable health systems do not respond to “blueprint-approaches” (p 7) that are often found in global health initiatives (Paina & Peters, 2011).

Modern-day health systems suffer from information overload. Smith et al. (2012) state: “There is more to do, more to know, and more to manage than at any time in history. Yet in one of many paradoxes, available knowledge is too rarely

applied to improve care, while information generated by the care experience is too rarely synthesised to improve available knowledge. Health care lags behind other industries like banking, retail, and transportation in its ability to meet the needs of patients, to offer choice, to adapt, and to become safer and more affordable. What is needed, is a care system that consistently delivers reliable performance and consistently improves … with each care experience – in short, a system with an ability to *learn.*" (p 1637)

Cortese and Smoldt (2006), in a commentary, "Healing America's ailing health system" ask for immediate "attention and action", "something needs to be done to fix – not patch – the system" (p 492). This sentiment is echoed by many stakeholders desperate for improvement of health systems. However, it is of the utmost importance to be cognisant that no health system, by virtue of its complex nature, can be fixed instantly; so, the focus should be on sustainable improvement.

3.2 Systems thinking as an alternative approach to address complex health care problems

Begun et al. (2003) draw attention to the fact that health systems are "machines" that have minds of their own that disregard control. Measures of control such as linkage, coordination, standardisation, rationalisation and vertical and horizontal integration have not been successful to ensure sufficient health care delivery to the satisfaction of internal and external stakeholders. For the authors, the best way to improve health systems or organisations is to comprehensively approach them as a living organism rather than a dead machine. The approach to traditional mechanical systems have created a cycle of designing a system and when it does not act as expected, redesigning the system.

Different questions are asked when we regard health systems as living organisms, for example, how do things continue to function when the system does not perform as designed? Stacey, Griffin, and Shaw (2000) refer to this as the ability to get things done anyway and it is this anyway that needs to be explored in understanding health systems. Sturmberg et al. (2012) further suggest that the focus should move from the question of "what is wrong with our

health system?" to "how can the health system achieve its required outcomes?" (p 207)

For Berwick (2004), improvement is "not forcing something, but releasing something" (p 1124). Cilliers (2001) suggests that there is a demand for theories to deal with patterns and principles as an alternative to theories assuming cause and effect linkages between separate details. "Transformation of health systems is a complex and difficult undertaking ... but no system had a roadmap for achieving perfect care, and each learned as it went along." (VanDeusen et al., 2007, p. 319) Change of the health system relies on an "evolving learning process rather than a series of pragmatic steps" (p 1), therefore change should build on health systems' ability to self-organise (Tsasis et al., 2012).

Kalim, Carson, and Cramp (2006) offer systems thinking as "…a framework of thought that helps us to deal with complex concepts or situations in a holistic way" (174) as a way to deal with living-organism systems such as health systems. The authors emphasise that there is a variety of methodologies within this framework. It is important to note that hard systems methodologies are more appropriate for "process" situations, but that, in complex situations where people play a prominent role, soft systems methodologies may be more appropriate. For Midgley (2000) it is important that theories and methods that suit the intent of the research should be pursued. This implies that the situation under study, rather than the preferences of the researcher, will dictate which systems-thinking methodology should be used.

Russell, Swanson, Atun, Nisthar, and Chunharas (2014) draw attention to the post-2015 Millennium Development Goals and point out that an important opportunity to strengthen health systems was missed due to prominence given to financing mainly disease programmes. A lesson from the Millennium Development Goals is that more comprehensive action is required that concede path-dependence and context dependence "… [the] use of approaches based on systems thinking can provide the fresh perspective needed to build on the experiences of the MDGs [Millennium Development Goals] and meet the emerging development challenges of the future" (Russell et al., 2014, p. 2124).

A further question that arises, is why systems thinking, and not a detailed strategic plan, should be used to facilitate change in a health system? The conventional strategic plan has simplified health systems and does not acknowledge the complexity of these systems (Tsasis et al., 2012). It is also important to note that health systems are too large for a strategic plan, hence a framework for improvement should rather be developed to guide change. For Waldman (2007) a health system is a thinking system; it has a free will, it learns, and it innovates. The author states that the planner or leader must "develop a process for change and NOT a detailed strategic plan" (p 281). The author is of the opinion that a strategic plan will fail because the health system consists of people who "must be engaged and must *own* to *do* otherwise they will subvert the change to preserve the status quo" (p 281). The health system as a thinking system will still self-organise and in so doing, change the strategic plan. Furthermore, the components of the system will co-evolve, changing the structure and function of the original plan and the subsequent results will differ from the results proposed initially.

A misplaced assumption is that copying and adapting winning recipes from non-medical industries such as aviation and nuclear power will ensure a safe health system. Amalberti, Auroy, Berwick, and Barach (2005) believe that:

> The most important differences among industries lie not so much in the pertinent toolkit, which is similar for most industries, but in an industry's willingness to abandon historical and cultural precedents and beliefs that are linked to performance and autonomy, in a constant drive toward a culture of safety. (p 756)

If we therefore choose to use systems thinking as an organisational rubric, great care should be taken not to fall into the trap of imposing winning recipes from other industries, such as aviation, on health systems, but rather to get an understanding of why a certain initiative was successful in a specific context.

3.3 Systems thinking acknowledges the interconnectedness of health care

As mentioned in section 1.1.2, scientific silos or compartmentalised knowledge has the potential to impede the understanding of the complex inter-relationships among components of health systems (Leischow et al., 2008). One example of the silo-functioning of health systems is the estimated time lag of 17 years from medical discovery to when patients in the United States of America benefit from the discovery. This has enormous cost implications in terms of mortality and morbidity. The reasons for this phenomenon are not always well understood. Because of the rigorous education and focus on continuing medical education, one would expect the medical profession to be well-equipped to aggressively implement new advances. Considerable resources are spent on continuing medical education, but the successes in changing established practice have been varied (Albanese, Mejicano, Xakellis, & Kokotailo, 2009a, 2009b).

Another example is that there is no shortage of continuing medical education models, but the limitations of these models are that they focus on only a few of the factors that establish the effectiveness of continuing medical education (Albanese et al., 2009b). These two illustrations serve as examples of the many manifestations of health systems components functioning as silos and, as mentioned, systems thinking is a path that can offer a solution.

Systems thinking draws attention to the fact that health systems do not function in isolation, but have an interconnection with other social systems and their respective goals, as illustrated in Figure 3-1 (Murray & Frenk, 2001).

	Education	Health	Economic	Political	Cultural	Other
Education						
Health						
Consumption						
Democratic participation						
Knowledge						
Other						
Responsiveness						
Fairness in financial contribution						

Key:

	Social systems
	Social goals
	Defying goal of each system
	Interaction between different systems
	Goals common to all systems

Figure 3-1 Social goals and systems (Murray & Frenk, 2001)

It is important to note that people in search of medical care see their medical and social needs as linked, they do not see themselves as “multi-ill”. They need support for their needs as they know them. To a great extent the onus is on the patients and their relatives to integrate the different medical and social delivery systems (Edgren, 2008). The aim of health care is for people to regain their experience of good health; therefore, a good, personal-health experience should be the shared vision for health systems. This implies that a person’s particular needs shape their interactions within the health system, “this ideal requires all system levels to respond adaptively (rather than prescriptively) to challenge, which allows the emergence of best solutions for individuals and communities” (Sturmberg et al., 2012, p. 204). Systems thinking acknowledges the complexity of health care.

The use of systems thinking will reflect the complex reality of health systems rather than mask it (Green, 2006). It is interesting to note that health care professionals appreciate the complexity of the human body and the aim of their care is to restore the balance in the best possible way for the patient to lead a full, productive life. However, this understanding is not reflected in the manner in which health care is delivered. Therefore, it is suggested that a similar, holistic approach be employed by health care professionals to understand the health care that is delivered (Cortese & Smoldt, 2006).

According to Lingrad et al. (2012), complexity is the *sine qua non* of health care teamwork. Health care providers are put to the test on a daily basis to provide good patient care in the context of a system "… in which the dimensions of the system itself grows increasingly complex, in which measures of success grow increasingly vague and in which an atmosphere of crisis grows increasingly pervasive" (p 870). This seem to be an impossible task, but health care providers often "win the game with whatever cards they are dealt", although the strategies used to do so are not always elegant, friendly or effective. Understanding health systems as a CAS will contribute to addressing problems that the health systems experience.

An increasing number of diverse fields where complexity prevails, such as business, engineering, physics, the military, science, agriculture, weather forecasting and public health, acknowledge the importance of systems thinking as an organising rubric (Leischow et al., 2008). To illustrate the value of systems thinking as an organisational rubric, or the consequences of the lack thereof, two scenarios that the health system can relate to will briefly be highlighted; they are the management of Hurricane Katrina and the prevention of pandemics.

Leischow et al. (2008) state: "… [a] complex system worth investigating lends itself to change because of new knowledge. This phenomenon is both the promise and the challenge of systems thinking" (p S197). The authors use the management of Hurricane Katrina to illustrate this phenomenon. Weather forecasting and modelling is an example of an advanced transdisciplinary collaborative that has a strong orientation towards systems thinking. Networks of organisations and scientists internationally work together to understand the

complexity of weather patterns to ensure more accurate and timely weather forecasts. But having accurate forecasting and analysis of complex weather does not necessarily translate into effective use of the information. Hurricane Katrina serves as a painful reminder of the dire consequences of the failure of the delivery component of the system, where communication (application of knowledge) to the public by federal and local officials failed. In health systems, there is extensive international collaboration at various levels of health care delivery to have a better understanding thereof and to work towards the delivery of quality health care. Yet, globally, patients still receive varying degrees of quality health care, which is often suboptimal.

Public health agencies acknowledge the risk of future pandemics such as the 1918 - 1919 Spanish influenza pandemic that millions of people succumbed to. These agencies have implemented systems, which includes platforms for transdisciplinary scientists, to prevent or curtail the impact of future pandemics. This comprehensive and multidisciplinary systems approach entails:

- massive and rapid data collection from many different sources,
- swift communication to a comprehensive array of sources,
- transdisciplinary science to understand and analyse data from multiple sources, and
- modelling of the complex relationships among the components in the system. (Leischow et al., 2008)

Although public health agencies have implemented transdisciplinary systems, to prevent or curtail the impact of pandemics, these do not necessarily translate into effective management of these events. The management of the 2014 Ebola epidemic for example, even though it did not progress to a pandemic, has been questioned (Matau, Van der Wal, & Locsin, 2015).

Health care has been criticised as functioning in silos (Leape et al., 2009; Waldman & Schargel, 2006). Leischow et al. (2008) are of the opinion that “Tackling complex … health problems require transdisciplinary and

multidisciplinary teams to understand and address that complexity and systems thinking is a path for getting them there" (p S202). This is confirmed by Bar-Yam (2005) who states that "complexity may be overwhelming, but we have to be cognisant that by working together effectively, we can solve complex problems" (p 9). A common mistake is to think that the problem is in the parts of the system, but in reality, the problem lies in the relationships between the parts. For the author "the system" is how people work together, "we need to learn how to improve the system without putting someone in charge, in order to make things work". This is echoed by Edgren (2008) who affirms that constructive relations between stakeholders should be identified and supported, but underlying tension and conflict must also be understood. Systems thinking will be the ideal vehicle to identify constructive relationships and to identify and understand underlying conflict and tension.

3.4 Systems thinking and the quest for quality health care

In keeping with the message from the Institute of Medicine that high-quality health care is delivered by systems, Chen, Mills, and Werhane (2008) introduced an interesting concept: "To facilitate this progress, physicians [health care workers] would benefit from both a systems-informed mental model and a type of moral imagination developed with keeping a systems approach to the ethical practice of medicine in mind." (p 724) This implies that members of health care teams must appreciate that optimal health care delivery goes beyond their own relationship with patients and involves other health system stakeholders. The dilemma arises that, if health care workers engage with a selection of stakeholders, this may move the focus away from their primary goal, the relationship with their patients. The authors argue that acknowledging and utilising this broad ethical commitment will ultimately allow health care workers to better fulfil the commitment to their patients.

Authorities, policymakers, managers and clinicians currently focus on health care quality and patient safety. Various approaches have been proposed, such as: evidence-based medicine and clinical practice guidelines, professional development, assessment and accountability, patient empowerment and total-

quality management. However, these approaches have not had a substantial impact on the quality of care. Efforts have been made to assimilate some of the approaches; different groups in health care often adopt one specific approach without considering the accomplishments of other approaches (Grol, 2001).

Following *Crossing the Quality Chasm: A New Health System for the 21st Century* many health care organisations have tried, but few have succeeded, to make substantial reform to achieve the Institute of Medicine's goals (VanDeusen et al., 2007). Traditional quality-improvement techniques accomplished short-term results because they were not supported by the culture and structure of the larger organisation. Chaung and Inder (2009) also draw attention to efforts made to improve health care safety and patient safety by means of accreditation and measurement systems. The authors highlight that, despite the rich literature on the association of accreditation and measurement of quality in health care, the correlation with patient outcome is poor. This research typically focuses on the correlation rather than the processes through which the impact on the system occurs and is fragmented as systems or subsystems are addressed in isolation. The fragmented research on the components of health care quality reveals partial observation and ambiguous results. It is therefore important to note that the safety and quality features of a complex system are an emergent property of the system as a whole and not the property of individual system components.

3.5 Health care research needs an additional lens

Turning to research in health systems, the question of why systems thinking should be considered can be posed. What we see is influenced by the lens or mental model that we use to observe (Edgren & Barnard, 2012). In any given situation or process we have implicit mental models of how things fit together, however, these models have concealed assumptions and no clear link to data. Systems thinking, on the other hand, affords explicit models with assumptions set out that can be calibrated to data (Peters, 2014).

Chen et al. (2008) define a system-related mental model for health care as: "knowing and understanding what a system is, how systems work, what happens when multiple systems interact. This entails understanding systems from a basic

and functional perspective, rather than simply recognising the various stakeholders." (p 725 - 726) However, in my opinion it is also essential that health care workers have an understanding of the ontology and epistemology of a systems approach as it is fundamentally different to the reductionist and objectivist approach that health care workers are familiar with. The system-related mental model should be introduced at under-graduate level and reinforced during post-graduate studies and lifelong learning.

Research grounded in an explicit systems orientation may enrich our understanding of the significance of health care as a system of structured relationships. This research will also enrich our understanding of the diverse methodologies that exist for learning how systems are organised, how they behave over time and how they can be better governed in dynamic and democratic contexts (Leischow & Milstein, 2006). Systems thinking can guide health system researchers to ask novel questions in areas where further research should be undertaken (Peters, 2014).

Green (2006) asks pertinent questions in an article titled: "Public Health Asks of Systems Science: To Advance Our Evidence-based Practice, Can You Help Us Get More Practice-based Evidence?". With one of the questions the author wants to know if systems thinking is going to help us move away from "… the singularly linear analysis that have offered limited temporal analytical power in getting at the order of cause and effect, the feedback loops, and the synergistic relations (beyond interaction effects of analysis of variance or multiple regressions)" (p 408).

Systems thinking and modelling (in a wider sense than engineering modelling) offer health systems simulation as an alternative to the controlled trial. Systems thinking and modelling consider the diversity of variables not as a nemesis that should be controlled, but rather as a resource that should be used for deeper analysis (Green, 2006).

Bate and Robert (2002) distinguish between "evaluation for judgement" research as the summative, non-interventionist evaluation research position and "evaluation for improvement" research or "can-opener" as the formative,

interventionist action research position (p 967). Although the authors refer to systems thinking and action research, both have intervention as the focus. According to the authors, there is increasing emphasis on the values of relevance, utility, knowledge, accumulation, learning and value-adding, and there is a move away from “evaluation for judgement” (accountability) to “evaluation for improvement” (on-going learning from the evaluation). The authors are of the opinion that: “Not only has there been the ‘pull’ of these new values, there has also been a ‘push’ of growing disappointment with the general lack of impact traditional evaluations have been having and people are beginning to ask, ‘what is the point?’” They also highlight that the pursuit of the non-interventionist hard-science ideal has made evaluation research voiceless and marginal, if not irrelevant, to the real world.

The authors further draw attention to the fact that evaluation is a profoundly political and value-laden process, “evaluation is performed within a political context in which decisions are driven more by values, political interests, and ideology than by scientific evidence”. This makes the case for interventionist research stronger as “recognizing the political nature of the evaluation does not mean that evaluators cannot come up with valid assessments of program effectiveness”. This will result in more holistic evaluation.

The role of systems thinking in health care research can be summarised by a concluding remark of Berwick (2007) in an editorial, commenting on two interpretive research studies:

> Purists will, of course, attack this notion with vigour borne of their concerns about bias, confounding factors, wishful thinking, multiple comparisons and data dredging … that mere stories are not enough to draw conclusions. I know that; I have taught experimental design, also, and I celebrate the scions of formal evaluative trials. But, I wonder, what price do we pay for formal designs that make it not just illegitimate, but technically impossible, to ask the good people out there, trying hard, using their brains, to tell us, ‘Really now … What do you think actually happened, and why?’ And I dare ask, what price do we pay, perhaps even greater, for rules of peer review and selection that make it seem illegitimate, and procedurally impossible, to tell, in our own journals, what we thereby might found out? (p 1125)

3.6 The appropriate use of systems thinking in health care

It is important to be cognisant of certain barriers that exist when using the systems thinking approach. Systems thinking does not come naturally (Schyve, 2005). Peters (2014) highlights the fact that “some see systems thinking as a powerful language to communicate and investigate complex issues, while others are confused by the sizable and amorphous body of theories, methods, and tools involved” (p 1).

Public health originated from the understanding that health and illness do not only originate from the biology and behaviour of the individual, but from sources far beyond the obvious. This need to understand the bigger picture confirms that public health is founded on a systemic insight (Midgley, 2006a). There is a growing need for the systemic insight of health systems in general, but unfortunately this is a relatively new concept, the scope of which is not always well understood by health professionals. The ontology, epistemology and principles of systems thinking are often used incorrectly in the health literature. When a systems approach is followed in addressing health system problems, there is a tendency to use hard systems approaches. Hard system approaches have more of a quantitative orientation, which fit in with the reductionist ideation of health care practitioners. Although there are definite situations in health systems where the use of hard systems is the appropriate choice to address problems, health systems often call for a soft systems approach or a combination of systems thinking approaches. In response to a call for a systems approach in public health, Midgley (2006a) suggests systemic intervention as a systems approach. Systemic intervention is defined by Midgley (2000) as: “purposeful action by an agent to create change *in relation to reflection upon boundaries*” (p 113) using methodological pluralism. Systemic intervention is suggested as a meta-methodology for this research and is discussed in the next section.

Without a full appreciation of systems thinking, problems in health care will not be addressed. When engaging with systems thinking in the health literature, as mentioned before, it becomes clear that the concept of systems thinking is not always understood and used appropriately. This phenomenon of using concepts

or techniques without a full understanding thereof or the inappropriate use is not unknown in the health care fraternity. Two well-known examples are statistics (Pentstone, 2011) and evidence-based medicine (Silva & Wyer, 2009) and the misunderstanding, misuse or abuse of these two phenomena are well documented in the literature, but the discussion thereof is beyond the scope of this thesis. It is, however, important to note that this seems to be less of a problem in public-health literature, where systems-thinking projects are undertaken by systems-thinking practitioners.

The consequence of not understanding the concept of systems thinking and inappropriately using this approach in complex health systems may result in systems thinking being deemed unable to address the complex problems in health care and being seen as yet another fad. Systems thinking is based on a specific ontology and epistemology and an overview thereof is given in Appendix 7 that needs to be understood. Systems thinking is a different approach with different values and language and one cannot understand systems thinking with a traditional reductionist research mindset.

The most common mistakes that are made include the following:

- “Systemic” and “systematic” are used interchangeably.
- Only one principle of systems thinking is focused on to the exclusion of the others.
- Hard systems thinking approaches, such as Systems Engineering and Senge’s system dynamics are used inappropriately.
- Researchers forget that systems thinking is used to address a problem in a specific context, and not a recipe for generalisation to other contexts.
- Researchers think that systems thinking is a quick fix.

Transforming health systems requires thinking beyond current boundaries. This necessitates a profound culture change. One example is the current training of health system workers that produces “square pegs for our care system’s round holes” (Leape et al., 2009, p. 427).

When the primary focus is on patients' needs, systems thinking acknowledges complexity which enables us to move away from the question "what is wrong with our health system?" to "how can the health system achieve its desired outcomes?" (p 207) Such a pragmatic shift in thinking will enable us to attain our ultimate goal – good health for all (Sturmberg et al., 2012).

Systemic intervention, as a meta-methodology for the understanding of intensive care delivery and the development of the framework with the relevant methodologies and their methods and techniques, will be discussed in the next section.

3.7 Systemic intervention as a meta-methodology for this research

Systemic intervention is a strand of critical systems thinking that offers a novel approach to systems thinking and supports the pluralistic use of various strands of systems thinking (Rajagopalan & Midgley, 2015). Midgley (2000) describes systemic intervention as "purposeful action by an agent to create change in *relation to reflection upon boundaries*" (p 113). The interrelated concepts of intervention, boundary critique, methodological pluralism and action for improvement are at the core of systemic intervention. See Appendix 7 for a detailed discussion of systemic intervention.

Systemic intervention emphasises intervention rather than observation as used in traditional science, yet methods observation can be used in intervention (Midgley, 2015). Intervention is purposeful action and not a "flawlessly pre-planned change based on accurate predictions of the consequences of action" (Midgley, 2008, p. 55). Intervention is also systemic in nature (Midgley, 2015). Pre-planned change in isolated aspects of intensive care delivery had limited success in the improvement of intensive care delivery (Chaung & Inder, 2009; Grol, 2001; Leape et al., 2009; VanDeusen et al., 2007). Therefore, systemic intervention offers an alternative approach to address the complex problems of intensive care delivery.

The interconnectedness of the universe – everything is connected to everything else – results in a "God's-eye view" (p 1) being unachievable and comprehensive analysis impossible. However, if different possible boundaries for analysis are explored, "we can paradoxically achieve greater comprehensiveness than if we take any single boundary for granted" (p 1). Different boundaries are explored through a process of boundary critique (Midgley, 2015). Boundary critique ensures the inclusion of key stakeholders that contributes to a more comprehensive understanding of intensive care delivery in South Africa.

There is no methodology or method that is perfect and methodological pluralism is proposed by systemic intervention for a more flexible and responsive intervention practice (Midgley & Richardson, 2007). Intensive care delivery consists of "hard" and "soft" issues and an approach allowing for methodological pluralism will be more appropriate to investigate these.

Lastly, systemic intervention asks for purposeful action, such as the implementation of methods, to create improvement (Midgley, 2000). It is not within the scope of this research to plan and implement the improvement of intensive care delivery, but an understanding of intensive care delivery will be obtained and a framework for intensive care delivery will be developed, and there will be purposeful action within this research. The reflection on and choice of boundaries, and the choice of appropriate methodologies and methods can be regarded as action, it is an intervention in the present to shape a strategy for the future (Midgley, 2015).

A discussion of boundary critique – the process of stakeholder identification and management and the methodologies with the relevant methods and techniques that was used in the understanding of intensive care delivery and the development of an improvement framework for intensive care delivery will follow.

3.7.1 Boundary critique – stakeholder identification and management

Midgley (2000) describes a stakeholder as "someone who is, or *ought to be,* involved in or affected by a social situation – in the present or the ideal future" (p 149).

In South Africa, the role of stakeholders in health care delivery has been reflected in the development of the policy process. Until 1990 the successive governments pursued mainly a traditional Western, industrialised, colonial policy approach. Although there were incremental policy changes, the overarching approach was dominated by political and bureaucratic elites that were focused on sustaining the status quo as much as possible. Interest groups that influenced the decision-making process during this time were cultural, religious and business elites representing white socio-economic interest. In 1994, a totally different, representative and more legitimate government came into power in South Africa and that resulted in fundamental change in policy focus and the planning process. The focus is now on formerly excluded groups and an acknowledgment of the importance of negotiation with “legitimate” stakeholders (Cloete, 2006). Yet, how inclusively stakeholders are currently incorporated in health care delivery decision making, is questionable. Cloete (2006) draws attention to the magnitude of uncovered corruption in the public sector, resource shortages, “organisational chaos in state departments and even in parliament” (p 98) and the impact these have on the public policy process. It is furthermore important to note that stakeholder involvement and improvement of health care delivery are still being done with traditional improvement structures and methods.

The identification of leverages, planning and implementation of the improvement of intensive care delivery will happen at different levels of intensive care delivery and therefore, at different levels of authority. This will be determined by a few stakeholders in power, such as the national Department of Health, various other government departments, private hospital groups and individual ICU management. However, the comprehensive involvement of stakeholders is of the utmost importance in making sense of the mess and the development of the improvement framework. First, a comprehensive involvement of stakeholders will ensure buy-in from the stakeholders that are responsible for the actual delivery of intensive care. Secondly, it will be a considerable step towards understanding properties that may emerge later. Lastly, the concept of stakeholders has systemic connotations and contributes to the systemic approach of this research. It is therefore proposed that a process of stakeholder identification and management should be included in the framework.

Banville, Landry, Martel, and Boulaire (1998) highlight two interdependent central ideas in the general definition of stakeholders: “vested interest” and “problem situation”. For the authors, the vested interest of the stakeholders and the stakeholders themselves can only be identified once a problem situation has been identified. Three “non-mutually exclusive categories” (p 18) of stakeholders have been identified and these categories will inform the improvement of the intensive care delivery infrastructure, namely: standard, fiduciary and silent stakeholders.

Standard stakeholders are those who are “affected by and affecting” (p 18) the intensive care delivery infrastructure and they take part in both the planning and the resolving thereof. These stakeholders resemble the general concept as expressed in the literature and the ideal view of the democratic decision-making process (Banville et al., 1998).

Fiduciary stakeholders act on behalf of clients – they may not be personally affected by the solution, but they are important in making sense of the mess and may affect the way it is resolved. The interests of the fiduciary stakeholders do not concur with their clients’, they are the “dim” or indistinct stakeholders (Banville et al., 1998).

Silent stakeholders are those people affected by the problem of intensive care delivery infrastructure: they have no way of affecting the problem and they do not participate in the problem-solving process. These stakeholders do not even have to exist at the time the problem is identified, for example, a next generation of patients. But, it is important that their interests are looked after (Banville et al., 1998).

For Vroom (1973) the visibility of stakeholders will be determined by the type of decision-making process that is followed and the situation in which the decisions are made. Three types of decision-making processes are presented. Type A is an autocratic process where stakeholders do not receive much attention. In Type C, a consultative process is followed where stakeholders are consulted, but final decisions are made by those in control. Group decisions are made in the third group, Type G, by stakeholders concerned with the problem. It is important to

note that the situation in which the decisions have to be made, will determine which decision-making process will be appropriate. The intensive care delivery decision-making process is not a straightforward process where one type of decision-making process will prevail; a combination of the different types will be needed.

Landry (1995) suggests that, “One cannot consider a problem independently of the identification of the problem’s ‘owner(s)’ and that identification further pinpoints the problem itself.” In order to ensure appropriate consideration of a problem situation such as the delivery of intensive care, stakeholder identification is essential. The process of stakeholder identification is an iterative process that starts with the identification of initial stakeholders (Banville et al., 1998).

It is important to consider who initiates the stakeholder management as this implies who determines the need and initiates the delivery of intensive care. In the South African context, it is assumed this is done by the national Department of Health in the public sector and the private hospital groups in the private sector. However, CCSSA was regarded as the best proxy for an entity governing both the public and the private sectors. The CCSSA is a professional society that is dedicated to promoting appropriate, quality care to critically ill patients in both the public and private sector. Therefore, representatives from the CCSSA started the iterative approach of identifying and classifying stakeholders.

The first step in the stakeholder management was for CCSSA representatives to categorise possible stakeholders that would take part in the process of understanding intensive care delivery using the classification of Banville et al. (1998). It must be kept in mind that these categories are non-mutually exclusive but would assist in generating a more comprehensive list of stakeholders. The classification includes:

- Standard stakeholders, namely:
    - those that are affected by the delivery of intensive care,
    - those that affect the delivery of intensive care.

- Fiduciary stakeholders, namely:
    - those that can or may act on behalf of those who deliver intensive care or receive intensive care.
- Silent stakeholders, namely:
    - those that could affected by the delivery of intensive care, but do not yet exist or are unable to voice their concern during the process of understanding intensive care delivery.

The next step is a deeper analysis of stakeholders to ensure a justifiable and responsible choice of stakeholders. Multiple stakeholders are responsible for intensive care delivery in South Africa. Some of these stakeholders have in the past been marginalised due to various reasons, such as political issues or have simply not been deemed important. To obtain a true understanding of intensive care delivery, it is essential to ensure comprehensive stakeholder representation. An adaption of CHS was regarded an appropriate for this step. At the core of CSH is the concept of social planning and this implies “social in the general sense of both socially relevant and societal” (Ulrich, 1996, p. 6). For the author, social planning is the art of promoting improvement. The aim of CSH is “to develop a critical consciousness in people regarding the conditioned nature of any kind of 'improvement', and thereby to 'subvert' people's technocratic notion of planning” (p 13).

Four of Ulrich (1996) original 12 critical-heuristic-boundary questions are associated with who should contribute to the understanding of intensive care delivery and these four were used. The four questions are shown in Table 3-1. It is useful to use both the “ought to” and “is” modes of the questions, although not necessarily in this order.

Table 3-1 Relevant critical-heuristic boundary questions to support stakeholder management, adapted from Ulrich (1987)

"Ought" mode
• Who ought to be the client or beneficiary? That is: whose interests ought to be served with ICU delivery?
• Who ought to be the decision makers? That is: who ought to be in a position to change the delivery of ICU?
• What kind of expertise ought to be consulted regarding ICU delivery? That is: what ought to count as relevant knowledge of ICU delivery?
• Who ought to be witness to the interests of those affected but not involved? That is: who should argue the case of those who cannot speak for themselves, but may be affected by or involved with ICU delivery?
"Is" mode
• Who is the client or beneficiary? That is: whose interests are to be served with ICU delivery?
• Who are the decision makers? That is: who are in a position to change the delivery of ICU?
• What kind of expertise is consulted regarding ICU delivery? That is: what counts as relevant knowledge of ICU delivery?
• Who is witness to the interests of those affected but not involved? That is: who argues the case of those who cannot speak for themselves, but may be affected by or involved with ICU delivery?

3.7.2 Judgement of appropriate methodologies

The concept of boundary critique where different boundary judgements, with their associated values, are explored, justifies theoretical pluralism. For Midgley and Richardson (2007) this implies "… drawing upon multiple theories depending on our purposes, rather than seeking one single 'grand' theory (p 183). Different theories assume different boundaries of analysis". Depending on the purpose of the intervention it might be necessary to harmonise the chosen theories.

The various methodologies and methods are based on different theoretical assumptions. Therefore, if theoretical pluralism is possible, methodological

pluralism is also possible. Furthermore, from a practical perspective, there is no method “that can do everything”. Methodological pluralism thus entails using a range of methods from different methodologies in an intervention, thereby ensuring flexible and responsive systems practice (Midgley, 2000, 2015).

Flood and Jackson (1991) propose a meta-methodology, total systemic intervention for this purpose. This approach suggests a process where systems metaphors are used to inspire creative thinking about the problem situation. A set of systems metaphors are used with a framework, the “system of systems methodologies” (p 22), that is linked to certain systems approaches to determine which approaches are most suitable for a specific problem situation. Midgley (2000) regards this approach as a generic contingency framework of methods aligned with problem situations that forces choices between discrete methods. The author argues for an ongoing learning process where the practitioner considers methods in terms of their stated purposes and principles; the theories that underpin them; the ideological assumptions they make; and practical results they may have achieved in previous interventions.

Therefore a “creative design of methods” is needed to ensure a “multi-layered intervention” where different levels of analysis are required. This “creative design of methods” not only implies the use of methods from various methodologies, but if appropriate, a part of a method. “Creative design of methods” also implies that the choice of methods at the beginning of a research project may not be conclusive since, as the research evolves, a need for new methods may arise (Boyd et al., 2007; Midgley, 2000). Following the national audit of critical care resources (Bhagwanjee & Scribante, 2007; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d) it became clear that one methodology with its accompanying methods would not suffice to give an understanding of intensive care delivery.

From the range of systemic methodologies, methods from interactive planning (Ackoff, 1981b) , SSM (Checkland, 1985), CSH (Ulrich, 1987) and VSM (Beer, 1984) were selected as the most appropriate for the research. CSH was already introduced in section 3.7.1 and a brief introduction of the other methodologies will

now follow. A more in-depth discussion of these methodologies is presented in Appendix 7.

A brief introduction to interactive planning

Interactive planning, an organisational development process, was developed by Russel L Ackoff in the 1970s and was based on work that he started in the 1950s. This approach allows organisations to use their innovation potential to move beyond the traditional problem-solving approach. Interactive planning is based on three operating principles, namely: the participative, continuity and holistic principle. For Ackoff (1981b) the principal benefit of planning is participating in it. The participation of members in the planning process enables them to develop and obtain an understanding of the organisation and therefore, ensuring that they serve the organisational goals more effectively. No plan, regardless of how well it is formulated, will evolve as planned and not all events can be foreseen. Therefore, plans should be continuously reviewed and adapted appropriately. The changes that happen continuously modify the value placed on a plan and the values should similarly be continuously adapted. With the holistic principle Ackoff (1981b) addresses the shortcomings of the sequential top-down or bottom-up approaches and suggests the “all-over-at-once” (p 74) approach. In this approach as many units of an organisation as possible plan simultaneously and interdependently across all levels.

Interactive planning consists of two parts: idealised design and realisation. Ackoff (1981b) presents a process of five interrelated phases for these parts: formulating the mess, ends planning, means planning, resource planning, and design of implementation and control. These phases do not follow a specific order but are interdependent aspects of a systemic process. The process is never completed, inferring a return to the various phases and continual planning. It was decided in this research not to use the term “formulating the mess” but rather “making sense of the mess” as this was viewed a more suitable term to describe the action.

A brief introduction to SSM

SSM has developed in reaction to hard system engineering approaches that failed to address messy real-world problems and has evolved over a 30-year action research period (Checkland, 2007). The development of SSM was guided by the iterative process of refining methodology by dealing with messy real-world problems practically and the simultaneous social theory development (Checkland, 2007; Checkland & Winter, 2006). SSM is regarded as one of the problem-structuring methods that deals with unstructured problems in complex circumstances. “Unstructured problems entail multiple stakeholders, multiple perspectives, conflicting interests, various types of uncertainties and significant intangibles.” (Hindle, 2011, p. 31)

SSM is an approach that encourages participation through a process of inquiring and learning that will ultimately lead to the improvement of a problem situation (Checkland & Winter, 2006). It comprises a four-stage continuous learning cycle. The first stage is to describe the current problem situation “as is”. In the second stage, conceptual models of purposeful human-activity systems are created for issues that were identified in stage one. The third stage is discursive: the models of stage two are debated for desirable and feasible changes that can be fulfilled in the final stage as action for improvement. However, following improvement of the problem situation, new problems may emerge, and the cycle therefore starts again (Checkland, 2007).

A brief introduction of VSM

VSM was developed by Beer in his quest to understand which characteristics an organisation needs in order to become and remain viable (Beer, 1984). VSM is a generic model that is applicable to any system. It can be used to design a new system or as a diagnostic tool to highlight the strengths and weaknesses of an existing system (Beer, 1984; Jackson, 2000).

For a system to be viable, five subsystems and six channels must be present and functioning appropriately (Beer, 1984). The five subsystems can be summarised as follows:

- S1 represents the operational units that carry out the functions that the system is expected to perform.
- S2 is the subsystem that has a co-ordinating function and that ensures the smooth running of the operational units and manages fluctuations.
- S3 is the control system that supervises successful policy implementation and distributes resources to S1. S3* is an audit system that informs S3 directly on the status of S1's functioning.
- S4 is the subsystem responsible for intelligence and the development of the system's internal and external environment.
- S5 is the "thinking part" of the system and is responsible for the course of the whole system. (Jackson, 2000)

For effective organisation, it is crucial to ensure that all five systems are present and that the channels (of communication) between these systems function optimally. In order to respond to complex issues, a viable organisational infrastructure must be present (Midgley, 2015).

3.7.3 Creative design of methods and techniques

The different methods and techniques that were used in the understanding of intensive care delivery and the development of an improvement framework for intensive care are summarised in Table 3-2.

Table 3-2 Summary of methodologies with relevant methods and techniques used in this research

	Key methodology	Methods and techniques
Understanding the delivery of intensive care	Interactive planning – making sense of the mess	CSH – stakeholder analysis SSM – rich pictures VSM – VSM diagnoses
Development of improvement framework	Interactive planning	Making sense of the mess • CSH – stakeholder analysis • SSM – rich pictures • VSM – VSM diagnoses
		Ends planning • Interactive planning – idealised design • SSM – CATWOE and conceptual models
		Realisation phase • Diverse appropriate methods

The use of rich pictures and VSM as diagnostic tools will be discussed in the next section. The remaining methods and techniques are discussed in Appendix 7.

Understanding intensive care delivery with rich pictures

The use of pictures and diagrams is as old as human culture itself and is an integral part of human expression. Rich pictures borrow much from a long-founded sense in the human race that a picture paints a thousand words (Bell & Morse, 2013).

The question may arise: why use drawing of pictures to get a better understanding of the situation? It is easier for the intuitive consciousness to communicate with impressions and symbols than with words. Fathulla (2008) refers to J D Watson, Nobel Prize winner, who discovered the structure of DNA,

who said: “… drawing and thinking are frequently so simultaneous that the graphic image appears almost as an extension of the thinking process” (p 265).

Rich pictures or situation summaries are used to depict complicated situations; to reflect the situation in all its richness (Williams & Hummelbrunner, 2011). The drawing of rich pictures is an “iterative process of understanding and refining of understanding” (p 22), opening of dialogue and coming to a broad, shared understanding of a situation (Monk & Howard, 1998). Therefore, the use of rich pictures to formulate the mess will be an appropriate method to depict the complex intensive care delivery in South Africa in all its complexity.

Understanding intensive care delivery with VSM diagnoses

A VSM diagnosis originates from the assumption that, for a system to be viable, there needs to be five subsystems and six channels present and functioning appropriately (Beer, 1984). Therefore, the first step would be to generate a VSM of the intensive care delivery and compare it against a generic VSM (Gregory, 2007). This will show if the structures required for a viable system are present and to what degree they function (Jackson, 2000). Hildbrand and Bodhanya (2015) propose qualitative research techniques to “feed” the VSM in an iterative manner as it affords in-depth insight into a system. Qualitative research techniques also offer the flexibility that is necessary for the generation and analysis of a model. The process of VSM diagnosis cannot be established at the beginning as one step will guide the following step. Jackson (2000) proposes a model to guide the VSM diagnosis. The adapted model used in this research is shown in Table 3-3.

Table 3-3 VSM diagnostic model adapted from Jackson (2000)

Study system 1 (S1)
• Detail the environment, operations and local management of each operational unit in S1. • Study the constraints imposed on S1 by higher management. • Examine how each operational unit is held accountable and what the indicators of success are. • Model S1 according to the VSM model.
Study system 2 (S2)
• List potential sources of fluctuations or conflict between operational units. • Identify the elements in S2 that have a harmonising and or dampening effect. • Ask how S2 is perceived in the overall system.
Study system 3 (S3)
• List the components of S3. • Determine how S3 exercises authority. • How is resource bargaining done with S1? • Determine who is responsible for performance in S3. • What audits (S3) are done on S1? • What is the relationship between S3 and S1 (autocratic/democratic)?
Study system 4 (S4)
• List all the activities of S4. • Determine how far ahead does these activities consider. • Determine if the activities guarantee adaption to the future. • Is S4 monitoring the environment and assessing trends? • Is S4 open to novelty? • Does S4 provide a management centre that combine internal and external information and provide an environment for decision making? • Does S4 have facilities for alerting S5 of urgent developments?

Study system 5 (S5)
• Who are on board and how do they act? • Does S5 provide a suitable identity for the overall system? • How does the ethos set by S5 affect the perception of S4? • How does the ethos set by S5 affect the relationship between S4 and S3? • Does S5 share an identity with S1?
Check that all communication channels are properly designed

3.8 Summary

In this chapter, the need to approach complex health care (including intensive care problems) differently, was discussed. Then systems thinking was offered as an alternative approach that acknowledges the interconnectedness of health care, that can assist in the quest for quality health care and that provides an additional health care research lens. Attention was drawn to the appropriate use of systems thinking in health care. Systemic intervention was introduced as a meta-methodology for understanding the delivery of intensive care and the development of a framework for improvement. Stakeholder identification and management and the methodologies with their relevant methods and techniques that were used in understanding intensive care delivery and the subsequent development of an improvement framework were discussed. In the next chapter, the understanding of intensive care delivery is presented.

Chapter 4: Understanding the delivery of intensive care

The previous chapters highlighted the fact that delivery of intensive care is complex because of multiple stakeholders with varied perspectives and conflicting goals that interact and are interdependent. The complexity of intensive care delivery further infers that there are hard and soft issues that influence the competency of the system. The hard issues are, for example, availability of resources such as ICU beds and health care workers, the burden of critical illness and the model of intensive care organisation. Communication, trust and worldviews are examples of the soft issues.

It became apparent that a systemic approach is was required to holistically explore and understand the complexity of intensive care delivery and to develop a framework to guide the improvement of intensive care delivery. Systems thinking appeared to be the most appropriate theoretical framework for the study. An analysis of systems approaches identified systemic intervention as a suitable overall methodology.

To inform the development of a framework for improvement intensive care delivery must first be understood. The method used to acquire this understanding, was Ackoff (1981b) formulation of the mess. As mentioned in section 3.7.2 the expression “making sense” of the mess will be used in this research.

4.1 Making sense of the mess

Making sense is an essential starting point, as: “We fail more often, not because we fail to solve the problem we face, but because we fail to face the right problem” (Ackoff, 1974, p. 8). Ackoff (2001) eloquently describes the aim of this phase as: “to determine how the organisation would eventually destroy itself if it were to continue behaving as it currently is” (p 3).

The inability of a system to confront its own reality or “mess” is due to self-imposed obstructions. These obstructions are formed by our perceptions and

they manifest in mental models, assumptions and images and “essentially set up, shape our world, and chart our future”. The aim of the obstructions are to preserve the status quo of the system and discourage efforts realising its potential” (Gharajedaghi, 2011). When making sense of the mess Gharajedaghi (2011) offers the following aims:

- Understand the underlying assumptions and reinforcing operations responsible for regenerating the problematic pattern repeatedly.
- Develop a shared understanding of why the system behaves the way it does and generate a shared understanding about the nature of the current reality among major actors.
- Minimize the resistance to change and maximise the courage to act by making the real enemy explicitly visible and believable.
- Identify the areas of the greatest leverage, vulnerability, and/or possible seed of systems destruction.

According to Gharajedaghi (2011), aims are not a “prediction” but rather an “early warning system” (p 166). Formulating and disseminating the mess is imperative to solving the mess, “proper packaging and communicating of the message is as important as the content of the message itself” (p 166). For the author, formulating the mess, or telling the story, should take into account the stake, interest and influence of the pertinent stakeholders and should not determine who is to blame. It is important at this point not to try and define the problem (Checkland, 1985).

After completing the national intensive care audit (Bhagwanjee & Scribante, 2007, 2008; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d), it became clear that there were various dimensions to the mess of intensive care delivery in South Africa. Firstly, the complexity inherent to intensive care delivery; secondly, the interdependence between intensive care delivery and various other subsystems and lastly, the context within which intensive care delivery takes place.

The making sense of the mess was done in two phases. In the first phase, the mess was formulated with the use of rich pictures (the use of rich pictures is discussed in section 3.7.3). The rich pictures were drawn by myself, the stakeholders in various workshops and patients and families during interviews. In the second phase, based on the data generated from the rich pictures in phase one, a diagnosis of the viability of the intensive care system was made using VSM. Espinosa and Walker (2013) conclude that the combination of SSM and VSM is a suitable starting point to get an understanding of a situation as it allows for the multi-perspectives of participants rather than that of the researcher.

4.1.1 Initiating the process of making sense of the mess

To initiate the process of making sense and to depict the complexity of the current reality of intensive care in South Africa, a preliminary rich picture – “Die groot gemors” [The big mess] – was developed. The rich picture was founded on my *Weltanschauung*, intensive care experience and extensive intensive care research in South Africa. This preliminary rich picture is shown in Appendix 11. This was a necessary step. After conducting the national audit of critical care resources, I realised that the delivery of intensive care was complex and that the improvement of the delivery posed a messy problem. However, by drawing the picture, a deeper understanding of the complexity and the “messiness” of the problem were obtained. Also, as a novice user of systems thinking, it afforded me the opportunity to experience the drawing of a rich picture first-hand and this experience proved to be valuable in conducting the remaining workshops.

The preliminary rich picture was used to consult a group of systems-thinking practitioners at the Centre for Systems Studies, University of Hull Business School. The group of systems-thinking practitioners had extensively published in their respective fields and included some leaders in the field of systems thinking. They confirmed that this was indeed a messy problem that would require a non-conventional approach and that a systems-thinking approach would be appropriate.

4.1.2 Stakeholder identification and management

Guided by the process of stakeholder identification in section 3.7.1, the following stakeholders were identified:

- opinion leaders in intensive care
- national Department of Health
- private hospital group management
- private hospital intensive care health care workers
- funders
- the medical industry (pharmaceutical and medical equipment companies)
- regional public sector intensive care health care workers
- trade unions
- former intensive care patients and their family members

A purposive sampling method was used to identify individual participants. Polit and Beck (2008) define purposive sampling as “a nonprobability sampling method in which the researcher selects participants based on personal judgement about which ones will be most informative; sometimes called judgemental sampling”. For some of the stakeholder groups, I consulted knowledgeable people to assist with the identification of individual participants. Two intensivists who treated intensive care patients helped to identify former patients and their families. A CCSSA council member representing private sector intensive care practice assisted in identifying private hospital group management, private health care workers, non-intensivists and funder participants. Two trade union experts were consulted to identify trade union experts.

One stakeholder group, the former patients and family members, need a special mention. When trying to establish an understanding of intensive care delivery in South Africa, a first reaction was that the public was an essential stakeholder.

Although this is true, the public posed certain realities and challenges which made it difficult to include them in this research. A discussion of the public as an intensive care stakeholder with a specific motivation to include former intensive care patients and their family members, is offered in Appendix 8.

As the process unfolded, rich data was obtained from the identified stakeholders and it was decided not to extend the boundaries of stakeholders in order to manage the overall scope of the study.

4.1.3 Organising of the workshops and interviews

It was decided for various practical reasons to conduct workshops with individual stakeholders rather than to conduct workshops where all stakeholders were represented. The most important reason to conduct individual stakeholder workshops was that there was animosity between stakeholders. Health systems have historically been known to be fraught with power relationships. It was anticipated that stakeholders would feel more comfortable to give their honest opinions of intensive care delivery in stakeholder-specific workshops – resulting in richer data. Workshops were organised at venues that were convenient to the respective stakeholders.

The venues, professional designation of participants, duration of workshops and the national Department of Health interview are presented in Appendix 9 in Table A9-1. The patients and family members' status within the family, whether they were from the public or private sector ICUs and duration of interviews are also presented in Appendix 9 in Table A9-2. No identifiable information of participants was recorded in these tables to ensure anonymity and confidentiality.

The organising of some of the workshops and interviews (national Department of Health, non-intensivist, regional ICUs and the medical industry) generated rich data which require mentioning. The organising of the former patient and their families' interviews is also presented.

National Department of Health interview

It was challenging to engage with the national Department of Health as there was no specific person or subdivision in the department that had intensive care delivery as a primary focus. Neither is there currently a specific policy that governs the delivery of intensive care in South Africa. Various key people were consulted to try to understand who would be the most appropriate person(s) in the national Department of Health to consult.

Firstly, a health economist who works closely with the national Department of Health was contacted. He believed that it would not be possible to engage with the government, which he regarded as an “incompetent machine”. Secondly, a former member of the executive committee (MEC) for health of a provincial government was approached who declined any discussion. Two intensivist who work closely with the national Department of Health was then consulted.

The first intensive care expert that was consulted stated that there was no formal structure that was accountable for intensive care delivery. There is no formal structure currently accountable for the delivery of intensive care delivery. Intensive care experts served on ad hoc committees where they make recommendations. However, these recommendations were then referred to a higher level of decision makers who did not have any intensive care insight or expertise and often these “recommendations go no further”.

The second intensive care expert concurred with the first intensivist. She gave several examples to illustrate these sentiments. The CCSSA at the National Forum of MECs presented a plan to address some problems in intensive care delivery and an online intensive care library. Only one province (who had the best organised Department of Health at the time, in the opinion of the expert) was interested and the committee decided it was not feasible.

In 2015 one of the provincial departments of health approached this intensive care expert to co-ordinate an intensive care working group but the initiative “died a natural death”. She also served on the National Health Technology Management Committee, but, she was the only person serving on this committee

that was using health technology and believed “people were pushing their own agendas”.

She was also of the opinion that there was a need for an intensive care ministerial advisory committee – as some other disciplines had. However, from her experience, she concluded that the national and provincial departments of health got “working groups together when they want to address something in intensive care, but then they do not support the working group forward”. She said, there were no attempts to co-ordinate intensive care delivery nationally or provincially. There was a realisation that there should be a structured approach to intensive care delivery, “… nevertheless they do not know what path to take. They do see a hazy picture, the minister certainly does see there is a problem, but it is certainly not on their ten-point plan.” The intensive care expert at the end of the consultation telephonically contacted the minister and deputy minister of national health and it was suggested that the most appropriate person to interview was the national deputy general of health. He was extremely busy and it took several months to secure an appointment.

Non-intensivists workshop

It was anticipated that a workshop with this group of stakeholders would be challenging. Non-intensivist doctors, the “other doctors”, treat the majority of patients in intensive care in South Africa. However, in previous workshops, they were repeatedly perceived to be the stakeholder least committed to improving ICU delivery because they were “more interested in the money they earn from intensive care patients than in improving intensive care delivery”.

To ensure that it was convenient for participants to attend the workshop it was scheduled after working hours and included a light supper. Further, to make it more compelling to attend the workshop, accreditation as a continuous professional development activity was obtained and four ethics points could be attained if attended. Ethics continuous professional development points are highly sought after.

A total of sixty potential non-intensivist doctors were identified from the Pretoria and Johannesburg area and an e-mail invitation was sent to these individuals. There was extensive e-mail and telephonic follow-up as the response rate was very low. Twelve doctors indicated that they would attend the workshop, however, only four doctors came on the night of the workshop. No apologies were received from the remaining eight doctors before or after the workshop.

Regional intensive care workshop

It was decided, for convenience, to conduct the workshop for small regional public sector ICUs during the annual, national CCSSA congress. A list of delegates was obtained from the congress organiser and 15 appropriate delegates were identified and invited via e-mail. Several follow-up e-mails yielded a very poor response and only four delegates indicated that they would attend the workshop. During the congress, a further two delegates that registered late for the congress, were invited to attend the workshop. Only two delegates from two neighbouring ICUs in the Eastern Cape attended the workshop. This is the stakeholder group that often complained that they were the “forgotten ones”.

Trade unions

Two trade union experts were independently consulted to determine which trade unions active in the health care sector would be the most appropriate to invite to the workshop. Four trade unions were identified.

The respective trade unions were contacted timeously and invited to send four representatives each to the workshop. It soon became clear that it was going to be difficult to engage with this stakeholder group. Great effort was made to follow-up on the invitations with e-mails and telephone calls. Three trade unions indicated that they were interested to take part in the workshop.

It posed much more difficult to engage with the fourth trade union, known for its militant tactics in demanding change. They responded to the initial invitation by asking for more information. Subsequent follow-up e-mails and telephone calls produced no response. I felt that they were an important stakeholder and asked one of the consulted trade union experts for further assistance. This trade union

did express an interest to take part, however, two days before the workshop they declined the invitation.

Although the other three trade unions indicated that they were interested in taking part, close to the scheduled date it became clear that they did not do much to identify participants. On the day of the workshop only one participant from one trade union arrived; an hour late. His office was notified late the previous afternoon by their head office and he only received the invitation that morning.

This was a very disappointing experience as I believed the trade unions would value the opportunity to join the conversation on understanding intensive care delivery in South Africa and be part of the development of a framework for improvement. The participant that did attend went to a lot of trouble to come, even though it meant that he would be late. He saw this as an extremely important conversation that he “had to be part of”.

Medical industry

Of interest was how prompt the reaction to the invitations was and when the invitee could not attend, a replacement was suggested. More than half of the participants accepted the invitation, stating that they were very interested to participate, but wanted to know what the cost would be to their company. This confirmed that the medical industry was almost always required to financially contribute to any intensive care activity they were invited to. Surprise was expressed that they were invited to contribute their perceptions of intensive care delivery in South Africa.

Former patient and family interviews

Former patients and their families, albeit a vulnerable stakeholder, were included in the research. However, certain measures were put in place to ensure that this stakeholder group was treated ethically. Firstly, the former patients and their families would be interviewed in a safe environment, in their homes, rather than at a workshop with other former patients and families. Secondly, the interviewer had experience working in ICUs and doing research in intensive care. This ensured sensitivity towards the former patients and their families and the insight

to identify possible post-intensive-care syndrome to appropriately refer patients or their families if necessary.

It was decided to interview five private intensive care patients and five of their family members as well as five public sector intensive care patients and five of their family members. (A total of nine patients and 12 family members were interviewed. The tenth patient was never available for the interview and the data collected by this time were already rich.) An intensivist practising at a private ICU in Centurion and one practicing at a public, tertiary academic ICU in Johannesburg were selected from which to recruit patients and their family members. The Ethics Committee required that I had to be able to refer patients and/or their family members for medical and psychological support if deemed necessary. The private intensivist that was identified is known to routinely follow-upon patients' post-ICU discharge and works in collaboration with a clinical psychologist. My relationship with the public ICU allowed me to refer patients back to this ICU where patients and/or their family members would receive both medical and psychological support.

Both the private and public sector intensivists were asked to identify five patients. They contacted the patients and notified them that I was going to approach them to take part in my research. I then made telephonic contact with each of the patients to invite them and a family member to take part in my study. All nine patients agreed and a suitable time for every interview was agreed on.

4.1.4 Management of the workshops and interviews

The management, my and the participants' experience of the workshops will now be discussed.

Workshops

At the start of the workshops, a short presentation was given that included: the background to the problem, the aim of the workshop, systems thinking as an alternative approach to understanding intensive care service delivery, and the use of rich pictures.

I facilitated all the workshops, even though other facilitators were also used in some of the workshops. In the opinion leader workshop, the additional facilitator was one of my supervisors with systems thinking expertise. This was deemed necessarily as the participants mostly function from a reductionist approach and the research was conducted from a systemic intervention approach. The facilitator is an experienced systemic intervention researcher that has worked extensively with participants originating from a reductionist approach. Furthermore, intensive care functions as a rule-bound system as referred to by Clayton and Gregory (2000) in which power relationships are an important feature. These systems often suffer from “change fatigue” whereby “doing” becomes more important than forward thinking or planning. The presence of an experienced systemic intervention facilitator unfamiliar with and removed from these factors was deemed necessary to ensure that the workshop did not become stuck in the reductionist paradigm. The facilitator was not used in subsequent workshops as the anticipated problems did not realise.

Four workshops were conducted in collaboration with the CCSSA for the following groups: the funders, private hospital group management, private hospital health care workers and non-intensivists. The results of these workshops were of specific interest for the CCSSA to inform the planning of an improvement project. A CCSSA council member who was responsible for the project served as the additional facilitator in these workshops.

It was interesting to note that participants, as mentioned before, mainly functioned in a positivistic paradigm and drawing pictures was not something they were accustomed to. Yet, a few minutes of reluctance at the start of the workshop was followed by enthusiastic drawing and discussion except in one workshop.

After the introductory presentation in the funders’ workshop, one funder group, represented by three participants, objected to the format of the workshop. Concern was also raised by the “objectors” that they could not collectively take part in the workshop as they were governed by the Competition Amendment Act (2009).

The facilitators of the workshop (the researcher and a CCSSA council member) apologised for the oversight and again explained that their general perceptions of intensive care delivery in South Africa and not “trade secrets” were the focus of interest. It was also emphasised that the focus of the workshop was clearly stated in the invitation letter. The objecting funder group became more “verbal” (aggressive) and asked for five minutes “time-out” to decide if they wanted to continue to participate. The facilitators assured all participants that they would respect any participants who wished to withdraw from the workshop at any stage.

After private deliberation, the “objectors” decided to remain but were not happy with the way the workshop was going to proceed. Not wanting to waste the participants’ time, as they were professional business people, some travelling by air to attend the workshop, the facilitators asked all participants if they wanted the format to change and if so, how. A very interesting dynamic developed and the participants began to polarise. One participant asked to be excused from the workshop; he made it very clear that he was in favour of the workshop and that it should proceed as planned, but that he objected to the “objectors’” behaviour and attitude. One participant of the objector group also decided to excuse himself from the workshop. Two participants, although willing to participate, were very uncomfortable with the idea of “drawing pictures”. The remaining six participants wanted the workshop to proceed as planned. Instead of three groups, there were now two groups consisting of six (Group 1) and four (Group 2) participants.

Group 1 immediately started working on their rich picture, and as the picture evolved, so did their enthusiasm, and lively discussion escalated, resulting in a very rich picture an hour and a half later.

Group 2, consisting of the remaining “objectors” and two participants not comfortable with drawing pictures, only started their “picture” forty minutes later. They did not draw, but listed solutions to the problem. The facilitators decided it would serve no purpose to intervene at this point as it was clear that rich data were being generated by Group 1. The “objectors” repeatedly made it clear that problems could only be addressed with data.

Discussion of the pictures started before lunch and continued after lunch. The "objectors" excused themselves from the discussion after lunch. The remaining participants verbalised that the "objectors" and their organisation were perceived as the "bullies" of the funding industry and that they were known dictating to others, that "things must be their way or no way".

The Competition Amendment Act (South Africa, 2009) was discussed in subsequent relevant workshops, but none of the other participants perceived the workshops as contravening the act.

At the end of the workshops, participants expressed how valuable the workshops were as well as how much they had learned. Participants, of their own accord, perceived the data generated during the workshop to be rich. This was illustrated by a participant commenting at the end of the funders' workshop that "a book can be written about our pictures".

From the passionate, lively drawing and discussion of the rich pictures I sensed a deep-seated "caring" in the participants for "intensive care". Of note was that the workshops made interesting impressions on some of the participants. A profound comment was made by one of the nurses at the end of the opinion leaders workshop:

"… – although I KNOW everything that was being said around nursing intellectually, it wasn't anything new to me, to see all the nursing issues drawn out in the fashion they were, it really hurt inside me. Somehow, seeing the pictures and hearing the reservation in everyone's voices when talking about nursing made this mess seem worse than I usually convince myself it is. Combined with that, is the exhaustion of knowing how hard I try, recognising that many others are also trying so hard, to make things better – but with the system as 'stuffed' as it is now – it doesn't matter what I try to do, I am set up to fail – that is the core of my sad-anger."

The "sad-anger" described by the participant encapsulated for me the mood in some of the workshops. All the participants had attempted at various levels to change the delivery of intensive care in South Africa, to no or little avail. I also

sensed a feeling of desperation during some workshops that was reflected through statements such as: “ICU is a jail – there is no escape” and “the clock is ticking, death is near – do something”. One group in the private health care worker workshop named their rich picture “Without a Rudder”; they chose the name because they felt at the end of the workshop: “we do not have any goals, we do not measure anything, we do not know what the aim of this whole process is … in all of this we actually spoke very little about the patient; it is quite interesting”.

Participants also verbalised that the other stakeholders offered the same service, experienced the same frustrations, but they did not know each other or talk to each other, “We are all frogs in the same pond, trying to do the same thing whilst sitting in our own corner doing so.”

Interviews

The interviews were conducted in the privacy of the participants’ homes, which were considered a safe space for both the patients and their family members. The participants from the public sector were from a low-income background and those from the private intensive care group from low- to middle-income backgrounds. The private sector participants were from the greater Pretoria district. A research assistant accompanied me to the homes of the public sector participants; which were mainly in Soweto – to assist with navigation and as interpreter if necessary (which was needed in the interviews with two elderly participants).

At the start of the interviews, great care was taken to introduce myself and to establish a comfortable relationship with the participants. Participants were informed of the background to the problem, the importance of their contribution was emphasised and the use of rich pictures was explained. It was emphasised that they could withdraw at any time during the interview, should they feel uncomfortable.

One participant started crying profusely when asked to draw a picture. I offered that we could stop the interview, but she was adamant to continue but not draw

a picture: “Not a picture, it will take me there, I cannot go there.” She proceeded to tell me her story whilst holding my hand. Her story was regarded as a verbal rich picture as referred to by Flood and Jackson (1991, p. 180).

I was deeply touched by the patients’ and their family members’ experience of intensive care. It was noticeable that the intensive care experience was much more traumatic for the family members of the patients than for the patients themselves. I was also deeply saddened by the disparity between the voices of the patients and their family members from the private and public sector ICUs.

All the participants, although they were fully aware that the interviews were for research purposes, saw me as “ICU” coming to visit them and experienced the interview as “ICU” caring. Both patients and family members had an enormous need to discuss their intensive care experience and it became clear that this was the first time they did so. Although the interviews were emotional for some participants, they all experienced it as a valuable experience. I only terminated the interviews when I was sure that no participant felt traumatised or needed further psychological counselling. Participants were asked to contact me telephonically if they subsequently developed a need for psychological counselling.

Positionality of the researcher

I am an intensive care nurse who has been involved in intensive care since 1981 and am well known in the intensive care community. During this time, I have served several terms on the CCSSA Council and I am currently serving on the executive of two CCSSA sub-committees namely: The Nursing Forum and the Research and Education Committee. I am the vice-chair of the CCSSA Egoli branch. I have done extensive research in the field of intensive care delivery. As mentioned in the Preface to the thesis I played a key role in the National Audit of Critical Care Resources. The results from this extensive survey culminated in six publications as well as various multiple international and national presentations. Therefore, my interest in the improvement of intensive care delivery in South Africa is well known in South Africa.

During the workshops I introduced myself to participants who did not know me personally and the aim of the research was explained. Purposive sampling was used as described in section 4.1.2 and all participants in one way or another had an interest in the improvement of intensive care delivery in South Africa. All the workshops had lively discussions with all participants contributing. Participants, of their own accord, perceived the data generated during the workshop to be rich and valuable. Therefore, it is my perception that my position contributed positively to the workshops.

I also stated my position to all former patients and family members and it is my perception as mentioned in section 4.1.4 that they saw me as “ICU” coming to visit them and experienced the interview as “ICU” caring. All the interviews resulted in rich data, therefore, it is my perception that my position contributed positively to the interviews.

4.1.5 Analysis and synthesis of data

Checkland and Poulter (2006) states that engaging in a real situation requires a “specific frame of mind’ in order to understand and then change the situation. The rich pictures generated in the workshops and interviews provided this “frame of mind” to the participants and myself. The rich pictures were very successful in illustrating the multiple interacting relationships and the complexity of ICU delivery. The rich pictures further allowed for a more holistic view of ICU delivery that guided the discussion of the “mess”. All the pictures were combined into one rich picture labelled – “Without a rudder” (Appendix 12).

The discussions of the rich pictures by the respective stakeholders were transcribed by myself and then analysed using the thematic analysis as described by Braun and Clark (2006).

Braun and Clark (2006) define thematic analysis as “a method for identifying, analysing, and reporting patterns (themes) within data … [it] minimally organises and describes your data set in (rich) detail …, it also often goes further than this, and interprets various aspects of the research topic” (p 79). The authors suggest a six-phase process for data analysis, namely:

- “Phase1: Familiarise yourself with the data.
- Phase 2: Generate initial codes.
- Phase 3: Search for themes.
- Phase 4: Review themes.
- Phase 5: Define and name themes.
- Phase 6: Write research report.”

Braun and Clark (2006) theoretical positions and values regarding qualitative research do not support the naïve realist view where the researcher “gives voice” to participants. The authors also acknowledge that there is “no one ideal theoretical framework for conducting qualitative research, or indeed one ideal method.” (p 80) For the authors, it is essential that the theoretical framework and methods match what “the researcher wants to know, and that they acknowledge these decisions, and recognise them as decisions”.

An *inductive* analysis was done on the transcribed data from the discussion of the stakeholders’ rich pictures. Inductive analysis (Braun & Clark, 2006) is a “process of coding the data without trying to fit it into a pre-existing coding frame, or the researcher’s analytic preconceptions … this form of thematic analysis is data-driven” (p 83). The diagnosis of the viability of intensive care delivery (VSM diagnosis) was done by means of a *deductive* analysis on the same data set used for the analytic analysis. The deductive analysis is thus more analyst-driven. Although this approach to thematic analysis affords a less rich description of the data overall, it does offer a more detailed analysis of some aspects of the data (Braun & Clark, 2006). The data set provided rich enough data to enable a comprehensive diagnosis of the viability of the intensive care system and thus no further data were collected.

It must be highlighted that, although a qualitative approach was followed in the analysis of the data, certain qualitative strategies were not adhered to here. Varpio, Ajjawi, Monrouxe, O'Brien, and Rees (2017) warn against the use qualitative strategies that were developed to measure “quality” in qualitative

research. The authors suggest that these strategies should not be used without critical reflection. Firstly, data were not collected until “data saturation” was achieved. One of the assumptions of systemic interventions is that there are as many realities as there are human beings; therefore “data saturation” is unachievable (Midgley, 2000; Varpio et al., 2017). Secondly, triangulation was not employed to ensure a valid representation of the data, but rather to “capture the richness and diversity of perspectives” (Varpio et al., 2017, p. 4). Therefore, triangulation was achieved by the stakeholder identification and management process that was followed. Lastly, no member checking was done due to the interpretive nature of the research. For Varpio et al. (2017, p. 46):

> The researcher and participants bring different perspectives to the analytic process. The researcher brings his or her own theoretical and methodological expertise to inform data interpretations. Findings generated by the researcher are designed for a wider audience and therefore will differ from the account of an individual participant simply because of the different roles of each person in the research process.

4.1.6 Synthesis of the mess

The data from the workshops and interviews and viable system diagnosis were very rich and complex. During the analysis of the data, six themes emerged, namely decreased service delivery, multiple-vested interests of stakeholders, broken relationships, poor communication, hostile environment and isolation. They are shown in Figure 4-1. It became apparent that these themes were interdependent and resulted in disorganised intensive care delivery with limited opportunities for learning to improve intensive care delivery. Of note were also the dichotomies that existed at various levels of intensive care delivery.

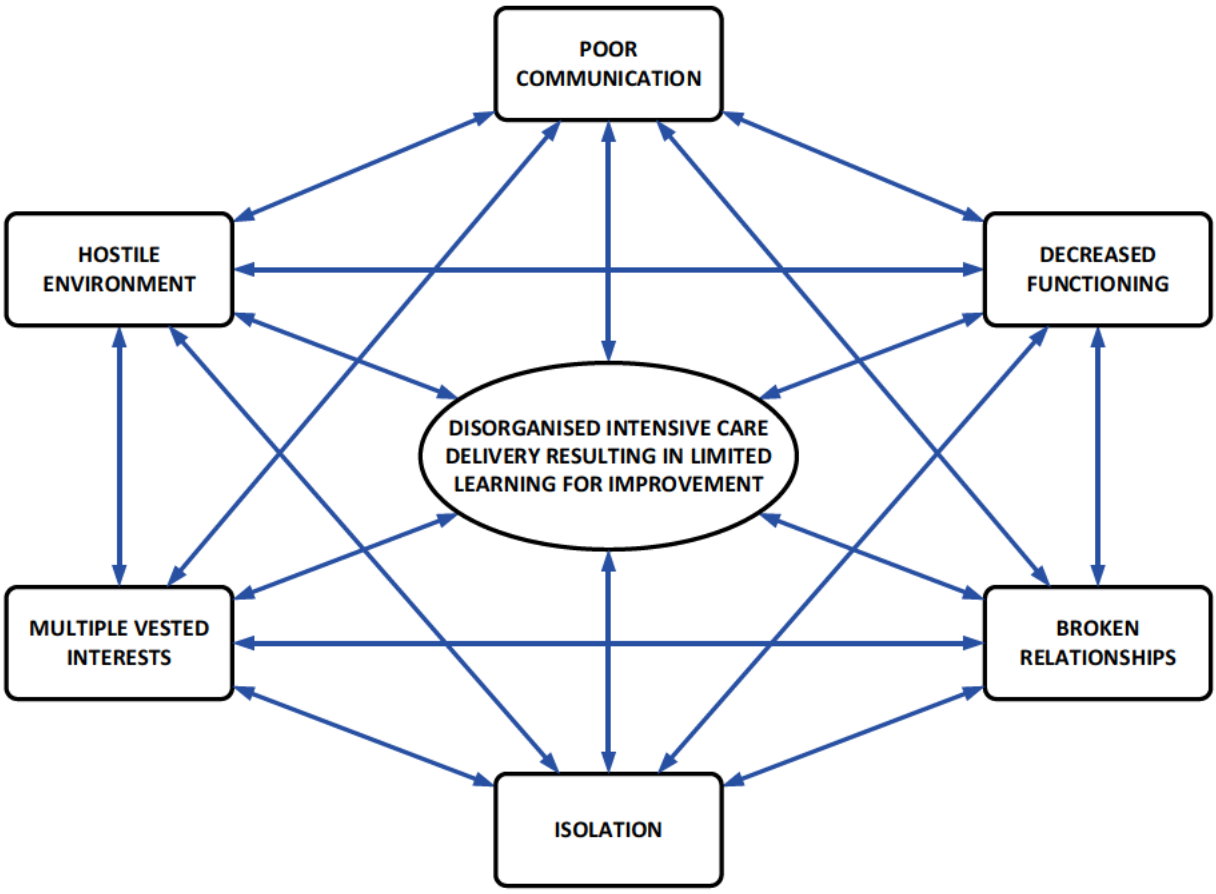


Figure 4-1 The themes and the resulting disorganised intensive care delivery and limited learning for improvement of intensive care

It was a problem to present the data in the traditional linear manner of theme by theme due to the interdependence of the themes. The complexity would have been lost if the analyses were to be presented in this manner. It is acknowledged that no attempt would comprehensively portray the complexity, however, a more creative approach to data presentation was deemed necessary. I was guided by one of the family members, an 11-year-old girl, when she told me: "I can only describe my picture to you if I can tell you three different stories." When I engaged with the data, it became clear that there were numerous different stories, thus the analyses are presented as six stories where the themes of the analyses are portrayed.

Storytelling is a known approach in the complexity discipline. It is an interaction that involves both speaker and receiver to attain insight (Weick, Sutcliffe, & Obstfeld, 2005). Hamstra (2017) maintain that "complexity … emerges through a

process of human interaction, which is best seen through the art of storytelling" (p 1). This view is echoed by several other authors. Browning and Boudès (2005) state that "complexity is best understood with narrative" (p 1) and storytelling, according to Boje (1991), is "the preferred sense-making currency of human relationships among internal and external stakeholders" (p 106). Snowden (1999) refers to 1 Corinthians 13 verse 12 in the Bible and concludes that the role of storytelling in complexity is that, "like St Paul, we see through a glass, darkly, to a more profound truth." (p 30) For the author, stories can communicate complex meaning in a manner that formal linguistic accounts cannot. Communication by means of storytelling enables humans to have a better comprehension of the complex world since storytelling as a cognitive process connects both sides of the human brain and "humans desire to know the 'what of life' and 'why' these are linked" (Hamstra, 2017, p. 3).

The six stories are very long, three will be presented in this section and the remaining three in Appendix 10 not to distract from the argument presented in the thesis.

The following three stories will be presented in this section:

- the story of the intensive care team;
- the story of the doctors, hospital managers and funders;
- the story of the doctors, the patients and their family members.

The remaining three stories are presented in Appendix 10:

- the story of the patients and their families;
- the story of enabling intensive care delivery;
- the story of intensive care delivery.

The stories are presented in keeping with systems thinking reporting and not in the traditional manner of qualitative results reporting.

The story of the intensive care team

The nurses and doctors were regarded as the main intensive care team players as they have the closest contact with the patient and co-ordinate all care. The other team members, also referred to as the allied members, included, but were not limited to, dieticians, clinical pharmacists, physiotherapists, speech therapists, occupational therapists and psychologists.

The doctors and nurses valued the allied intensive care team members' contribution to the quality of intensive care. However, the funders regarded them as "fashion statements" that deliver "open-cheque-book" care, that started in the ICU and carried on after discharge from hospital.

The participants recognised only professional health care workers as team members. The importance of cleaners in the ICU was emphasised, especially their role in infection control, but they were not regarded as intensive care team members.

Most importantly, the patients and their families were not depicted in any of the workshops as part of the intensive care team nor were they mentioned in the discussion of the rich pictures. The family members, for example, were drawn in one picture in the corner away from the patient, with no relationship with the intensive care team. Furthermore, there was no place for "Dr Google" in the intensive care team – Dr Google was seen as the enemy. (Dr Google will be explained in the doctors', the patients' and family members' story).

Participants acknowledged that the functioning of the intensive care teams in the different ICUs varied from being effective to dysfunctional. The functioning of the intensive care teams was influenced by a variable degree of poor or broken relationships between team members, for example:

- doctors and doctors,
- doctors and nurses,
- nurses and nurses,

- doctors, nurses and allied intensive care team members.

The doctors felt the coordination of the intensive care team when there were poor or broken relationships put a huge burden on the doctor who was ultimately responsible for the care of the patient. An example that was given was that the intensivist did not trust the dietician even though the dietician was the expert: “I cannot let the dietician do her own little thing – that is why I sometimes ‘crap’ on her.”

The function of the intensive care team was further compromised by suboptimal relationships with other stakeholders. Firstly, the relationship of intensive care team members with hospital management. In the public sector the relationship of the intensive care team with the provincial Department of Health and in the private sector with the hospital group management and funders. There were limited relationships between public and private ICUs. Lastly, there were better relationships between the intensive care team and the medical industry when the latter was involved in education and training in the ICUs or sponsoring intensive care members to attend congresses and educational events. However, the medical industry commented that they did not always have enough access to intensive care members. The relationship between the intensive care team and the patients and their families is discussed separately.

The diverse focus of the stakeholders and their perceptions of one another influenced intensive care team members’ functioning and prevailing relationships. Some of the perceptions are shown in Table 4-1.

Table 4-1 Some of stakeholders' perceptions of each other

Doctors	Perceive funders as dictators "The funders are all bad there are good bad ones and bad, bad ones"
Funders	Perceive doctors as gods "When doctors engage with patients they portray themselves as "good cops" and the funders as "bad cops"
Stakeholders as a collective	Perceived non-intensivists as money grabbers
Stakeholders as a collective	Perceived nurses as: • not committed • the front face of ICU • the backbone of ICU delivery – the ones rolling up their sleeves
Stakeholders as a collective	Perceived the professional organisations such as SANC, the Health Professions Council of South Africa and CCSSA as: • dead bodies • dysfunctional • toothless • Department of National Health as an incompetent machine
Medical industry	Perceived the South African Medical Council, both the national and provincial departments of health, private hospital groups management and funders as the "Kings"

Effective communication is essential for the optimum functioning in complex intensive care delivery. The poor communication that prevailed at all levels was aptly summarised: "Various stakeholders are involved in a complex communication process – a case of too many cooks spoiling the broth – resulting in conflict."

The ICU environment was described as a hostile environment to work in – "a jail" where the intensive care team experienced emotional trauma and were often burnt out. The threat of litigation was seen as ever-present, "just like the sun but with 'gamma rays' that influence every aspect of intensive care delivery".

Litigation was also compared to “a growing monster lurking behind the corner that is adding to the already-high stress levels”. One participant noted that “There are huge billboard signs outside hospitals for medical malpractice lawyers.” For the participants, these ‘lawyers’ are ever-present in the ICU. The presence of “superbugs” and other organisms and the associated risk of the intensive care team being infected contributed to the hostility of the working environment.

The high demands that were placed on the intensive care team did not happen in isolation, but also effected their families – “they also pay a price”.

There are doctors with a variety of backgrounds working in intensive care, few of whom are intensivists. A perception of some of the intensivists in the workshop was that:

> Intensive care is the hub around which the whole wheel of health care turns, without the intensive care nothing works, you have to have the infrastructure to allow you to provide health care … central to the hub is the intensivist, not the patient, the patient is only a visitor, and the ICU is dependent on the intensivist to run the ICU.

There were often multiple doctors looking after a patient in the ICU. The participants felt that there was a lot of wastage in the intensive care system and that a large portion of this wastage could be attributed to the secondary doctors treating patients in the ICU. Secondary doctors referred patients to doctors such as cardiologists, neurologists and nephrologists that are consulted when a patient has a specific underlying co-morbidity in addition to their intensive care diagnoses or when the patient developed a co-morbidity during their ICU stay. Secondary doctors were colloquially referred to as SODs – single organ doctors and they had no formal intensive care training. SODs could independently admit patients to the ICU and are then referred to by participants as the “other doctors”.

Intensivists could sometimes influence the secondary doctor’s practices but not always. Secondary doctors did not like feedback from intensivists and this often resulted in conflict. Intensivist tried to block secondary doctors – “some-times you can, some-times you cannot”.

Intensivists in the workshops appeared to have many frustrations. A major source of frustration for intensivists was the “other doctors” that admitted and looked after patients in ICU. The problem with the “other doctors” was that they saw many patients (both general and intensive care patients), charged the same fee as intensivists and did not spend the time with the patient that an intensive care patient required. The “other doctors” sometimes referred patients to intensivists, but often too late, when they were dying and when all the available drugs were used, mostly inappropriately. Furthermore, “The SODs do procedures that the intensivists think they should not do, but the worst is when they write on the chart ‘the patient is stable from either a neuro/cardiac/lung etc. perspective and can be extubated’, in the meantime the patient is about to die.”

Intensivists experienced their work burden as overwhelming and were concerned that there were not enough intensivists practicing in intensive care. There was no incentive to practice as an intensivist in the current intensive care system; intensivists did not get paid enough and they did not have enough time to spend with their patients.

Non-intensivists experienced the ICU as chaotic and overwhelming; they had to deal with life-threatening situations, “doctors eyes must be out on stalks, for everything that can go wrong – very intimidating environment”. They were not always sure if they were doing the right thing and sometimes they panicked, “when should you use protocols, do you ventilate or not, there is a need for more comprehensive protocols”. It was perceived by the participants that there was not always enough time to do what was needed and there was not always somebody more knowledgeable in the ICU to consult.

The result of multiple doctors treating patients was that: “We do not always talk to each other, everybody talks to the nurse and the nurse gives messages to everyone else.” It was felt that ideally one should have everybody together around the bed at times but this, however, did not happen. This was disruptive for patients and their families and nurses were caught in the middle. Patients and/or their families were often shouting at the nurses and everybody else and placed the doctor on a pedestal – “doing a marvellous job, the doctor is the ‘saint’ and everybody else is at fault”. However, it was noted by one doctor that it was also

very easy for the doctor, when things went wrong, to fall from that pedestal. It was also acknowledged by the doctors that doctors were also guilty, they often have an attitude of – “I am the doctor, if you do not like what I am doing, find another doctor.”

The number of doctors allocated to work in regional ICUs fluctuated and depended on the availability of staff from other departments. Junior doctors such as interns and medical officers were usually allocated to work in the ICU and in exceptional circumstances, registrars and consultants. There was therefore no “go to person” for these junior doctors working in regional ICUs.

The doctors working in regional ICUs were often confronted with ethical dilemmas and frequently felt helpless. The participants felt that there was not enough intensive care teaching and training of lower-level doctors and nurses in South Africa. Junior staff did not get early exposure to intensive care: “Your first exposure to intensive care is when you specialise in a specific field like anaesthesiology or internal medicine; the other medical specialities have minimum exposure to intensive care.” No one person is responsible for intensive care delivery in a regional ICU. Participants experienced attending the annual national intensive care congress the participants as overwhelming. “There is a lot of new information to digest, we realise that we still have to learn a lot but we also had confirmation that there are some things that we do correctly.”

It was interesting that nurses were drawn as very, very small. No relationships were indicated between the nurses themselves, neither between nurses and doctors, patients or their families. There seemed to be a perception that there was a hierarchy in the intensive care team and that the nurses were “lower down on the food chain … they are the ones taking orders”.

Different categories of nurses worked in intensive care: registered professional nurses with or without intensive care training and non-professional nurses also known as enrolled nurses. It was emphasised by the participants that better nursing skills improved the quality of care but drove up input costs. The enrolled nurses were regarded as “wearing goggles”, which gave them tunnel vision – their training did not give them insight into the complexity of intensive care. It was

the participants' opinion that nursing (including intensive care nursing) was not regarded as an attractive profession by nurses and that school learners do not consider nursing as a profession as a first choice. Nurses training was regarded as being "in the clouds, removed from the reality".

A shortage of nurses in intensive care remained an overwhelming problem and the use of agency nurses (who were not drawn with solid lines but with dotted lines), remained a major concern. Yet, it was emphasised that the reason why there was only a core group of permanent nursing staff was not "always because of a shortage of nurses but for financial reasons; it is a cost issue, private hospitals are financially driven". In the short term, agency nurses might be cheaper for the hospital group, but in the long-term their impact on intensive care delivery in the private sector was very expensive and this was not always acknowledged by the management of the hospital groups.

Nurses depicted nurses as incompetent, ignorant and having a bad attitude. This, according to the nurses, resulted in more errors in the ICU and an increasing number of adverse events. Nurses were shown shouting at patients, sleeping on duty and regarding their mobile phones, tea and lunch breaks as more important than patient care. A nurse participant made a profound statement regarding the relationship among nurses: "We do not trust each other, nurses do not trust each other, I think you are dodgy, at least you start off dodgy until proven otherwise."

The other members of the intensive care team, often the unit managers and shift leaders, had a high regard for the competent nurses. On the other hand, the lack of knowledge and motivation of many nurses working in intensive care were a major concern to the other intensive care team members.

Nurses were regarded by one participant as "the 'backbone' of health care delivery, often the ones that 'roll up their sleeves' and make things happen, but their success stories are not always depicted in the media, the stories of committed nurses do not sell newspapers".

Intensive care nurses were regarded as the "front face" of the ICU with the result that a nurse was the first person to be confronted if there was a problem with

linen, food or equipment. A substantial amount of nursing time was spent on infrastructure problem solving and even more time was spent on “nursing paperwork” and kept nurses from nursing patients. Nurses were overwhelmed by their workload, they were buried under paperwork and this could contribute to patients dying. Nurse managers were perceived as always being meetings.

It was acknowledged that nurses moonlighted extensively, often working double or triple shifts, resulting in nurses sleeping on duty and posing a safety hazard to patients in ICU.

Nurses preferred working in closed ICUs with intensivists rather than the “other doctors” as the treatment protocols were more standardised and patient management was less confusing. However, nurses did not want to work with agency nursing staff and were very concerned about the competency levels of their peers. The low competency level of nurses placed an enormous burden on the shift leaders “she sometimes has to look after five patients and five nurses”.

The story of the funders, doctors, hospital managers and patients

The funders felt very strongly that health care providers, patients and their relatives had no understanding of what health insurance entailed that health insurance was not a bottom-less pit but a finite pool of money. There was a dichotomy between the “the sick versus the well” and they also had an obligation to look after the “well” contributors’ money. It was not always appreciated by all stakeholders that a complicated intensive care admission cost more than the patient’s contribution to his insurance. The question, “Kill the goose that lays the golden eggs, then what?” was posed. There was a strong sentiment that the finite pool of money became a boxing ring, with everybody fighting instead of taking hands and working together.

A further question: “Do the funder and the patient get value for money from an ICU bed?” was posed. It was felt that the funder paid a standard fee for an ICU bed but the hospital provided inappropriately trained nurses; patients were cared for by non-intensivists in open ICUs. There were no admission or discharge

criteria and often inappropriate patients were admitted to the ICU. Furthermore, there were no standard care protocols to guide intensive care delivery.

The funders perceived that the doctors thought they were God. When doctors engaged with patients and their families they were the “good cops” and the funders the “bad cops”. There were multiple doctors consulting with patients in ICU, all “wanting their big bags of money”. Doctors had poor knowledge of pharmacy benefit management, poor guidelines adherence and there was no peer review process in place for doctors. There was also no understanding that a prolonged of intensive care stay contributed exponentially to cost.

It was the opinion of doctors that the funders wanted to spend as little money as possible, the hospitals wanted as much income as possible and case managers were caught between the funders and everybody else. Doctors perceived that “funders are all bad, there are good bad ones and bad, bad ones”, and the funders were merely attempting to manage costs; their primary priority.

Funders were also perceived as dictators by doctors and hospital management: “The funders set the rules and then they want to engage but on their terms.” There was significant price pressure from funders, regardless of the fact that medical inflation was higher than the consumer price index. They constantly tried to drive patients into a lower level of care and they wanted more and more information to make sure the patient was an appropriate intensive care candidate. Funders were seen to be very slow in adopting new technology. Sometimes it took two to three years to evaluate new technology and the funders were determined to be provided with the necessary evidence. According to the participants, they were “penny wise and pound foolish, for example, only a CT [computerised tomography] scan is authorised for a patient, then three days later the patient needs a MRI [magnetic resonance imaging].”

It was perceived by the funders that doctors wanted good outcomes for their patients and a good personal income. Families also wanted good patient outcomes and they sometimes had unreasonable expectations of patient outcomes and even felt “entitled to good patient outcomes”. It was also felt that: “People are naturally antagonistic towards funders – it is a grudge purchase.”

Regarding patients and families, it was felt that they were often left in the dark; that they were sometimes isolated from discussion making and what was happening to the patient. It was appreciated by the participants that patients and/or their families pressurised doctors to treat, even when there was no hope. Doctors' fear of litigation often resulted in over-treatment of intensive care patients. According to the group, advance life directives were often not in place when patients were admitted to the ICU. It was perceived that South Africans had "First World" health care expectations in a "Third World" scenario.

For the funders, there were no systems in place to assess if a patient was receiving futile care. It was suggested that there should be a "basket of care" available for ICU, currently there is "a Pick n Pay[4] trolley where you can go on an uncontrollable shopping spree – just because you can does not mean you should." It was questioned why the funders had to take responsibility for the costs of complications caused by health care providers. Superbugs were acknowledged as a "mean" problem that contributed to high intensive care costs. Currently funders were also paying for care of patients in intensive care that did not take responsibility for their own health for example smoking and not wearing seatbelts, etc.

A lot of emphasis was placed on information. Funders needed information, "they need the patient's story – objective and subjective story" and it was perceived that they received no or limited information from health care providers. A doctor added a different perspective; the funders said they wanted to engage and asked for more information. He diligently sent in more comprehensive patient narratives, just to discover that the funders never used them. The amount of information that the funders required caused an administrative burden to the doctors.

Doctors trying to communicate with the funders caused a lot of frustration. "Funders are structured, doctors are dealing with the 'peanut' – peanut blocks you." Doctors were often told that they could not use certain codes, but the

[4] "Pick n Pay" is a large supermarket chain store in South Africa

“peanut” did not know the patient, they had no clinical insight, “We do not know how they work and they do not know how we work.”

Categorisation of patients presented a huge frustration for participants and they regarded acuity scoring systems[5] as “archaic”. Funders took “categories” very seriously; it was felt that the acuity systems were old, “illness has changed, treatment modalities have changed, yet you get paid more for out-of-date treatment modalities than cutting-edge modalities”.

International coding of diseases was compared to poker gaming – each party wanted to better the hand to get the upper hand. The pharmacy benefit management was outdated and should be revised. Designated service provider rules were difficult to apply, the majority of the hospitals that one was allowed to choose from did not have the speciality care that patients needed.

Case managers in intensive care were perceived by the doctors and funders as a huge frustration and as a barrier as they had no insight in intensive care. The doctors felt that case managers were dictated to by funders.

The Council for Medical Societies was regarded as “clowns” by the funders, instead of making service delivery easier, they made it more complicated and expensive.

In general, from the funder perspective, intensive care delivery in South Africa was complicated by the current burden of disease. An aging membership and a declining young membership posed a real problem for funders that would influence delivery of intensive care in the future and this problem would be exacerbated by poor general preventative care. Hospital management also expressed a concern regarding lower health insurance membership, which was their primary market.

[5] Acuity or severity scores in intensive care are used to predict patient outcome, to categorise disease severity and the degree of organ dysfunction.

The story of the doctors, the patients and their family members

Doctors' communicating with the patients and their family members was either highlighted or absent in the workshops and in the patient and family interviews. No mention was made by doctors treating adult patients in the public sector regarding communication with patients and their families. In the workshop with the doctors working in the public sector regional ICUs, it was sensed that they were so busy trying to "cope" working in ICU that communication with patients and family members was not a priority. Paediatricians in both the public and private sector acknowledged that communication with patients and their family members was time consuming but important. Communicating with patients and their family members was mostly a problem for doctors working with adult patients in the private sector.

Doctors agreed that patients and/or their families had to be part of certain decisions made in intensive care. However, patients and their families did not always understand why things were done differently in intensive care. Families wasted the doctor's time, "the doctors have to discuss/explain unimportant things with family – could rather focus on the patient". It was acknowledged that patients and their families differed from ICU to ICU and it was difficult to generalise, some, however, were very entitled and very argumentative.

It was acknowledged that the families were stressed because they had a family member in intensive care but that they were also a cause of stress for the doctors and nurses, "doctors develop radar to try and avoid family". The doctors experienced that families and patients did not trust them and they believed that the media was instrumental in instigating the public's mistrust.

A huge frustration for the doctors was that "Dr Google" was introduced to intensive care via the patient's family. The question was posed to the participants: is the family using Dr Google to say I am worried; I want to be part of the team? The reaction of the participants was: "No, it reflects mistrust, it is extremely antagonistic." It was felt that families did not have medical insight, "Reading about a disease on Wikipedia does not give you insight into often complex diseases … if you type in a list of symptoms into Google it will spit out diagnoses, but Dr

Google was not standing next to the patient's bed." The use of Dr Google was perceived as mostly confrontational – "it is not a discussion, it is an attack, why are you using this, why are you not doing this". Family members' expectations of intensive care were also often tainted by what they saw on television, in shows such as ER and Grey's Anatomy.

Doctors were presented with various challenges that compromised communication when dealing with intensive care patients' families. Family members did not always agree on treatment, for example, should a patient be ventilated, dialysed or not. Doctors often had to communicate with various family members at different times. Family sometimes demanded futile care and doctors succumbed to the pressure in fear of litigation. The patient might have a living will and the family could not find it or did not think of bringing it to the ICU.

Doctors sometimes had to communicate with family that were out of town or overseas, "It is very difficult to explain to the professor of radiology at Johns Hopkins why his mother-in-law of 87 is not having ... he is not standing next to her bed."

The family, on the other hand, experienced the communication with doctors differently. The communication for them varied from thorough engagement – even though the information was not always understood to limited or no communication. It became clear that patients and their families sometime needed information that differed from what was offered by the doctors and nurses: "When we saw all the pipes everywhere, all we wanted to know [was]: will he talk again?" It was highlighted that it was not the information that was given, but how it was given, as explained by a husband.

> Doctors and nurses explained everything in great detail. However, there is a difference between somebody who explains to you for the sake of explaining and somebody who is explaining standing on your side, in your shoes.

The doctors regarded Dr Google as the enemy, but for the family, Dr Google became the go-to person. This was aptly described by the wife of a patient.

> I was very grateful that the doctors went out of their way to communicate with me throughout my husband's stay, yet as a lay person hearing of all the medical concepts and treatments was overwhelming. Although the doctors explained everything, I felt bombarded with new information that was difficult to understand and Google became my 'new best friend'. Doctors are so used to their medical knowledge that they do not always appreciate how intimidating this knowledge is to a layman, especially in a stressful situation.

The family appreciated doctors' honesty, the difficulty to convey "bad" news and that they acknowledged their medical limitations. However, being honest with patients and families was also challenging for doctors as it was not what patients and their families wanted to hear at the time.

> They gave me assurance, but sometimes they called a spade a spade, that is why I will respect them forever, to have that courage to tell me that she might not make it is tough.

> At times, I felt that the doctors were too cautious when they spoke to me: I wanted to share my optimism that … [my son] was going to survive. I felt that the doctors did not listen to me, the mother, I knew certain things about him and they would not listen.

Obtaining consent from family for procedures was a legal requirement and part of the intensive care communication process. Some family members questioned the value of signing consent forms in the ICU.

> I was asked on several occasions to sign consent for various procedures. I feel strongly that it is not ethical to ask for consent when the person does not really understand what they are signing. It is not fair for a layperson to decide if the patient should receive a procedure or not. It would be much more reasonable if I was asked to sign that I was "aware" that a procedure was going to be performed.

> Signing consent in ICU was like signing a cell phone contract, you do not know what you [are] signing, you have to ask them to explain to you and in the end, you still do not understand.

The patient and family in the public sector had varying experiences regarding communication with doctors. Of note was the limited or no communication that some patients had with the doctors. “I only asked questions to the nurses, I did not know I have a right to ask the doctor.”

It became clear that patients were told things, but explanations were not always given by either doctors or nurses.

> The doctors and nurses were good to me, they did explain to me when they did things, but I never asked them any questions. I was put in a little room with windows in the ICU [isolation cubicle] the doctors they were confused if I still had TB [tuberculosis]. I did not understand why they put me in the little room; I was very alone all the other patients they were on the outside. Everybody was wearing masks when they came into my room, this made me scared, I did not ask why they were wearing masks, I just thought it was the rules.

Family members did not always know who to talk to and had difficulty to identify the appropriate doctor or nurse to speak to.

> There were so many medical staff to speak to in the casualty department, it made me very confused, you did not know who was in charge, all the movement in that department was too much. When he was admitted in ICU nobody told me what was happening, the doctors spoke to each other and the nurses did not seem to know what was going on. For the remainder of his stay in ICU no doctor spoke to us, there was only a few miserable sisters there, they did not explain anything only what to bring to wash him – I was very disappointed. When you ask a nurse, what is happening she would say this is not my patient, then they look for the nurse that is looking after him, then she says, we are waiting for the doctor.

Patients in private sector ICUs had more positive experiences with doctors communicating with them even though it was not always ideal, as illustrated by one patient’s comments.

> My family in the beginning of her ICU stay had a problem with the doctors, not with their treatment, with that they were very happy, but, there was no communication, they did not tell them anything.”

> “Blood shooting [from haemodialysis machine] and everybody running around trying to stop it. This did not make me panic, I knew the nurses were capable of addressing the problem, but nobody explained to me what actually went wrong.

4.2 Summary

The making-sense-of-the-mess phase confirmed the complexity of intensive care in South Africa, at both a situational and a cognitive level. With an understanding of the disorganised intensive care delivery where there are limited learning opportunities, a framework for the improvement of intensive care delivery can now be developed. In the next chapter, the development and the proposed framework for ICU delivery is presented.

Chapter 5: Towards a framework for the improvement of intensive care delivery

In this chapter, the concept of improvement from a systemic perspective is introduced and a summary of the findings so far and the salient principles underpinning the framework for the improvement of intensive care delivery are presented. The use of systemic intervention as a meta-methodology for the approach to the problem is justified and then an appropriate systems methodology is pursued for the development of the framework. Finally, a systemic framework for the improvement of intensive care delivery is proposed.

5.1 Improvement from a systemic perspective

The limited effect of conventional, rational planning on the improvement of health care delivery (Chaung & Inder, 2009; Grol, 2001; Leape et al., 2009; VanDeusen et al., 2007) is highlighted in Chapter 2. Midgley and Richardson (2007) refer to rational planning as an example of irrational planning: “It is irrational because it did not take into account the perspectives (or the rationalities – plural) of those people who needed to take the decision” (p 168).

Improvement actions in health care sometimes have the command and control focus of traditional systems engineering. They often fail, however, as people have a mind of their own and resist such an approach. In this regard, Churchman (1970) emphasises the bound nature of improvement. As highlighted in Appendix A7.4, if improvement is to be regarded as just, reflection on the boundary of analysis becomes essential. The author proposes that the demarcation of boundaries is an ethical concern that requires value judgement. The establishment of boundaries, for Midgley (2000, p. 137), “defines both the knowledge to be considered pertinent *and* the people who generate that knowledge (and who also have a stake in the results of any attempts to improve the system”. The appeal of an expert driving improvement actions has started to diminish with the recognition that there are different kinds of expertise, such as the expertise of the people involved in the day-to-day realities of the problem area (Midgley & Richardson, 2007).

When the definition of improvement is explored, Churchman (1979) suggests the notion of critique. The author follows Hegel (1807) who emphasised the need for self-reflection that subjected valued assumptions to scrutiny. For Churchman (1979), this implies engagement in a “dialectic process”. This entails subjecting your ideas to their “worst enemies” in a rational debate and only when the “enemies” are heard and the ideas survive, should the improvement proceed.

The limitations of the notion of optimisation are also recognised – what is regarded as optimal is subjective, and what is an acceptable “optimal” to one person may be unacceptable to the next. It is clear that “… if you simply start with the goals of one stakeholder and assume that this is unproblematic, then all kinds of side effects can emerge”. (Midgley & Richardson, 2007, p. 169)

Improvement must be defined “locally” and temporally. Locally defined improvement implies that what is regarded as valid improvement by stakeholders in one context, may not hold true for stakeholders in another context. Furthermore, improvement that is presently regarded as valid, may not be regarded as such by future generations. The concept of sustainable improvement now becomes important to ensure long-term improvement where future generations are accounted for (Midgley, 2000).

The goal or future of the improvement must be decided upon. The change of pattern (paradigm shift) required to reach the goal will determine the criteria of improvement. Hodgson and Midgley (2014) propose a systemic foresight method – “three horizons” (p 6) – to perceive the future of improvement, namely to sustain, reconfigure or transform the current system. The different views of the future will influence the boundary critique and how the success of the improvement will be defined.

When engaging in the development of an improvement intervention from a systemic perspective, it does not entail “a flawlessly pre-planned change based on accurate predictions of the consequences of action” (p 55) associated with that of a mechanistic worldview (Midgley, 2008).

To overcome these limitations when planning for improvement, the significance of multiple rationalities must be acknowledged. Furthermore, expertise must be democratised and there must be engagement with self-conscious stakeholders. Optimisation must only be applied in limited situations where appropriate and conflicting values and viewpoints can be acknowledged (Midgley & Richardson, 2007).

Systemic intervention is an approach that encompasses all of these suggestions. The primary aim of systemic intervention is improvement of the "system" – where system is not a fixed object but rather a particular way of organising our thoughts about the world (Hodgson & Midgley, 2014).

5.2 The salient principles of the framework for improvement

In section 2.3.3 it was acknowledged that the way health systems thinking has evolved, the "bifurcations and choices made along the way" will influence the development of an improvement framework. It was concluded that it is imperative, when developing an improvement framework, to appreciate that the intensive care system functions as a CAS, but that it is also a rule-bound system that does not function in isolation, but as "health in a social-ecological system". Analysing the challenges of intensive care service delivery in section 2.5 to section 2.8 and making sense of the mess (understanding intensive care delivery in South Africa) in section 4.1.6 emphasised the complexity of intensive care delivery, both on a situational and cognitive level.

Various factors contribute to the complex delivery of intensive care. Some of the factors are the multiple, interdependent stakeholders with multiple vested interests interacting in intensive care. It became clear that both hard and soft issues influence the delivery of intensive care and that the viability of the intensive care functioning is impaired. Approaches to improve intensive care delivery were discussed in section 2.7 and it became evident that the current reductionist approach to improvement had limited success in facilitating sustainable improvement in intensive care delivery. Therefore, the improvement of intensive care delivery requires thinking beyond current boundaries. Based on the afore-

mentioned discussion, the new approach needs to offer *continuity* to ensure sustainable improvement.

An analysis of systems approaches in section 3.7 and Appendix 7 and the use of systems approaches in making sense of the mess (understanding intensive care delivery in section 4.1.6) deemed systemic intervention a suitable meta-methodology. The motivation for this choice stems from the practical need to accommodate the multiple vested interests of stakeholders, some of whom have been marginalised. Systemic intervention, through boundary critique, asks for the rational, comprehensive, ethical inclusion of stakeholders. Intensive care is delivered in South Africa with limited resources and there is a need for the *just use* of resources to foster distributive justice. Boundary critique, where different boundary judgements with their associated values are explored, can contribute to the just use of resources. A further practical need is that problem areas of intensive care delivery are so diverse and there is "no method that can do everything" (Midgley, 2008, p. 55). The methodological pluralism of systemic intervention allows for the most appropriate methods to be selected to facilitate improvement. Purposeful action, the third principle of systemic intervention, requires that the framework is emancipatory in nature and improves the delivery of intensive care.

Based on the findings so far, the principles guiding the framework for improvement were derived and are shown in Table 5-1.

Table 5-1 Principles that underpin the framework for the improvement of intensive care delivery

1	The framework must be systemic in nature to address the emergent properties of intensive care delivery.
2	The framework must allow for multiple-perspectives, including that of marginalised stakeholders and it must mitigate multi-vested interests and power relationships.
3	The framework must be flexible and adaptable to promote learning about the complex problem of intensive care delivery.
4	The framework must allow for the strengths of various relevant approaches to complex problem solving.
5	The framework must facilitate sustainable improvement of intensive care delivery.
6	The framework must ensure the “just use” of resources to foster distributive justice.
7	The framework must acknowledge the trajectory of intensive care delivery – the patient comes from the community and returns to the community.
8	The framework must acknowledge that intensive care delivery is a continuum that ranges from basic to highly sophisticated.
9	The framework must consider all aspects that contribute to successful intensive care delivery.

As systemic intervention is the meta-methodology of the proposed framework for the improvement of intensive care delivery a brief discussion of the philosophical justification of systemic intervention by Midgley (2000) is presented in section 5.3.

5.3 Midgley’s philosophical justification of systemic intervention

The appreciation of a methodology’s underpinning philosophy is necessary as the underlying assumptions thereof are frequently used to defend valid practice. Midgley (2000) advocates the importance of a philosophical underpinning of methodology on two grounds. Firstly, if one wants to promote an alternative practice, and dominant practices are rationalised in terms of philosophy, it is

strategic to participate in philosophical discourse. Secondly, philosophical arguments are important to discussions on methodology, methods and systemic practice to ensure valued and justifiable practices. These arguments can help to see *practice* in a new light and the new perceptions can be very valuable.

In intensive care, a reductionist approach is traditionally followed in improvement interventions – with limited success, as highlighted in section 2.7. There is therefore, in the improvement of intensive care delivery, as Midgley (2000) suggests, a need to move beyond subject/object dualism or reductionism to a more comprehensive form of knowledge production. Midgley (2000) offers process philosophy as an alternative to overcome the limitations of subject/object dualism as mentioned in Appendix A7.6.

The origins of systems philosophy can be traced back to the Greek philosopher Heraclitus (544 - 483 BCE) who is known for the famous words: “you could never step twice in the same river” – for it is not the same river and you are not the same man (Colvin, 2007, p. 760). Heraclitus believes in “total flux and especially material flux” (Colvin, 2007, p. 767) However, Midgley (2000) believes that the twentieth century process philosophers do not presume that “nothing is” but take as analytical prime those “objects” (or systems) that offer the “means of becoming” (p 78). Midgley concedes that he uses the term “process” in a related but slightly different manner to other process philosophers. For him “process philosophy involves identifying a process that is not dependent on the further identification of a single type of system that give rise to that process” (p 79).

In his early work, Midgley (2000) used the theory of “three worlds” (Habermas, 1976) to develop a new ontology and methodology for systems enquiry. Habermas (1984a, 1984b) states that there are four validity claims in any sentence meant for communication. Giddens (1985) aptly summaries the theory as follows:

> “When I say something to someone else, I implicitly make the following claims: that what I say is intelligible; but that its propositional contents are true; that I am justified in saying it and; and that I speak sincerely, without intent to deceive.” (p 99)

These validity claims refer to the objective external world, the normative social world and the speaker's subjective internal world (Habermas, 1984a, 1984b). Midgley (1992a), when reflecting on what assumptions to make on the relationship between language, subjects and objects, argues that:

> the dynamism of language demonstrates that individual subjects bring unique insights to bear and thereby change the use of language, and that it would not be possible to have individually differentiated subjectivities (with the capability to changing language) if there were no physical reality separating individuals from one another.

Midgley (2000) concluded that this reasoning resulted in a new dualism of language/object where the subject was marginalised. He argued that creating a new dualism did not offer acceptable ontology, but exposed the improvised nature of the description. This line of enquiry was then discarded in favour of the philosophical position of postulating knowledge or a knowledge-generating system as the focus. The concept of a knowledge-generating system implies "something that gives rise to the existence of knowledge through its own activity" (p 76). Numerous knowledge-generating systems were suggested by different authors, such as a biological observer (Von Bertalanffy, 1968), an autopoietic organism (Maturana, 1988), circular pathways (Bateson, 1970) and self-organising linguistic systems (Douglas, 1986). For Midgley, the problem was that all these authors attempted to produce one knowledge-generating system as the focus of an epistemological theory. In the late twentieth century, authors, for example Bhaskar (1986), acknowledged that all theories were partial and their partiality was the result of the aims and values of their inventors. It became clear to Midgley that he had to consider the possibility of working with a variety of theories, acknowledging that each favour specific perceptions, values and aims. This implied that a plurality of theories would render more insights for intervention than working from one philosophical stance.

Authors of knowledge-generating systems focus on specifying the content of these systems. Midgley (2000) questions this and proposes that the process of specifying the content should be the focus, and not further identification of a single category of system developing that process. By changing the analytical

focus from content to process he proposes boundary judgement as the focus of analysis rather than the specific knowledge-generating system. Now the *"subjects come to be defined in exactly the same way as objects – by a boundary judgement"* (p 79). Following Churchman (1970), who states that a boundary determines what the focus of attention is, the boundary now defines the object of attention. The result is that: "When there are multiple objects in a relationship with one another, there are multiple boundaries – and the set of objects is delineated by a wider boundary that defines that set in relation to everything that is excluded from attention" (Midgley, 2000, p. 79). The author furthermore suggests that diverse boundary judgements can be made "looking outwards to the world" and similarly "looking back at a knowledge-generating system". The judgements made in this manner are referred to as "*first order"* and "*second order*", respectively.

It must be explained that the term *knowledge* is used by Midgley (2000) in the wider sense of "any understanding". Any understanding includes whether it is phrased in language (communication) or not (imaginary), this implies that perceptions can also be included. Perception is not regarded as "recorded images of an external reality, but as a complex construction by a sentient being in interaction with its environment" (p 81). This supposes that there can be knowledge without language; this explanation of knowledge distances knowledge from the notion that it is imprinted in language and consequently, both human and theoretical in nature.

When using process philosophy, at least two boundary judgements need to be made: one to determine the extent of the knowledge-generating system and the other to determine the nature of the sentient beings who are part of it. The placing of these boundaries is always dependent on the purposes being pursued, the theoretical ideas employed in a local situation. When a different point of view is allowed, the purpose may change and this may lead to new knowledge-generating systems with associated sentient beings being identified (Midgley, 2000).

Midgley (2000) elects to refer to sentient beings instead of human beings in order not to limit knowledge to human knowledge. However, the difference between

non-human animals and humans needs to be appreciated. Non-human animals only have command of basic language (verbal and non-verbal signs) that have meaning-in-context, yet “these signals do not provide *context for one another* that change their meanings” (p 83). The implication is that, if emergence of knowledge needs to be explained, it is done through language that humans have command of, hence non-human animals, although they could be included in boundary judgement, could never be exclusively included. There are three further reasons to use the language of humans to frame boundary judgements. Firstly, explicit theories to analyse the production of first-order knowledge can only be articulated in human language. Secondly, human language can express values and value judgements influence what is important to achieve (the purpose of what is pursued). Lastly, human language can differentiate what exists, what could possibly be under different circumstances and what ought to happen.

To summarise, sentient beings rooted in knowledge-generating systems are concerned with producing knowledge. The theories used in the local context determine where the boundaries are positioned around the sentient beings and around the wider system. Midgley (2000) now introduces the notion of an agent. An agent can be a single human or a group of distinguishable interacting humans. A group of humans is viewed as an agent when “it (or its representatives) are perceived as acting to realise a dominant purpose at group level, regardless of the actions or views of the sub-agents” (p 114). Since sentient beings are defined in an open manner, the precise definition of agency should similarly be left open to permit for theoretical pluralism and for multiple possibilities of boundary judgements. The action the agent embarks on is influenced by the knowledge-generating systems in which it is rooted and needs to be explained by means of boundary critique. Therefore, with process philosophy, if the identity of the agent can be numerous, the notion of action can also vary. Since it is possible to draw upon a vast number of boundary judgements, it is accordingly justifiable to use related theory – keeping in mind all theory suggests boundary judgement and are consequently partial. Thus, Midgley (2000) concludes that it would be inconsistent to establish a theory of action for systemic intervention and consequently invites that an assortment of theories of action are used in a pluralistic manner; not in a way that suggests that only one theory is valid.

There are, however, four significant implications that need to be considered if theoretical pluralism is accepted. Firstly, following Kuhn (1970), the abandonment of the general assumption made by traditional scientists, for example Popper (1959), that knowledge is cumulative. Within the systems idea of everything being interconnected, it is unattainable that any theoretical knowledge, irrespective how elaborate, can accurately reflect reality in the absolute sense. According to Fodor (1974), a single body of knowledge is unobtainable if different language is used to generate theories. Yet, it is acceptable to talk of and defend a growing body of knowledge, provided that it is not viewed as perfect. “Therefore, knowledge is relative to the agents … who are … under the influence of wider systems which can be bounded in any number of ways” (Midgley, 2000, p. 161). Secondly, theory serves societal roles; theory can never be pure but is always significant in terms of the interventions pursued by the agents. Thirdly, there is always an agent that needs to choose from a multitude of theories. However, the interpretation of “choice” is vastly different from the diverse theoretical perspectives and the related boundary judgements.

Lastly, theoretical pluralism does not infer that no standards or principles inform choice. Midgley (2000) argues that there can be no universal standards for choice between theories and explains his position by critiquing the renowned Burrel and Morgan (1979) framework of sociological paradigms that emphasises the assumptions of various perspectives. For Midgley, this framework cannot make any satisfactory claim to objectivity and, therefore, universality; he substantiates his argument with the reasoning of among others, Willmott (1993) and Gregory (1992). Willmott (1993) suggests that all the sociological perspectives do not fit where Burrel and Morgan (1979) claim they do. When attempting at a meta-level to classify multiple theories, it becomes apparent that their classification exhibits just another theory. Gregory (1992) proposes that all meta-theories are questionable, they pretend to function at a higher level but exist at the same level they try to classify. The fact that there are no universal standards for choice does not imply a position of absolute relativism for Midgley. He states that:

> It puts us in the position where we not only have to acknowledge that agents choose theories according to their purposes, but we also have to recognise that agents … create standards of their own that develop and change over time –

> how the origins are seen will depend on how the agent is viewed. (Midgley, 2000, p. 167)

Midgley (2000) acknowledges Foucault (1982) theory of the origins of standards that argues that knowledge, power and the agents' identities are tightly interconnected. This implies that the choice between theories will be influenced by power relationships and the identity of agents. Hence, the multiple theories available to agents, the manner in which agents understand their purposes and choices, may be influenced by power relationships, and norms will develop for these relationships. Therefore, which theories will be understood as beneficial and for what purposes will be determined by the agents' relationships, including power relationships with the wider systems in which they are rooted. It can thus be concluded that local standards for choice can be defined.

Midgley (2000) concludes that he has shown the connection between process philosophy, boundary critique and theoretical pluralism and turns his focus to methodological pluralism. He defines methodology as "the set of theoretical ideas that justifies the use of a particular method or methods" (p 105). Therefore, as methodology is basically theoretical, it can be deduced that methodological pluralism is possible, allowing for the use of multiple methods as justifiable.

Methodological pluralism, for Midgley (2000), entails engagement on two levels. On the first level, at the level of methodology, there is appreciation for other methodology ideas and letting their understandings enlighten our methodology. Engagement on this level can either be temporary during an intervention or continual as a point of orientation. The value of this engagement is that no theory or methodology is complete and learning from other methodologies will evolve our own methodologies. The second level of engagement, on the method level, allows for the use of a wide range of methods. The use of a wide range of methods allows the practitioner to be more responsive to more diverse problem situations and not to see problems through the same methodological lens.

The framework that is developed in this research cannot be restricted to a single paradigm. As already mentioned, the improvement of intensive care delivery is complex and needs to address both hard and soft challenges, therefore both hard

and soft systems approaches, such as functionalist, interpretivist and emancipatory approaches will be used. It is clear that a plurality of paradigms and methodologies, as offered by process philosophy, will render more insights for improvement than working from one philosophical stance.

In summary, Midgley (2000) has illustrated that process philosophy of systemic intervention considers subjects and objects in the same manner; both are identified using boundary judgements. In doing so, the challenge of subject/object dualism or reductionism is addressed. Process philosophy furthermore allows for theoretical, methodological pluralism and creative mixing of methods to direct systemic intervention.

When confronted with a complex problem such as the improvement of intensive care delivery, it is clear that a flawlessly pre-planned change based on accurate predictions are not going to be helpful. There is a need to have a non-reductionist approach and to accommodate the multiple vested interests of stakeholders. It is also clear that “no one method can do everything” and that pluralism, which allows for the most appropriate methods to be selected to facilitate improvement, is needed. Systemic intervention seemed the most appropriate choice as a meta-methodology for this improvement framework.

5.4 A multimethodological framework for the improvement of intensive care delivery

The improvement framework (also referred to as the “framework”) is generic in nature but was specifically developed and is proposed for intensive care in South Africa. Hence, it is necessary to explain who is responsible for improvement in the current situation (authoritative power) and who is responsible for the implementation of the improvement. The improvement of intensive care delivery is, at the time of this research, fragmented. It is the responsibility of the deputy director of the national Department of Health, and only happens on an ad-hoc basis with the primary focus being on the public sector. The private hospital groups and funders drive the improvement of intensive care delivery in the private sector. The implementation of improvement is therefore also fragmented through multiple agencies. The proposed framework does not depend on who “owns” the

improvement of intensive care delivery, but rather that improvement should be approached systemically following the suggestion of this research. If improvement is approached systemically, it will result in benefits for all stakeholders.

Embedded in the nine framework principles that are illustrated in Table 5-1, are matters relating to systemicity, complexity, flexibility, empowerment and transformation of intensive care delivery. The review of the systems thinking literature revealed that the various systems thinking approaches each had its own strengths and weaknesses. System dynamics, an approach often suggested for health care and intensive care improvement, focuses on hard issues where there is not much uncertainty. This approach is not recommended for complex situations where uncertainty prevails. The systems thinking approach that pays special attention to empowerment is systemic intervention. Interactive planning is effective for planning for an uncertain future as it is interpretive, systemic and comprehensive in its approach, and managing complexity due to acknowledging recursivity in an organisation or system. Hence, systemic intervention and interactive planning will be used to meet the principles of the framework and to address complexity. The following sections will discuss some of the methodologies that form the elements of the framework and its overall structure.

5.4.1 Appropriateness of interactive planning as a key systemic methodology within the framework

Interactive planning (discussed in more detail section 3.7.2 and Appendix A7.9) was viewed suitable as the key systemic methodology for several reasons. Firstly, interactive planning emphasises learning that addresses an important framework principle. Furthermore, intensive care stakeholders are given the chance to construct their own future. The future improvement is based on existing assumptions and possible scenarios of the future. This allows for flexibility and responsiveness to be built into the improvement design that will ensure that intensive care can endure rapid change while retaining control of intensive care delivery. More informed decisions are made as all intensive care subsystems and surrounding systems are part of the problem conceptualisation and the solution thereof. The participants are cognisant of the effects of their decisions on the

whole system as the methodology makes them aware of the web of relationships in- and outside their organisation.

Interactive planning encourages participation, which in turn leads the participants to feel like they are important assets that can make a difference in the delivery of intensive care. Participation from various levels of intensive care ensures that a holistic view of improvement is generated.

Designing an ideal system of intensive care delivery encourages creativity and participants are not constrained by trying to improve the current system. This out-of-the-box thinking can lead to breakthroughs that can have far-reaching effects; even beyond the current system.

Interactive planning requires continuity; no intensive care improvement intervention, regardless of how well it is formulated, will evolve as planned and not all events can be foreseen. Therefore, improvement interventions should be continuously reviewed and appropriately adapted.

The methodology of interactive planning is based on transparency and awareness of the project and this will contribute to easier implementation of changes. The participants who made the plan are also responsible for the implementation.

The three operating principles of interactive planning: participation, continuity and holism, satisfy the first of the framework principles and as the framework develops, it will be demonstrated that interactive planning accommodates all the framework principles. Interactive planning methods and techniques are intended for corporate organisations that are not always relevant to other systems. Hence, interactive planning will be used as the key methodology providing the key working orientation for the framework, but will be enriched by more suitable methodologies, methods and techniques that suit the requirements of the framework. The choice of methodologies, methods and techniques that are included in the framework, will be presented in correspondence with the phases of interactive planning.

5.4.2 Methods and techniques for making sense of the mess

Establishing the key systemic methodology within the framework is followed by the making-sense-of-the-mess phase. This phase is essential as it informs the entire process that follows and it must be done in a thorough and exhaustive manner. It is here where learning starts as it is the beginning of the systemic intervention where the minds of stakeholders are changed when they begin to see the problem situation through each other's worldviews. It must also be emphasised that this phase is ongoing and can never be completed.

In this phase, it needs to be decided who should undertake the sense making and how it should be carried out and presented. The focus of this phase should not be the planning for improvement of intensive care delivery; an understanding of the stakeholders' worldviews of intensive care delivery, what they regard as the purpose of intensive care and the context of intensive care delivery should be obtained. Then, using appropriate methods, sense needs to be made of the mess. One needs to be aware that the mess has several dimensions: firstly, the inherent cognitive complexity of intensive care, secondly the complexity of the delivery of intensive care, and lastly the complexity of the improvement of intensive care delivery.

If the improvement of intensive care delivery is to be leveraged to assist with the emergent properties of intensive care, then the position of framework principle 2 must be adhered to. Framework principle 2 allows for multi-perspectives, including that of marginalised stakeholders, and for the mitigation of multi-vested interests and power relationships. Improvement of intensive care delivery does not only lie within the jurisdiction of the national Department of Health or private hospital groups. Therefore, it is essential to include the salient stakeholders, at least in some key parts of the improvement process. The first task in making sense of the mess is to determine which stakeholders should be involved and how this process should be managed.

Section 3.7.1 offers a detailed discussion on the identification and management of stakeholders; a brief summary is now presented to remind the reader. Banville et al. (1998) highlight two interdependent, central ideas in the general definition

of stakeholders: “vested interest” and “problem situation” (p 17). The vested interest of the stakeholders and the stakeholders themselves can only be identified once a problem situation has been recognised. Three “non-mutually exclusive categories” (p 18) of stakeholders were identified, namely standard, fiduciary and silent stakeholders. The visibility of stakeholders will be determined by the type of decision-making process that is followed and the situation in which the decisions are made. Three types of decision-making processes were identified: autocratic, consultative and group decisions. The intensive care delivery decision-making process is not a straightforward process where one type of decision-making process prevails; a combination of the different types will be needed. It was suggested that a problem cannot be considered independently of the identification of the problem’s “owner(s)” and that the identification further describes the problem. In order to ensure appropriate consideration of a problem situation, such as the delivery of intensive care, stakeholder identification is essential. The process of stakeholder identification is an iterative process that starts with the identification of the standard, fiduciary and silent stakeholders. The initial identification is followed by a deeper analysis of stakeholders to ensure a justifiable and responsible choice of stakeholders. An adaptation of CSH was suggested as appropriate for this analysis “to develop a critical consciousness in people regarding the conditioned nature of any kind of 'improvement', and thereby to 'subvert' people's technocratic notion of planning” (Ulrich, 1996, p. 13).

Rich pictures from SSM could be used to make sense of the mess and VSM should be used to make a systemic diagnosis of viability, both of these methods are discussed in section 3.7.3.

5.4.3 Ends planning

Idealised design is a vital component of ends planning and it distinguishes interactive planning from other planning approaches. It provides a comprehensive picture that informs how one moves to the action of improvement of intensive care delivery. It is important to remember that idealised design cannot represent a utopia of intensive care delivery, but must represent an ideal-seeking system. An idealised design of intensive care delivery improvement is only

allowed technology that is feasible in the current situation and can survive in the current environment.

5.4.4 The realisation phase

The realisation phase consists of three stages, namely: means planning, resource planning and implementation and control, that are focused on accomplishing the idealised design as closely as possible. These three stages are conventionally associated with planning and improvement and will influence how and when the current reality will be transformed towards the idealised design. In this part of the framework, it is useful to incorporate appropriate traditional methods and techniques of planning and improvement. Due to the diversity of elements of intensive care delivery no methodology, methods or techniques are suggested to manage the activities of the realisation phase.

Means planning

The aim of means planning is to attempt to close the gap between the reference scenario (the mess) and the idealised design. Creative, alternative means must be carefully considered to achieve this goal. The conventional approach in intensive care delivery is to focus on the hard issues such as optimisation of resources. The benefit of the systemic approach of the framework is that a comprehensive picture informs what needs to be done to achieve the idealised design. Making sense of the mess highlighted the profound soft issues of intensive care delivery that need to be addressed. It furthermore highlighted that intensive care delivery is not restricted to just the ICU, but that it starts in the community and continues when the patient returns, with the consequences of intensive care, to the community. By improving all aspects of intensive care delivery, framework principles 7 and 9 are satisfied. The means planning may require the development of new policies to assist in realising the idealised design. Due to various reasons, such as resources, not all improvement actions may be achieved in the initial planning period; these actions must be part of the continuous planning principle to ensure sustainable improvement (framework principle 5).

Resource planning

Ackoff (1981a) specifies the types of resources “people, facilities, equipment materials and energies, money, information, knowledge and understanding” (p 24) that need to be considered to see if the required means can be met. Not only must the “how much”, but also “whether and how these requirements can be met”, be determined. In a country like South Africa, the just use of resources (framework principle 6) is essential. It must further be acknowledged that intensive care delivery is a continuum that ranges from basic to highly sophisticated and that resource planning should be done accordingly (framework principle 8). Ackoff (1981a) emphasises that if the requirements are not met, or they are found to be impossible to achieve, the previously idealised design or means planning must be revised and modified, and the cycle must be reiterated (framework principle 3).

Implementation and control

In this phase, the “who is to do what, when, where and how, is decided” (Jackson, 2000, p. 238). The plan is implemented and the outcomes must be evaluated to ensure that the plan has been accomplished. The results must be fed back into the planning process so that learning can take place and adjustments made (framework principle 3).

5.5 The proposed complete framework for the improvement of intensive care delivery

The proposed framework is illustrated in Figure 5-1. It shows how systemic intervention, especially methodological pluralism, was used to combine the strengths and appropriateness of methods from different methodologies to ensure improvement of intensive care delivery (framework principle 4). Although the use of various methods and methodologies at different stages of the framework reflects the use of systemic intervention, the methods and their methodologies still function in the spheres of their own paradigms.

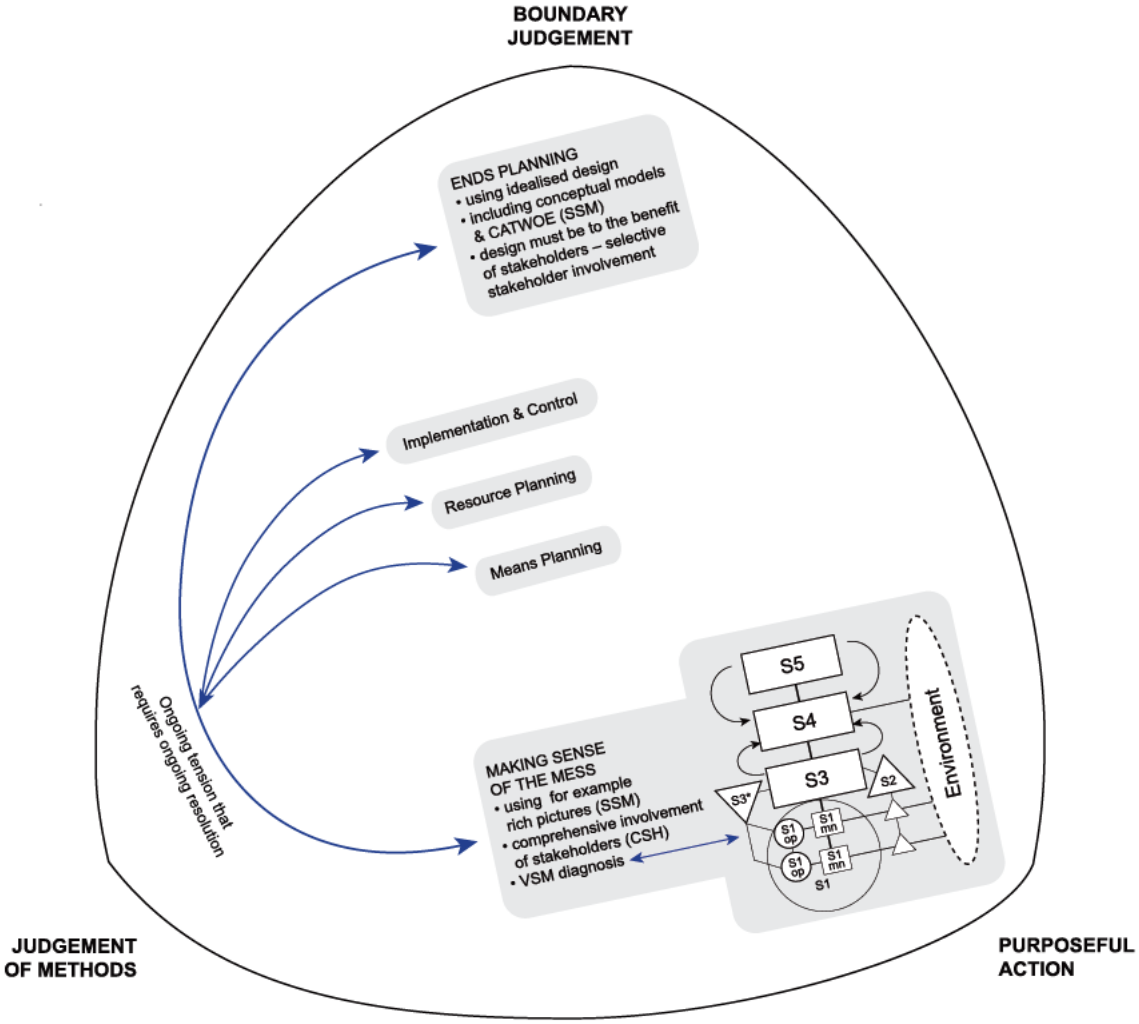


Figure 5-1 Proposed framework for improvement of intensive care delivery

While making sense of the mess in the first part of the research, the value of using certain methodologies and methods became apparent and this assisted in the choice of methodologies included in the framework. Interactive planning (an interpretive approach), is the primary systems methodology that offers the mechanism for the intervention process. It serves as a basis for other pertinent systems methods that were incorporated in the framework. The methods included in the framework are as follows:

- methods from interpretative methodologies, such as rich pictures, conceptual models and stakeholder analysis;
- elements of the methodology of CSH, an emancipatory approach; and

- VSM, a methodology from the functionalist approach, but used in an interpretive manner as a diagnostic tool.

Although the methodologies and methods are diverse, their connectedness is ensured by their inclusion in the various stages of interactive planning and by the philosophical base of methodological pluralism of systemic intervention.

It is obvious that not one of these methodologies on its own would have adequately addressed the improvement of intensive care delivery. Interactive planning offers a holistic, inclusive and continuous process that focuses on understanding the system. Furthermore, interactive planning emphasises the development rather than the growth of the system (Ackoff, 1981b). All of these factors are essential for the improvement of intensive care delivery. A system such as intensive care needs to be viable in order to render an effective service. VSM affords a language of “viability” (Espinosa, Harnden, & Walker, 2008) and when VSM is used as a diagnostic tool, it depicts a powerful image of the system (Flood & Jackson, 1991). A viable diagnosis of a system contributes to making sense of the mess – the understanding of intensive care delivery, that in turn, will aid the process of improvement of intensive care delivery. This also holds true for the use of SSM, a process of understanding and learning that encourages the inclusion of different worldviews (Checkland, 2007). Methods of SSM that are valuable in interactive planning are rich pictures and the building and use of conceptual models. Interactive planning, VSM and SSM have been critiqued for not always contributing to emancipation, a requirement for the process of improvement (Jackson, 2000). This criticism is addressed by including elements of CSH, an emancipatory approach, in the interactive planning stages. The characteristics of the improvement framework that have been highlighted thus far contribute to the framework’s compliance with the nine principles that underpin the framework.

5.6 The justification of the framework from a validation and legitimisation point of view

The justification of the framework so far, is founded on the nature of intensive care delivery in South Africa and the current body of knowledge in systems thinking. In addition, justification can be obtained by validation and legitimisation.

Research products in traditional science and health care are typically justified by scientific norms. However, the justification of a framework that includes different paradigms, such as developed in this research, is not as clear-cut and is much more challenging. This framework is concerned with the improvement of intensive care delivery in a real-world situation and its consequent emerging properties. The implementation of this framework will be the ideal validation thereof; however, this is not practical. Once the framework is implemented, the extent of the emerging properties that benefit all stakeholders needs to be assessed. This is a time-consuming undertaking that can take years and therefore not realistic within the scope of this research. Yet, due to the nature of the framework, an alternative process is suggested. But, some pertinent aspects require clarification.

In the process of developing a framework, a model of intensive care delivery was offered in section 4.1.6. Models are typically associated with representations of the real world, subject to thorough validation. This model of intensive care delivery was intended as a heuristic mental construct to understand the mess that needs to be addressed to develop a more suitable improvement framework. Checkland (1995) suggests that models are “not part of the real world; they are only relevant to debate about the real world … and are used in a cyclic process” (p 47). The author regards heuristic mental models to be valid if they are relevant and competently built and argues:

> In the ‘hard’ approach models must be shown adequately to represent a part of the real world; in a soft approach models have only to be internally valid, that is to say internally defensible against a set of principles which define a particular kind of intellectual construct, a particular kind of epistemological device. (p 54)

The model of intensive care delivery was constructed following a set of principles and served as a competent and clarifying epistemological device for the purposes of developing the framework. Hence, the model satisfies the two aspects for the validation of epistemological devices. The same argument applies to the framework and the validation thereof will be presented in the next section.

It is further necessary to clarify who the owners of the framework are, as this will have an impact on the validation and the legitimation discussed in the next step. The answer to this question is not obvious, taking into account the various stakeholders or actors involved in the delivery of intensive care. The framework could be owned by, amongst others, the national Department of Health, private hospital groups, the funders, CCSSA, or the community. The framework was developed with the primary goal of assisting those responsible for the improvement of intensive care delivery. Consequently, the national Department of Health and the private hospital groups will own the framework and the other stakeholders will be the other actors in the system.

Many concepts and methods of validation exist. Polit and Beck (2008) define validity as “a quality criterion referring to the degree to which inferences made in a study [model, or framework] are accurate and well founded”. Midgley (2000), suggests that if a method, model, or framework is regarded as legitimate, it will be “viewed (by the researcher, stakeholders and/or other interested parties) as *appropriate in the circumstances*” 9p 106). Model validation and legitimations are two overlapping, yet separate, activities in operational research modelling, and for an operational research model (also important to this framework) to be acceptable, it has to be valid and legitimate (Landry, Banville, & Oral, 1996).

Midgley offers a similar view:

> The term ‘validity’ is generally used by proponents of observational science: if a method is valid, it yields knowledge that reflects reality without known distortions or intervention by the observer. However, those … who believe that truly independent observation is impossible tend to avoid the word ‘validity’ and talk about legitimacy. (p 106)

Any model or framework that is not legitimate in the eyes of those it is intended for, has less of a chance to be implemented successfully. A valid model (this is also true for a framework) does not imply that the model is legitimate (Landry et al., 1996). The emergent properties of the intensive care delivery for which the improvement framework is developed, such as benefits to all stakeholders, will be an indication of the validity and legitimacy of the framework.

The “Model Validation in Operational Research”, recommended by Landry, Malouin, and Oral (1983), will guide the validation of the improvement framework. (The term framework rather than model will be used for consistency.) The principles of validation that are recommended by the authors are applicable to the modern-day operational research community (and to intensive care delivery) that is confronted with situations of uncertainty, complexity, and where social elements prevail, make this approach applicable to the improvement framework. Representativeness, which was regarded in previous situations of certainty and a physical environment, has become irrelevant in the contemporary situations described. Therefore, the authors emphasise the usefulness and usability of a framework for contemporary situations and reiterate that framework building and validation should be concurrent processes.

The framework validation process suggested by Landry et al. (1983) is shown in Figure 5-2. The framework-validating activities are arranged into four basic, interrelated and interactive stages: the problem situation, the conceptual framework, the formal framework, and the solutions and recommendations. Concerning the improvement framework, the problem situation that led to the development of the framework was elucidated in Chapter 1 to Chapter 4. The improvement framework represents the formal framework.

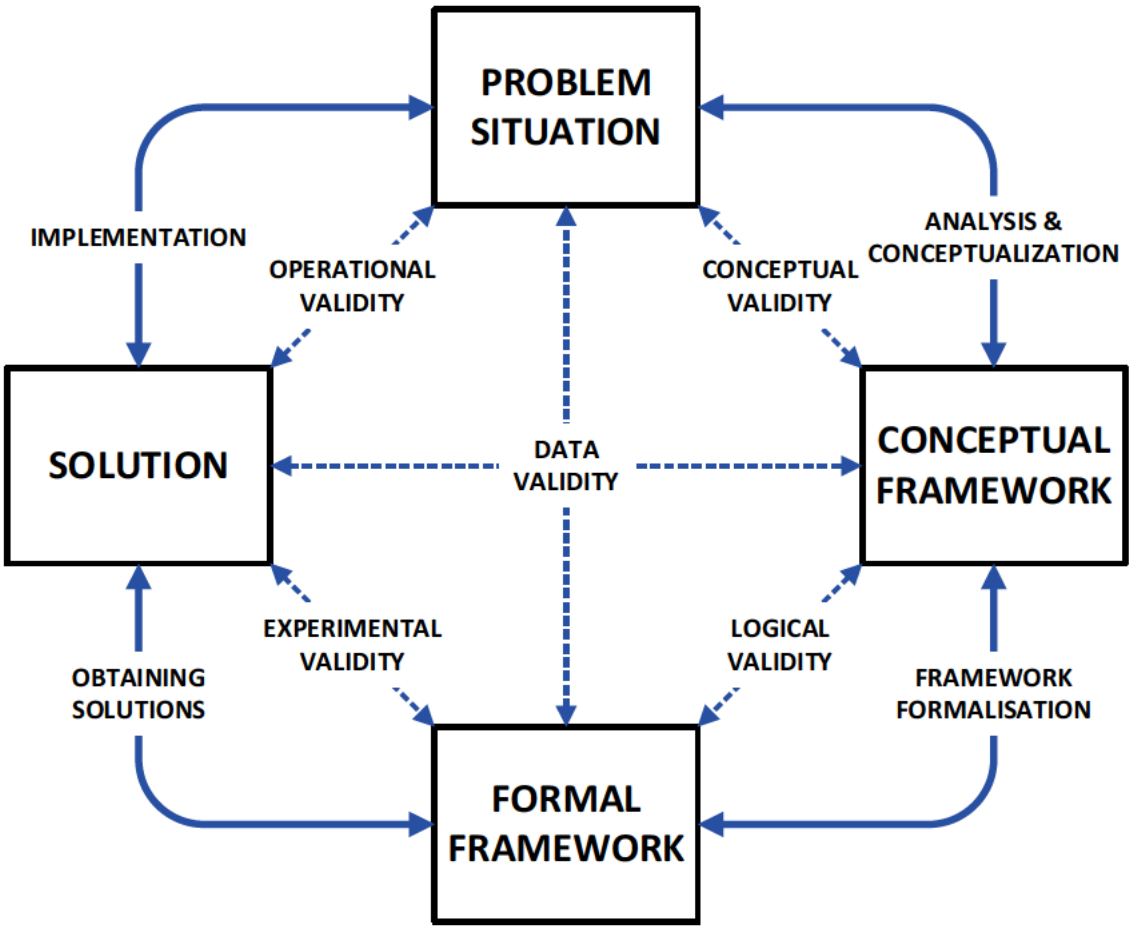


Figure 5-2 Framework validation process adapted from Landry et al. (1983)

Figure 5-2 distinguishes five different validation activities, namely conceptual, logical, experimental, operational and data validation. Conceptual validation focuses on the suitability of the perceptions, assumptions and theory that support the improvement framework. Logical validation addresses the analytical verification of the associations in the framework, yet for the improvement framework that crosses different paradigms, logical validation posed a problem. Conceptual validity was obtained through the previous chapters that comprehensively discussed the justification of a systems approach to the problem, the need for a methodological pluralism approach to the framework, the rationale for the choice of philosophical orientation of the framework and the choice and methods used in it.

Experimental, operational and data validation (if applicable) are related to the implementation of the improvement framework that is beyond the scope of this

research. However, the design of the framework was informed by a justified systemic intervention process and rich data.

Of note is that the validation actions of Landry et al. (1983) are more appropriate to hard systems thinking approaches. The improvement framework intends to enable learning concerning the delivery of intensive care that categorises the systemic nature of the framework as “soft”, according to Checkland (1995). The author argues that the same validation methods cannot apply to hard and soft systems models. Checkland suggests that a model, or framework as in this instance, with a soft systemic orientation can be judged as valid on the foundation that it was relevant and competently built. On one level, the theoretical justification of the framework contributes to such an evaluation, but the experimental and operational validations, which are not part of the scope of this study, will complete the validation evaluation.

As mentioned earlier, the soft systemic intervention requires endorsement or legitimisation by its stakeholders and this will be addressed in the next section.

Legitimisation of the framework

Landry et al. (1996) see legitimacy as “a rich and powerful concept. It is quite abstract and multifaceted.” (p 444) There are extensive variety issues that are linked with the notion of legitimacy. However, all these issues speak to the basic conditions necessary for survival, maintenance, sustainability, adaptation or change within a system. As mentioned earlier, framework validation and legitimisations are two overlapping, yet separate, activities of operational research modelling. (Landry et al., 1996). For the improvement framework, the two concepts are undistinguishable, the framework cannot be valid if not considered legitimate by the stakeholders.

Landry et al. (1996) offer a set of heuristics to guide the development of a framework to ensure legitimacy. Not all the heuristics might be directly applicable to the improvement framework, but they direct the developer of the framework to consider valuable aspects. The heuristics to guide the development of a framework to ensure legitimacy are summarised as follows:

- stakeholders view the framework as legitimate;
- the ability of the framework to produce knowledge, advance thinking and understanding, and assist with the construction of decisions and actions;
- the consistency of the framework with the cognitive capability and value system of stakeholders;
- the flexibility within the framework to accommodate different stakeholders and unforeseen circumstances; and
- the preconceived ideas and concepts of the stakeholders regarding problem definition and likely solutions.

When the above summary of the heuristics is compared to the principles underpinning the improvement framework presented in Table 5-1 and the methods and techniques suggested in the improvement framework, one can deduce that the heuristics are reflected in the proposed improvement framework.

The process of legitimation suggested by Landry et al. (1996) consists of two complementary activities. The first activity is the assessment of the improvement framework with a code that consists of values, norms or symbolic reference systems and the evaluation of the conformity of the framework with the code. Traditionally, improvement interventions in intensive care have followed an autocratic top-down and reductionist approach – with limited success. The result was that the improvement interventions were not viewed as legitimate by the health care workers delivering intensive care and the patients and family members that receive the care. The systemic approach to improvement suggested in this research will lead to a more democratic view of legitimisation, even though it may initially be difficult for some of the stakeholders.

Legitimisation of a framework used in systemic intervention is a process that starts at the first consultation with stakeholders. According Midgley (2000) to a key outcome of systems thinking is new insight/learning about the complex problem under consideration, which leads to a more comprehensive and deeper understanding of the problem. The systemic approach followed was new to all stakeholders. The rich pictures generated by the stakeholders were an indication

of the quality and depth of the thinking of the stakeholders which lead to the refinement of the proposed framework. During the making-sense-of-the-mess phase at the end of every workshop presented in section 4.1.4, participants expressed how valuable the process was. Therefore, this research can be regarded as the start of the systemic intervention in itself. As the proposed framework is aimed at improving intensive care delivery, the making-sense phase of the thesis can be regarded as having been legitimised by stakeholders in the consultation process.

A workshop was initiated by the CCSSA for the funders, private hospital groups and health care workers from the private sector. The aim of this workshop was to give feedback of the results of the making-sense phase of the research and to identify people who would be interested in getting involved in the next phase of implementing the framework. The results of this phase and the preliminary framework were presented to the participants. The participants commented on how valuable it was to get an understanding of the complexity of intensive care delivery and that a traditional approach to improvement would not be appropriate. The framework and the principles underpinning the framework were regarded as an appropriate approach to facilitate improvement of intensive care delivery. Even though the workshop was not formally part of this research, it serves as further legitimisation of the framework.

5.7 Summary

This chapter presents the proposed framework for the improvement of intensive care delivery. The development of the proposed framework is based on the concept of systemic improvement, the comprehensive understanding of intensive care delivery (obtained from an in-depth review and analysis of the literature and making sense of intensive care delivery in South Africa) and the salient principles underpinning the framework.

In the next chapter, I reflect on how the aim of the research was achieved and makes some concluding remarks, bringing this thesis to a close.

Chapter 6: Conclusion of the research

The health of a society is an important aspect of the society's well-being and the way it functions. Health care delivery is intended to serve society and the insufficient delivery of health care services, such as intensive care, could lead to societal problems. Our mental models of societal problems are generally insufficient depictions of poorly understood models. Sturmberg et al. (2012) argue "… the way one *talks* about health care *is* the way and *shapes* the way one *thinks* about health care" (p 202). The way we talk and think about health care, and therefore also intensive care, is predominantly from a reductionist perspective. This research is based on the assumption that intensive care is a complex system that is not always well understood, that it is not delivered in a satisfactory manner and that it can contribute to societal problems.

There are several difficulties that need to be considered when dealing with complex situations. The essential aspects of the complex situation must be understood. The components of the situation and the interrelationships among them must be established and these must inform any action taken. Furthermore, a shared understanding of the stakeholders' multi-perspectives of the situation must be developed. Another difficulty is using this shared understanding to develop an organised form of knowledge, such as a framework for action that can accommodate changing circumstances. This final chapter will reflect on how the aim of this research was achieved, the theoretical and practical contributions of the research and will offer recommendations for future research.

6.1 Reflection on how the aim of the research was achieved

The aim of this research was to develop a systemic framework for the improvement of intensive care delivery. The motivation for this research followed from the results of the national audit of critical care resources (Bhagwanjee & Scribante, 2007, 2008; Scribante & Bhagwanjee, 2007a, 2007b, 2007c, 2007d) that highlighted various shortcomings in intensive care delivery in South Africa and identified the need for the development of a framework for the improvement of intensive care delivery in South Africa. From the results of this audit, it became

clear that an alternative to the traditional improvement approaches was necessary and systems thinking was identified as the most suitable approach to guide the development of the framework.

The first objective was to investigate the factors affecting the delivery of intensive care, both in South Africa and internationally. This objective was realised by a comprehensive review and analysis of intensive care literature from both high-, middle- and low-income countries and the results from the national audit of critical care resources in section 2.8. A further understanding of intensive care delivery in South Africa was obtained by “making sense of the mess” presented in Chapter 4. Making sense of the mess was guided by a systems approach. Systemic intervention served as the meta-methodology and methods and techniques from interactive planning, CSH, SSM and VSM were employed. Making sense of the mess emphasised the complexity of intensive care delivery, both on a situational and cognitive level. Various factors that contribute to the complex delivery of intensive care were identified, such as multiple, interdependent stakeholders with multiple vested interests interacting in intensive care. It became clear that both hard and soft issues influence the delivery of intensive care and that the viability of the intensive care functioning was impaired. It was confirmed that the current reductionist approaches to improvement had limited success in facilitating sustainable improvement in intensive care delivery. It also became clear that not one methodology would suffice, but that a pluralist methodology (mixing of suitable methods and techniques) was required to guide improvement in intensive care delivery.

In order to realise the aim of this research, an analysis and synthesis of suitable methodologies and techniques from the field of systems thinking that could be applied to the understanding of intensive care delivery and that might contribute to the improvement of current intensive care delivery was done and is presented in section 3.7 and Appendix 7.

A philosophical/theoretical justification for a pluralist approach to improvement, especially within the systems-thinking context of systemic intervention is given in section 5.3.

On the basis of the work so far, nine principles were formulated to guide the development of a framework for the improvement of intensive care delivery. Systemic intervention was used as the meta-methodology to harness the strengths of various methodologies, methods and techniques in a complementary manner to build the framework. Interactive planning was identified as the key methodology, incorporating methods from CSH, SSM and VSM, to form a systemic framework that satisfies the nine guiding principles. The developed proposed framework for the improvement of intensive care delivery, the main aim of the research, is presented in section 5.5.

6.2 The theoretical and practical contributions of the research

This research makes a theoretical contribution to the field of intensive care by providing a systemic framework for the improvement of intensive care delivery. A further theoretical contribution is to the field of systems thinking. Systemic intervention has been applied in public health (Midgley, 2006a). However, to the best of my knowledge, this is the first time that a clinical health system, such as intensive care, has been researched using a systems thinking approach; neither has the combination of methods from the methodologies (interactive planning, CSH, SSM and VSM) been used in clinical health systems research.

This research makes several practical contributions. Margaret Chan (De Savigny & Adam, 2009) emphasise that strong health systems are essential if we are to improve health outcomes and accelerate progress towards the Millennium Development Goals. The result is that health systems' strengthening is dominant in political agendas worldwide. Chan further highlights that, despite global consensus on the need to strengthen health systems, there is no established framework for doing so, especially in low-income countries. Several authors (Adam, 2014; Begun et al., 2003; Gatrell, 2005; Leischow et al., 2008; McDaniel et al., 2009) have appealed to the research community to move beyond the call for systems thinking research of complex health situations to actually doing the systems thinking research. This research answers that appeal by making sense of intensive care delivery from a systems thinking perspective and developing a systemic framework for the improvement of intensive care delivery. Furthermore,

the framework for the improvement of intensive care delivery may contribute to the strengthening of health systems.

This research gives insight into South African intensive care delivery. For the first time, the complexity of the “whole” intensive care system was untangled – reflecting on key stakeholders, their values and their interdependent relationships. This understanding of intensive care delivery and the framework for its improvement will inform the national Department of Health’s process of health system improvement.

The contribution of the research to the South African intensive care delivery thus far is noteworthy. During the making-sense-of-the-mess phase, which can be regarded as an intervention, learning occurred amongst key stakeholders as they gained insight into the complex delivery of intensive care and they experienced the value of approaching a problem in a non-traditional manner.

Although the context of this research is South African, the generic nature of the framework may guide the improvement of intensive care delivery in other high-, middle- and low-income countries.

6.3 Limitations of this research

The scope of this thesis was to gain an understanding of the current intensive care delivery and to develop a framework for improvement. It was not feasible, due to time and financial constraints, to engage in a comprehensive research project that would study:

- a practical trial or evaluation of the entire framework developed; nor
- the improvement of an intensive care delivery from conception through to evaluation.

The process from the initiation of a project to the commissioning of the recommended intensive care delivery will take several years. To monitor and evaluate the impact of the improvement will take an additional number of years. Therefore, the result is that the improvement framework was only conceptually

validated as defined by (Landry et al., 1983). However, at the end of the phase where participants gained an understanding of intensive care delivery in this research (the making-sense-of-the-mess phase of the framework) they commented on the valuable learning experience. As the framework is aimed at learning to improve intensive care delivery, the making-sense phase of the framework was regarded as legitimate by stakeholders.

Participants voluntarily participated in the workshops and interviews and this might have had a positive influence on the research, since they all had an interest in the problem situation. Stakeholders, such as the non-intensivists, trade unions and health care workers from regional ICUs gave limited input, as there was no obligation to take part in this research. Would this have been different if they were ordered to take part in the research? It is suggested that the nature of the framework and the methods used would facilitate participation of reluctant stakeholders. This assumption has informally been confirmed. The group of participants in the funders' workshop that were reluctant to take part in the study, participated in a follow-up workshop, that was outside the scope this research and where they made a valuable contribution.

This research was conducted in a real-world problem situation that was characterised by politics and stakeholders with different worldviews. This research revealed the conflicting interests of stakeholders with issues of power and coercion. In making sense of the intensive care delivery, a deeper understanding of the problem was obtained; however, awareness of and management of the problem are essential in future improvement interventions.

6.4 Directions for possible future research

Potential future research, as a result of this research, can be made on two levels.

Firstly, the improvement of intensive care delivery in South Africa from conception through to implementation, employing the developed framework, could be formulated as an action research programme. Following the implementation of the framework, an evaluation should be commissioned to determine the realisation of the emergent properties of the framework. Similar research may

also be done in other intensive care contexts in high-, middle- and low-income countries.

Secondly, the understanding of intensive care delivery in South Africa highlighted certain areas of concern, especially in the “soft” domain, that necessitate further research. Some pertinent issues include:

- the improvement of communication at all levels of intensive care, in particular the communication between intensive care health workers and patients and their families;
- a better understanding of how patients and their families experience intensive care, especially in a culture-rich country such as South Africa; and
- the improvement of relationships between the various stakeholders.

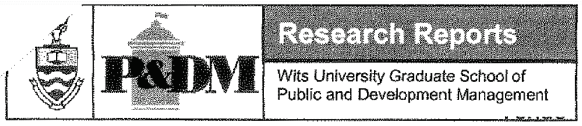
6.5 Concluding remarks

The delivery of intensive care is complex and requires thinking beyond the current boundaries of traditional improvement approaches. The developed framework does not offer a flawlessly pre-planned change based on “accurate” predictions. Instead, the framework for the improvement of intensive care delivery offers a systemic approach that is focused on learning.

The thesis is a break from the traditional way complex problems are addressed in intensive care in that the research calls for different paradigms of intervention. The challenge for any interventionists will be at least two dimensional. On a personal level the interventionist will have to be comfortable with embracing new and different paradigms. The other dimension is that of legitimising the agency of the interventionist and to facilitate learning among the stakeholders of complex problems. This should at least include the stakeholders that are the owners of the intervention. This research has demonstrated that this is possible through the different systems methodologies, methods and techniques.

It is hoped that this research will provide a better understanding of intensive care delivery in South Africa and contribute to the improvement of intensive care delivery in the theoretical and practical sense, bringing together systems practice and intensive care.

Appendix 1: Approval of the Graduate Studies Committee of the University of the Witwatersrand



Panel Date : 12/08/2010
Time : 10:00-11:30
: Research Hub Board Room

PHD Research Report Proposal Evaluation Form

Copies sent to: Dr Zandamela, Dr Gillian Godsell, Prof Laetitia Rispel, Prof Fatima Paruk Abiodun Tayo

Student's Name: Juan Scribante
Student Number:

Year first registered: ....2010.....

Supervisor: Prof Anthoni Van Nieuwkerk

Short Proposal Title: The Development of a Strategic Framework for Managing Critical Care Health Services in South Africa

Please comment on each of the issues below:

1. **Is the research relevant to the Public and Development sector? Is it suitable in scope and nature?** Yes
2. **Has enough of the relevant literature been considered to indicate that the candidate can proceed?** Yes
3. **Has the research problem been adequately defined?**
4. **Is the proposed methodology appropriate?** Yes
5. **Is the writing style and referencing according to P&DM requirements?** Yes
6. **Is the time frame for the research feasible?** Yes .
7. **Are there outstanding ethical issues?** Methodology to be cleared by CLM ethics committee — double check
8. **Is the title acceptable?** Yes
9. **Any other comments?** No.

Proposal Committee Conclusions:

✓	**Accept as it stands (Pass)**
	Accept, subject to minor revisions (Pass)
	Major revisions required, proposal needs to be resubmitted to committee (Pass/Fail withheld)
	Reject, the proposal is fundamentally flawed or inappropriate (Fail)

Changes to be made to proposal:

Examiners (This section not to be given to student)
(Please ensure the title of the below persons is given (ie. Dr, Prof etc) and that contact details are supplied.

Supervisor: Prof Ann Nieuwkerk / Prof S Bhagwanjee

Internal Examiner: .....

External Examiner: .....

Tel:.....**Fax:**.....

Meeting attended by: Dr G. Cockell
Mr. E Ntsoaledi Prof Zandamela
Dr Abbey Jagun
Prof A v Nieuwkerk
observers: Prof F. Panisa Prof Ulrich Mer
Prof Chris Lundgren

Supervisor's signature.....

Note to Supervisor -

1. Please hand a copy of this document to the student without examiners names after meeting.
2. Please submit a copy to the Research Administrator (together with a copy of the students proposal , where necessary) and the Research Manager.

Handed in to Student Research Administrator / Student Liaison Officer

Received by: _____ **Copies Made by Supervisor:** Yes/ No

Date: _____ **Signature:** _____

From: Vanishree Pillay
Sent: 4 August 2017 13:29
To: Juan Scribante <Juan.Scribante@wits.ac.za>
Subject: RE: PhD submission checklist

Dear Juan

Checklist

- X 2 spiral bound copy single sided printing
- X 1 cd with your thesis saved in pdf format
- completed forms (attached)
- turn it in report

Title Approved : The development of a framework for improvement of intensive care delivery: a systemic intervention

I am away on leave so please leave all of the above with Nasreen Abdulla at our reception and she will hand to me on my return.

Kind regards

Mrs Vanishree Pillay
Faculty Manager – Postgraduate Affairs, Management Campus
Faculty of Commerce, Law and Management
011 717 3125
BSoc Sci (UKZN)
Postgraduate Diploma in Management (Public and Development Management) (Wits)
Masters of Management (Public and Development Management) (Wits)
PhD Candidate (Wits Business School)

As "A" is the first letter in the alphabet, so is God the starting point of all that exists (Thirukkural)

How is our service ?
If you wish to comment on our service or offer suggestions on service issues, please click on http://www.wits.ac.za/askwits

Have you tried our Student Self Service Portal: https://self-service.wits.ac.za

Parents can also submit their email addresses to: feesoffice.finance@wits.ac.za in order to receive statements via email.



Appendix 2: Provisional approval of the Human Research Ethics (Medical) Committee of the University of the Witwatersrand

Department of Anaesthesiology

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
Tel 011 933 9334/5 Fax 011 933 1843

Piloting needed to design full application. Congress with suitable people is imminent. Risk nil. Favourable risk/benefit ratio. Approved by Cleaton-Jones & Feldman 24/08/12

The Human Research Ethics Committee: (Medical)
Wits Medical school

23 August 2012

Dear Professor Cleaton-Jones

Preliminary PhD Workshop

Our previous discussion with regards to using a Mode 2 research approach for my PhD research refers.

The current reality of ICU in South Africa, or the "formulation of the mess", is essential to generate a better understanding of what needs to be addressed. The researcher decided to conduct a preliminary workshop with two of the very important stakeholders, doctors and nurses, based on the assumption that these two stakeholders would provide the richest source of information. The results of this workshop will guide the unfolding of the remaining research process.

The Critical Care Society of Southern Africa's (CCSSA) has an annual national congress. This congress is attended on average by more than a 1000 nurses and doctors, including opinion leaders in the respective fields. This year the congress will be held at Sun City from 29 August to 2 September 2012. It deemed the optimal opportunity to coincide the preliminary workshop with the congress.

As the first step in getting a sense and understanding of, and depicting the complexity of the current reality of ICU in South Africa, the researcher has developed a rich picture founded on her *weltanschauung*, experience and extensive ICU research in South Africa.

There are three specific aims for the preliminary workshop:

- to make the stakeholders aware of the complexity of the current reality of ICU in South Africa;
- expand on the researcher's rich picture; and
- to engage in a process of stakeholder analysis.

Twenty doctors and nurses have been invited to the workshop and their respective acceptance of the invitation will be deemed as acknowledgement of their consent. At the start of the workshop the participants will be informed that all information gathered will be reported anonymously but that if anyone wishes to withdraw from the workshop that they are free to do so at any time.

The workshop will start with a short orientation and introduction to systems thinking and the use of rich pictures in developing stakeholder analyses. This will then be followed by the actual purpose of the workshop viz. interactive stakeholder analysis and the development of multiple rich pictures seeking to depict the current reality of ICU in South Africa.

I trust you will find this in order.

Kind regards.

Juan Scribante
082 882 9938

UNIVERSITY OF THE WITWATERSRAND
PROF PE CLEATON-JONES
HREC (MEDICAL)
JOHANNESBURG

Appendix 3: Clearance certificate of the Human Research Ethics (Medical) Committee of the University of the Witwatersrand

R14/49 Ms Juan Scribante

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M150386

NAME: (Principal Investigator)	Ms Juan Scribante
DEPARTMENT:	Anaesthesiology Wits School of Governance
PROJECT TITLE:	Development of a Framework for the Planning of an ICU Infrastructure in South Africa
DATE CONSIDERED:	Adhoc
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Prof Anthony van Nieuwkerk
APPROVED BY:	Professor P Cleaton-Jones, Chairperson, HREC (Medical)
DATE OF APPROVAL:	25/03/2015

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.
I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report**.

Principal Investigator Signature Date

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

Appendix 4: Example of an invitation letter to a workshop

Department of Anaesthesia
Faculty of Health Science
University of the Witwatersrand

13 May 2015

Dear xxxxxx

Depicting the current status of the South African ICU system

Understanding the current reality of ICU in South Africa is essential to generate a better sense of what needs to be addressed. As the first step in getting a sense and understanding of, and depicting the complexity of the current reality of ICU in South Africa, I am conducting a serious of workshops as part of my PhD. The pharmaceutical and medical equipment industries in South Africa are important stakeholders in the delivery of ICU. I would therefore like to invite you to take part in the medical industry workshop. Your participation would be highly appreciated. If you feel that you are not the appropriate person or would not be able to attend you are welcome to extend the invitation to another member of your company.

Date	10 June 2015
Time	14:00 – 16:00
Venue	PPS Boardroom 4th floor Wits Medical School
RSVP	Juan Scribante 082 882 9938 juan@scribante.co.za

Thank you very much.

Kind regards

Juan Scribante

Appendix 5: Public sector invitation letter and consent form

Department of Anaesthesiology

University of the Witwatersrand

28 July 2016

Dear Colleagues

Good day, my name is Juan Scribante I am a PhD student at the University of the Witwatersrand. You or your family member has been admitted to ICU. My study is trying to understand how ICU is delivered in South Africa. I will be asking various people for example the doctors and nurses working in ICU how they think ICU service is delivered. But it is very important that we understand how patients and family members experienced the ICU and I want to invite you to please take part in my study. Understanding how ICU is delivered will help us to address problems that we identify.

I will ask you to please draw me a picture, and explain the picture, of how you experienced your or your family members stay in ICU. Confidentiality will be ensured as only my supervisors and I will interpret the picture and the results will be reported anonymously. If at any time you should wish, you can withdraw your consent to use this picture.

It might be very difficult for you to remember and talk about your experience in ICU and you can stop at any time if it is too difficult for you. If you feel you need some additional support you can contact the social workers at [redacted] on [redacted] or [redacted].

If you have any at any time have further questions you are welcome to contact me on 011 717 2512 or the Chairman of the Ethics Committee on 011 717 1234.

Thank you again for your valuable time.

Kind regards

Juan Scribante

I hereby give consent for my picture to be used for the PhD research project.

Name **Signature**

Date

Appendix 6: Private sector invitation letter and consent form

Department of Anaesthesiology

University of the Witwatersrand

17 August 2016

Dear Patient and Family

Good day, my name is Juan Scribante I am a PhD student at the University of the Witwatersrand. You or your family member has been admitted to ICU. My study is trying to understand how ICU is delivered in South Africa. I will be asking various people for example the doctors and nurses working in ICU how they think ICU service is delivered. But it is very important that we understand how patients and family members experienced the ICU and I want to invite you to please take part in my study. Understanding how ICU is delivered will help us to address problems that we identify.

I will ask you to please draw me a picture, and explain the picture, of how you experienced your or your family members stay in ICU. Confidentiality will be ensured as only my supervisors and I will interpret the picture and the results will be reported anonymously. If at any time you should wish, you can withdraw your consent to use this picture.

It might be very difficult for you to remember and talk about your experience in ICU and you can stop at any time if it is too difficult for you. If you feel you need some additional support you can contact Dr [redacted] on [redacted].

If you have any at any time have further questions you are welcome to contact me on 011 717 2512 or the Chairman of the Ethics Committee on 011 717 1234.

Thank you again for your valuable time.

Kind regards

Juan Scribante

I hereby give consent for my picture to be used for the PhD research project.

Name **Signature**

Date

Appendix 7: An overview of systems thinking

The understanding of intensive care delivery and the framework for improving intensive care delivery are in this thesis under-pinned by the theories and ideas inherent to systems thinking. Lane and Jackson (1995) state that the systems movement as a whole is “characterised by a belief in holism, the organisation of knowledge in cognitive systems, and structured frameworks expressing certain intellectual norms … that people find useful in understanding the real world” (p 219). Yet, the field of systems thinking is broad and diverse, and the authors warn against the dangers of labelling one specific systems methodology, such as system dynamics, as system thinking. This mistake is often made in health care.

The various documented systems methodologies have been investigated in depth. However, it is not in the scope of this thesis to engage in an exhaustive account of all systems methodologies. Hence, this appendix introduces the concept of systems thinking, provides a brief overview of the systems movement and a more in-depth discussion of the relevant systems approaches applicable to the problems of understanding and improving of intensive care delivery.

A7.1 The concept of systems thinking

For Cabrera (2006) the term systems thinking is ambiguous and there is disparity in the perceptions of what systems thinking entails. Some of the perceptions include that it is a:

- specific methodology, such as system dynamics;
- plurality of methods;
- systems science;
- general systems theory; or
- social movement.

Regardless of this, Cabrera believes that the growing attractiveness of systems thinking is because it offers a model for thinking differently, even though people do not have a complete understanding of systems thinking. The author concludes that the reason for the attractiveness of thinking differently is that the root crisis is that of perception "– the crisis common to all crises – is the way we think" (p 4). Cabrera warns that thinking differently will not automatically address all the crises facing the planet.

> However, it does reframe how we think about those crises, what we see as a problem in the first place, and what solutions might look like … Systems thinking alone does not heal the human condition. Whether the problems are local … or global …, it is vigorous problem-solving efforts in these areas, informed by a systems thinking perspective, that will act as a salve for the human condition. (p 6)

A7.2 Development of systems thinking

As with many other disciplines, the origin of systems thinking as a discipline is steeped in controversy. Von Bertalanffy (1968), a biologist, has in the Western world been widely regarded as the founder of systems theory. He expanded his work in biology from the 1920s to establish general systems theory in 1940. Many decades later it became known that Bogdanov (Gorelik, 1987) published the three-volume *Tektology* in Russia between 1912 and 1927. Bogdanov's research was supressed by the Russian authorities as it was regarded as opposition to Marxism and only became known in the Western world in the 1970s.*Tektology* describes similar concepts to Von Bertalanffy's general systems theory. Although Von Bertalanffy's seminal article was only published in 1950, he is still regarded as the founder of general systems theory as his original work originated from the 1920s (Jackson, 2000).

Systems thinking is a diverse field that has developed over nearly 100 years and it is impossible to present the whole field of systems thinking within the scope of this thesis. To offer a more concise overview of systems thinking, Midgley (2000, 2006b) uses a metaphor of three waves to describe the development of systems thinking from the 1940s. For Midgley the three waves represent the key shifts in

the understanding of systems thinking and the resulting different methodological approaches. This metaphor will be used to guide this discussion on the development of systems thinking.

A7.3 First wave of systems thinking

Following World War II, three interrelated approaches to systems thinking developed to assist with public planning, namely: general systems theory, cybernetics and complexity science (Midgley, 2006b). A brief discussion of these approaches follows.

General systems theory

The development of general systems theory by Von Bertalanffy was in reaction to the dissatisfaction at the time with the limitations of the reductionist, closed-system approach of the early physicists. He was critical of the mechanistic view of the reductionists that viewed the world, and its contents, as a “clock-work toy” which is not helpful when engaging with real-world phenomena (Midgley, 2000).

Von Bertalanffy (1968) differentiates between closed and open systems. Closed systems do not interact with their environment, in contrast to open systems or living systems that depend on their environment for survival and are teleological – purposeful and adaptive. Each living system is a whole that consists of interrelated, interdependent, interacting parts that self-organise to sustain the whole. Midgley (2000) emphasises that it is this “ordering” of living systems that is Von Bertalanffy’s answer to the mechanism of the reductionists.

Cybernetics

Cybernetics is derived from the Greek word *kybernetes* – the art of steersmanship. Plato used this term to indicate “the piloting of a vessel” and the “steering of the ship of state” (p 44). Following transdisciplinary work to address military problems during World War II, Wiener, an American philosopher and mathematician, was the first to use the word cybernetics to describe a specific field of study (Jackson, 2000).

Wiener (1948) combined all ideas on control processes prevalent at the time in his book *Cybernetics* and defined cybernetics as “the science of control and communication in animals and machines” (11). For the author, cybernetics is truly interdisciplinary as it deals with general laws that regulate all control processes in a system, regardless of the system’s nature. The concept of negative feedback is important in comprehending the control of any system, particularly for the realisation of the system’s goal. Communication also plays a significant role in the control of a system; if you want to control a system you must communicate with that system. Jackson (2000) concludes that, “The theory of control can be seen as part of the theory of messages.” (p 68) A valuable contribution to the field of cybernetics was made by Ashby (1956), who introduced the concept of variety and the law of requisite variety.

Midgley (2006b) highlights that human perception has the tendency to simplify causality, disguising feedback loops and interdependencies. It can be useful to model feedback processes to aid the understanding of a system. There are several systems methodologies that offer this kind of modelling of which systems engineering and system dynamics are well known.

The work of Beer (1984) remains prominent in management cybernetics and a more detailed account of his work is afforded in AA7.8 of this appendix.

Complexity science

Midgley (2006b) identifies Weaver (1948) as first to address complexity as a field of enquiry. For Midgley, it is apparent from the work of the late 1940s that writers referring to organised complexity implied the concept of systems. For the author it is furthermore clear that, throughout history, the concepts of complexity and systems have been closely related; a statement that is often made is that “the purpose of applying systems thinking is to help us *deal* with complexity” (Midgley, 2006b, p. 18). A more detailed discussion of complexity, and more specifically of complex adaptive systems, is presented in section 2.3.3. Key writers in this field include Weaver (1948), Simon (1962), Prigogine (1987) and Cilliers (1998).

A7.4 Second wave of systems thinking

The first wave of systems thinking was very popular in the 1950s and 1960s, but towards the 1970s and 1980s the philosophical assumptions and the repercussions of their practical implications were questioned.

Criticism of the first wave

A criticism of the modelling approach in the first wave was that models were viewed as reality and were not used for gaining an inter-subjective understanding of the reality (Checkland, 1985; Churchman, 1970; Espejo & Harnden, 1989; Flood & Jackson, 1991). Flood and Jackson (1991) described the practitioners from the first wave as elite technicians who served decision makers as experts providing objective and neutral guidance. There was no involvement from other stakeholders who would be affected by the changes. The stakeholders were treated as objects without their own goals and there was no recognition of the impact that stakeholders' personal goals had on the implementation of change (Midgley, 2006b).

The 1960s saw the attempt, with no great success, from systems practitioners to build "super models" of, for example, whole cities – regions with multitudes of interacting variables. With the better understanding of complexity (Cilliers, 1998) and the unavoidable limits it posed on human understanding, this was a mistake that should not be repeated (Midgley, 2006b).

A further criticism was that it was assumed by systems practitioners that the goals of the person(s) who assigned the evaluation were without any problems. In reality, their goals were often uncertain or there were numerous perspectives of which goals should be followed (Checkland, 2007).

The second wave evolved in reaction to the criticism of the first wave of systems thinking. Systems were no longer perceived as real-world entities, it "is not used to refer to things in the world but to a particular way of organising our thoughts about the world" (Flood & Jackson, 1991, p. 2). The authors who made the most

substantial contribution to the second wave were Churchman (1970), Checkland (2007) and Ackoff (1981b).

Rethinking the systems idea

The rethinking of the systems idea will be presented based on Churchman (1970) eminent contribution to the paradigm shift of the second wave of systems thinking. However, the scope of Churchman's work is vast and this discussion will follow the summary by Midgley (2006b) of pertinent contributions.

Thinking of boundaries of analysis is essential when change is regarded as improvement. For Churchman, to be ethical, as much information as possible, without being impractical, should be included in the analysis. The reason is that the result of an analysis with narrowly defined boundaries might not be as acceptable as when the boundaries of analysis were "pushed out" to be more comprehensive (Midgley, 2006b).

The new reflection on boundary analysis resulted in a different understanding of the concept of holism. In the first wave of systems thinking the boundaries of a system were "given by the structure of reality" (p 21). For Churchman, however, boundaries define "the limits of knowledge that are taken to be pertinent in an analysis" (Midgley, 2006b, p. 21).

There is no role for traditional experts where pertinent knowledge is generated by one group of people. The pushing out of the boundaries also establishes the knowledge that is deemed important and the people who generate that knowledge. Therefore, the subject of who is regarded as legitimate to make decisions might change. The perspective of holism now implies increasing our knowledge of what we are studying and defining the people who would be producing that knowledge (Midgley, 2006b).

To be able to define improvement sufficiently, "rigorous self-reflection" is essential; this is where you must allow your most valued assumptions to be critiqued. Churchman suggests "a 'dialectical process': this involves seeking out the strongest possible 'enemies' of our ideas and entering into a rational argumentation with them" (p 22). Improvement is only possible if the participants

of the dialectical process listen closely to others' views and if arguments survive (Midgley, 2006b).

Examples of second wave systems thinking are SSM (Checkland, 2007; Checkland & Poulter, 2006) and interactive planning Ackoff (1981b) that are both used in this research and a more detailed account of these methodologies is presented in Appendix A7.7 and A7.9.

A7.5 Third wave of systems thinking

The third wave of systems thinking is discussed under the banner of critical systems thinking.

Criticism of the second wave

The main critique of the second wave of systems thinking or participative methodologies was that they did not adequately consider power relationships in intervention and/or conflict inherent in society (Jackson, 2000; Mingers, 1980). The power relationships in an intervention might prevent stakeholders from speaking openly as they might fear the consequences. A criticism from a Marxist perspective was that the second wave of systems thinking could cause a false consciousness among disadvantaged stakeholders. Stakeholders could reach collective agreements in participative methodologies and experience that they accomplished something worthwhile, yet no social inequalities where addressed in the intervention (Thomas & Lockett, 1979). A further criticism was that the second wave of systems thinking did not address emancipation adequately and therefore resulted in superficial instead of deep social change (Jackson, 2000; Mingers, 1980).

In the 1980s there was a "pragmatic war" between the first and second wavers – hard systems thinking versus soft systems thinking – that tore the systems thinking community apart (Midgley, 2006b). Jackson and Keys (1984) published a seminal paper that argued for methodological pluralism; the first- and second wave systems thinking should not compete but rather complement each other.

Both forms of systems thinking were needed as they addressed different aspects of problems (Midgley, 2006b).

The publication by Jackson and Keys (1984) became one of the foundation stones for the development of the third wave of systems thinking. The second foundation stone was the CHS methodology of Ulrich (1983).

Critical systems heuristics

Ulrich (1983) builds on the work of Churchman (1970) and agrees that the maximum amount of information should be included in an analysis for improvement, but that this is not always practical. The question arises of how stakeholders can judiciously rationalise the boundaries they use? Ulrich (1983) responds with the development of CHS – a methodology that explores and justifies boundaries. CSH entails a process of boundary critique where stakeholders explore and justify boundaries through debate. For Ulrich, boundary critique is an ethical process as boundary judgements are closely linked to value judgements, which in turn determine the knowledge that is important. He develops a set of practical guidelines to direct the process of boundary critique in the form of 12 questions. The 12 questions address four important areas of concern, namely: motivation, control, expertise and legitimacy.

Towards a methodological pluralism

The work of Ulrich (1983) steadily became part of, and had a substantial influence on, third wave systems thinking. Yet, the call for methodological pluralism and mixing of methods – the main argument that lead to the start of the third wave of systems thinking – took much longer to advance (Midgley, 2006b).

Jackson (1987) suggests that the three waves of systems thinking are helpful to deal with three different types of problems. The first wave of systems thinking approaches are appropriate when stakeholders agree on the nature of the problem and the purposes to follow. When there is non-coercive disagreement among stakeholders that requires debate and learning, the of second wave systems thinking approaches are suitable. Third wave systems thinking approaches are applicable when there is coercion between stakeholders that

cannot be solved by debate. Flood and Jackson (1991) built on this work and established the system of systems methodologies: total systemic intervention. Even though total systemic intervention promotes methodological pluralism, it has been criticised as having a too narrow scope (Midgley, 2000). There was a call for a more creative mixing of methods from across paradigms to ensure a more adaptable and responsive systems thinking practice. Midgley (2000), in response to this call, developed systemic intervention that is discussed in the next section.

A7.6 Systemic intervention

Systemic intervention, one of the critical systems thinking strands, was developed by Midgley during a 20-year research programme (Boyd et al., 2007). Systemic intervention attempts to afford “a new approach to systems philosophy and systemic social theory that can underpin the pluralistic use of various strands of systems thinking” (Rajagopalan & Midgley, 2015, p. 547).

Midgley (2000) defines systemic intervention as “purposeful action by an agent to create change in *relation to reflection upon boundaries.*” (p 113) For the author, the concept of boundary – what is included or excluded from analysis – is at the core of systems thinking. Secondly, the perspective of “process philosophy” has evolved to address the philosophical problem of subject/object dualism. Process philosophy identifies both the objects (that are under consideration) and the subjects (researching the objects) in an identical process of judgement about their boundaries (Rajagopalan & Midgley, 2015).

The challenge of subject/object dualism will be discussed, which will then be followed by a discussion of intervention and the methodology of systemic intervention. For Midgley (2000) the essence of systemic intervention methodology is: boundary critique, theoretical and methodological pluralism, as well as action for improvement.

A7.6.1 The challenge of subject/object dualism

Systems thinking is opposed to mechanism and reductionism that both assume subject/object dualism. Midgley (2000) regards reductionism as a superficial manifestation of subject/object dualism. Systems thinkers have for decades been confronted by mechanisms that deem phenomena similar to clockwork toys: "predictable, functional, inherently understandable objects seen from a discrete distance by an independent subject" (p 39). One feature of a mechanistic worldview is reductionism (Midgley, 2000). Reductionism generates knowledge and understanding of phenomena by breaking them down into small parts and then studying these parts in terms of unidirectional cause and effect relationships (Flood, 2010). When this cannot be attained, statistical methods are used to show associations between phenomena. It further totally detaches "the observer from the observed … which produces the illusion of objectivity" (Midgley, 2000, p. 33). Reductionism can be seen to separate out unnecessary complexity and therefore cannot explain emergent properties (Midgley, 2000). The emergent properties of a system are properties that the system as a whole displays, which originate from the system's components, activities and structure, but which cannot be reduced to them (Checkland, 2007). Therefore, emergent properties can only be explained by complex systems with multi-directional interactions.

Midgley (2000) offers an anti-subject/object dualism perspective. From this perspective, everything is regarded as interacting with everything else. Boundaries are constructs allowing for the inclusion and/or exclusion of elements in analysis rather than physical indicators of systemic closure. It now becomes clear that real independent observation is simply impossible as "the observer will always be connected to the observed in some way" (p 42) and therefore there is no true objectivity or "value-free" science (p 44). For Midgley, the acknowledgement of "value-full" science moves beyond the notion of observation to the comprehension that any form of knowledge production is involved in intervention that will be discussed in the next section. He further believes that the subject/object dualism challenge has been overcome as a new analytical dualism has been ascertained between process and content. "Both subjects and objects

are viewed as *content* defined through the *process* of making boundary judgements" (Midgley, 2000, p. 98)

A7.6.2 Intervention

As mentioned in the previous section, Midgley (2000) emphasises intervention rather than observation – the usual focus of traditional science. In traditional science, independent observation is observation "detached from the values and idiosyncrasies of the observer". From a systems thinking perspective, this is not possible due to the interconnectedness – as everything in the universe is connected either directly or indirectly. Observers are therefore part of the reality that they observe (Midgley, 2008). Furthermore, scientific observation is constructed to facilitate observation under controlled conditions and a value judgement is made consciously or unconsciously in the decision of what to study (Midgley, 2000). For the author, scientific observation is a type of intervention.

It is also important to note that interpretation is a fundamental part of observation. What the observers see, is determined by their expectations and influenced by the language used and the values flowing into the act of observation (Midgley, 2008). The author explains these statements with two experiments from the 1950s. First, people were shown two pictures of faces with a tachistoscope; the one eye received a right-side-up face and the other eye an upside-down face. All the participants saw the right-side-up face (Engel, 1956). In the second, similar experiment Americans and Mexicans were shown the same two images of an American and a Mexican landscape; almost everybody saw the image that was culturally familiar to them (Bagby, 1957). Midgley (2008) concludes "… the brain, linked to its environment, is actively constructing the observations, not simply reflecting what enters the eye" (p 64).

Caution must be taken that intervention is not incorrectly viewed from a mechanistic worldview as "flawlessly pre-planned change based on accurate predictions of the consequences of action." (Midgley, 2008, p. 55) The intervention is rather a purposeful action. The purpose can be determined from either the outside or the inside of an organisation, but once action commences, "it is always action from inside" (Midgley & Richardson, 2007, p. 172).

The intervention is systemic in nature and, for Midgley (2015), the essence of systemic lies in the process of boundary critique that will be discussed in more detail in the next section.

The interacting agent can be a single human being or group of human beings that have purpose attributed to them. Individuals in the group do not have to share the purpose of the whole. But the group will be regarded as an agent when it is "perceived as acting to realise a dominant purpose at the group level regardless of the actions or views of subagents" (Midgley, 2000, p. 114).

A7.6.3 Systemic Intervention methodology

Boundary critique

Boundary critique, according to Rajagopalan and Midgley (2015), is a "conceptual treatment of how boundaries should be reflected on" (p 547).

It is essential that agents must critically contemplate upon and choose between boundaries. Midgley (2008) emphasises that, "Boundaries define both *what issues* are to be included, excluded or marginalized in analysis, and *who* is to be consulted or to be involved." (p 66) It is important to note that the *what issues* and the *who* are interrelated. Further, because of the *who,* power and participation are inevitable in systemic intervention.

Boundary judgements and the subsequent boundary decisions are ethical undertakings as they are closely associated with value judgements. Because situations are dynamic and evolve over time, boundary judgements need to be evaluated. It follows that an ethical systemic intervention involves pushing the boundaries as far as possible (Churchman, 1970).

For Ulrich (1994), the idea of pushing the boundaries as far as possible is not always practical. The author suggests a rational process of justification of boundary choices. Rationality is essentially regarded as dialogue, all rational arguments are expressed in language, and language is primarily a tool for communication, so boundary judgement is only truly rational if it has been agreed

to in dialogue with all of those involved in and affected by an intervention. (Midgley, 2015)

Midgley (1992b) builds on the work of Churchman (1970) and Ulrich (1987) when he draws attention to the marginalisation that occurs when a boundary is placed around a problem within which the critique will be performed – resulting in an incomplete view. Midgley believes, "We can never get away from making boundary judgements, the best we can do is to embrace critical flexibility with regard to such judgements." (p 5) In order to identify marginalised elements, an alternative system boundary needs to be acknowledged, as illustrated in Figure A7-1. The consequence of primary and secondary boundaries that experience ethical conflict is that marginalised elements tend to perceive each other as either profane or sacred. Profanity supports primary boundaries while sacredness supports secondary boundaries.

Thus, there must be an awareness that certain stakeholders might be marginalised and it might sometimes be necessary to challenge consensus on boundaries and involve stakeholders who might not be seen as directly involved or affected, but who might bring an important perspective to the intervention (Midgley, 2000).

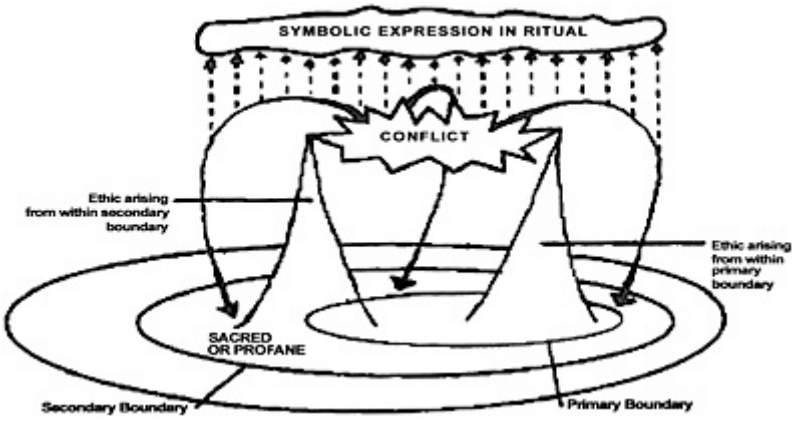


Figure A7-1 Margins, ethics, sacredness, profanity and ritual (Midgley, 1992b)

Theoretical and methodological pluralism

The concept of boundary critique where different boundary judgements with their associated values are explored, justifies theoretical pluralism. For Midgley and Richardson (2007), this implies "… drawing upon multiple theories depending on our purposes, rather than seeking one single 'grand' theory. Different theories assume different boundaries of analysis." (p 178) Depending on the purpose of the intervention, it might be necessary to harmonise the chosen theories.

The various methodologies and methods are based on different theoretical assumptions. Therefore, if theoretical pluralism is possible, then methodological pluralism is possible. Further, from a practical perspective, there is also no method "that can do everything". This necessitates, based on your purpose, that choices be made between different methods (Boyd et al., 2007; Midgley, 2008)

Methodological pluralism is firstly learning from other methodologies. "We no longer have to accept a situation where people build a methodology like a castle and then defend it against others who want to breach the castle wall. Rather, if people begin to see methodology as dynamic and evolving, they can learn from others on an ongoing basis." (Midgley, 2015, p. 4) Secondly, methodological pluralism entails using a range of methods from different methodologies in an intervention, thereby ensuring flexible and responsive systems practice (Midgley, 2000, 2015).

Action for improvement

Action for improvement should be clearly stated in the methodology of systemic intervention. This should be action for the better, but it is important to note that it cannot be regarded as totally objective. The boundary judgements of different agents may result in different improvement needs. There might be extensive agreement between current stakeholders regarding improvement, however, this may not be the case between future stakeholders. The concept of sustainable improvement now becomes important; however, not even sustainable improvement will endure forever. As "gearing improvement to long-term stability

is essential" (p 67), the systemic intervention agents should from time to time revisit the criteria used to obtain sustainability (Midgley, 2008).

The process of boundary critique and theoretical and methodological pluralism already implies action, "it is intervention in the present to shape a strategy for future intervention" (Midgley, 2008, p. 67).

As mentioned, improvement is not objective; how improvement will take place, and in whose interest, will be influenced by the boundary critique that will reflect assumptions regarding the system's prevailing power relationships. In addition, Hodgson and Midgley (2014) draw attention to the boundary of time that also adds to the ambiguity of improvement. The authors, when referring to time, use the term "temporal windows" (p 3) used in foresight practice. They emphasise that in systemic intervention "it is necessary to go beyond the simple linear sequential view of time (short, medium and long term). This is especially true where the situation of interest is going through some kind of transformative change. We need to consider the *qualities* of the temporal window of interest." (p 3)

The qualities of the temporal window of interest can be determined by differentiating the goal of the systemic improvement, by addressing whether it is to sustain or transform the current status quo. When the aim of improvement is sustaining the status quo, the perspective of the system is based on the limited view of the specialist. The innovation focuses on supporting and reinforcing the current dominant pattern of action. Conversely, when the aim of improvement is transforming the status quo, a holistic or a wide-angle view of the system is taken. Here the focus of the innovation is disruptive, the status quo of the system becomes obsolete and there is a new pattern of action for a different context (Hodgson & Midgley, 2014). A substantial change is required when improvement must move from a sustaining pattern to a transforming pattern.

Moving from one pattern of change to another requires strategic thinking and foresight. There are four modes of foresight that are eminent, based on the level of agency the decision maker has and the degree of uncertainty there is in the decision-making process, which are illustrated in Figure A7-2.

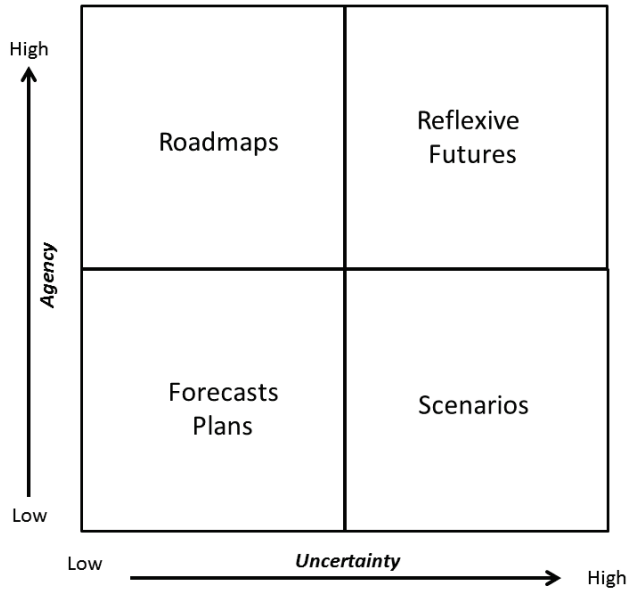


Figure A7-2 Four broad categories of foresight (Hodgson & Midgley, 2014)

Forecast plans, roadmaps and scenario planning, used in three of the boxes, are well known. For the fourth box, where high agency and high uncertainty prevail, for example in government, commerce and society, there is little methodology available.

It is useful, when considering time boundaries in systemic intervention, to think in terms of the three horizons framework illustrated in Figure A7-3.

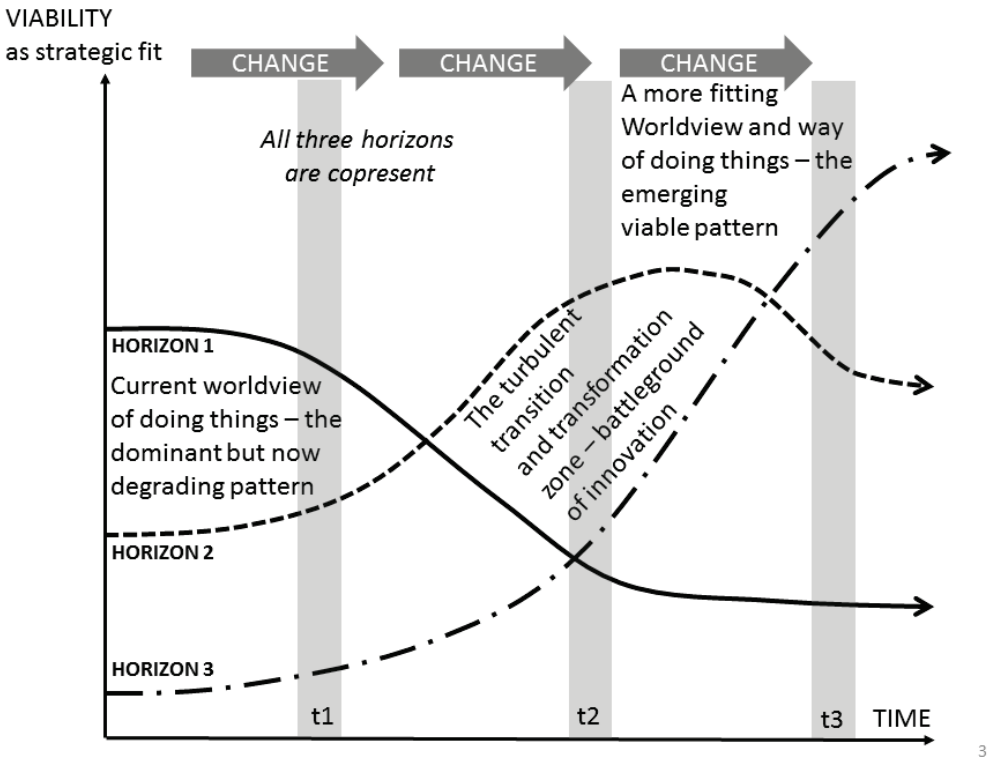


Figure A7-3 Looking into the future with three horizons (Hodgson & Midgley, 2014)

In Figure A7-3 the line labelled *Horizon 1* represents the viability, in a given context or environment, of the dominant pattern or structure of the system in question. Its viability is considered to be degrading due to an increasing mismatch with the changing external conditions. The line labelled *Horizon 3* represents a differently transformed pattern which, although seemingly with minor significance early on, turns out to be a much better fit with the changing external conditions and so becomes the dominant viable pattern. The line labelled *Horizon 2* represents the turbulent, even chaotic, situation of transition from one pattern to another. The three lines taken together, unfolding over time, represent three potential futures.

Table A7-1 Three modes of systemic improvement (Hodgson & Midgley, 2014)

Horizon 1	Horizon 2	Horizon 3
Identify and repair self-defeating feedback Identify missing necessary feedback	Identify and displace self-defeating feedback and feedback that creates lock-in	Challenge buried assumptions
Seek optimisation	Seek unmet need	Seek new visions and patterns of viability
Be efficient	Be the disrupter	Be the future

(Hodgson & Midgley, 2014) summarise systemic improvement as follows:

- "Recognising that improvement is entirely dependent on a time horizon to realise that improvement.
- Build this consideration into the conduct of boundary critique to clarify the system in question.
- Raise awareness of whether the improvement desired is mainly H [horizon]1, H [horizon] 2 and H [horizon] 3 in its emphasis.
- Determine which mode of improvement is most likely to generate the desired results.
- Match the appropriate systems concepts, systemic problem structuring methods etc., to the desired mode of improvement." (p 10)

A7.6.4 Interrelating the three activities of systemic intervention

In summary, there are at least three elements necessary for a systemic intervention process; these elements are illustrated in Figure A7-4.

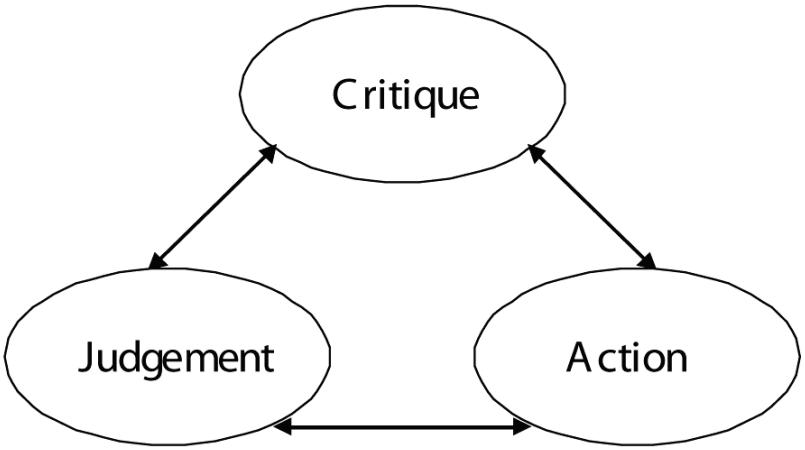


Figure A7-4 Methodology of systemic intervention (Midgley & Richardson, 2007)

In the process of critique, there should be critical thinking regarding boundaries and values. There also needs to be judgement, which entails creatively choosing and synthesising appropriate methods. The action is the implementation of the outcomes of the interactive process of critique and judgement. However, it is important to note that these are not three linear methodological steps, but rather three lenses. These lenses should be used to ensure that all the elements required for systemic intervention are addressed (Midgley & Richardson, 2007).

Midgley and Richardson (2007) emphasise that boundary critique and methodological pluralism are not unique to systemic intervention and have been used extensively in modern systems thinking. However, “involving a synergy of boundary critique and methodological pluralism gives added value compared with either in isolation.” (p 183)

A7.6.5 Deepening systemic intervention through the application of an extended epistemology

Rajagopalan and Midgley (2015) propose “extended ways of knowing” (p 546) in systemic intervention. The authors believe new ways of knowing can further boundary judgement, especially the knowledge of knowledge-generating systems (subjects). For the authors, boundary critique describes the process of

boundary judgement for objects without difficulty. However, they do not afford the same detail on how boundaries of subjects should be examined.

The argument for extended ways of knowing is based firstly on the view of Bateson (1972) that, rationality unaided by such phenomena as art, religion, dreams and the like, is necessarily pathogenic and destructive of life. Secondly, the authors include Heron and Reason (1997) four basic epistemological types of knowing, namely: experiential, presentational, propositional and practical knowing, in their argument.

For Rajagopalan and Midgley (2015), including irrational knowing with rational knowing will prevent marginalised people and cultures from remaining on the peripheries. This is especially true in low-income countries where marginalisation may have been engrained over centuries. Just as important for the authors is that, “The recognition of these forms of knowing can also provide to interveners some redemption and the opportunity to rediscover and reintegrate the shadow aspects in the dominant culture.” (p 559)

A7.6.6 Critique of systemic intervention

Among the strengths of systemic intervention for Barros, Midgley, and Pinzóen (2011) is that it brings together the emphasis of methodological pluralism with the theory of boundary critique that requires the consideration of issues of inclusion, exclusion and marginalisation. Systemic intervention not only focuses on boundary critique, but also on learning from that process through critical reflection on both the process and the outcome. With this approach there is no need to defend a singular philosophical position. Instead, process philosophy – “where primacy is granted to analyses of ‘the process of bringing knowledge into being’ instead of accepting a ‘foundational’ theory of knowledge” (p 15) is suggested. Lastly, a vital concern for systemic intervention is for the well-being of people, especially those who are marginalised. Consequently, respect, values, ethics, aesthetics, emotions, and passions are essential dimensions to the process of judgement about what constitutes improvement.

Mingers (2006) offers some criticism of systemic intervention. The author feels that systemic intervention's process philosophy does not succeed as, it is impossible to theorise about anything without there being a "thing" to theorise about. Systemic intervention creates the impression that there is no real world. Also, it is not clear if all boundaries are simply constructs of the observer and it is not certain if the process is helpful, as in practice it seems if infinite boundary judgements can be made. Though, according to Midgley (2000), systemic intervention does not deny the existence of the real world, but our knowledge of the real world is constructed via the process of bounding. It is therefore important to switch analytical primacy from "content analyses" (analyses that focus on phenomena in the world, including the identities and roles of agents observing these phenomena) to the analysis of how these phenomena are bounded (or 'framed'). Also, when Mingers talks about the "problem" of never-ending boundary judgements, he fails to recognise that any process of making boundary judgements is basically a value clarification process rather than a hopeless quest for comprehensiveness, as Ulrich and Reynolds (2010) explain. So, despite the claim that nothing should, in principle, be excluded from analysis, the inevitable, practical move to action limits critical reflection and makes choices between boundaries inevitable (Midgley & Ochoa-Arias, 2001). In every systemic intervention, there is a need for decision making on when and how to end critical reflection in order to move to action, which is a topic that Ulrich (1983) has written about at length.

A7.7 Soft systems methodology

SSM was developed by Peter Checkland and colleagues in 1969 at Lancaster University in reaction to systems engineering approaches that failed to address messy real-world problems. SSM has evolved over a 30-year action research period (Checkland, 2007). The development of SSM was guided by the iterative process of refining methodology by practically dealing with messy real-world problems and the simultaneous social theory development (Checkland, 2007; Checkland & Winter, 2006).

The development of SSM paved the way for a change of focus from the “hard” systems idea to the new “soft” systems idea that emphasised the inclusion of different worldviews. SSM moved away from attempting to engineer “real-life” systems to obtain a certain goal to a “process of learning in order to take action and improve the situation” (Van Rooyen & Labuschagne, 2016, p. 181).

This approach is regarded as one of the problem-structuring methods that deal with unstructured problems in complex circumstances. “Unstructured problems entail multiple stakeholders, multiple perspectives, conflicting interests, various types of uncertainties and significant intangibles.” (Hindle, 2011, p. 31)

SSM, as mentioned before, encourages participation through a process of inquiring and learning that will ultimately lead to improvement of a problem situation, placing it in the interpretative paradigm (Checkland & Winter, 2006). Jackson (2000) concludes that SSM is based on a strong theoretical foundation and this, more so than the methodology of SSM, has had a substantial impact on systems thinking and practice. It provides a useful language to ensure that on-going planning retains a systemic focus and provides support to people to find acceptable ways forward when they have different perspectives on an issue (Midgley, 2006a). Hindle (2011) suggests that, “Contemporary SSM is a multipurpose and flexible methodology and therefore has been interpreted in a variety of ways by academics and practitioners.” (p 32)

A7.7.1 Assumptions that underpin SSM

Managers are not often confronted by well-defined problems that require obvious solutions. Instead, they are challenged with problems that are “unique, complex, dynamic, social, political, and that contain interacting perceptions of reality” (Hindle, 2011, p. 32). Checkland and Poulter (2006) refer to these problems as “real-life” problems. Managers are not only tasked with achieving the specific goal of the organisation but also have cultural, political and strategic tasks. Therefore, managers are not only responsible for maintaining and controlling their organisation but also influencing the future direction of the organisation (Hindle, 2011).

SSM believes people have different worldviews that guide their behaviour. People's worldviews are more or less set but can transform over time (Checkland & Poulter, 2006; Hildbrand & Bodhanya, 2014). Checkland and Poulter (2006) illustrate the diverse worldviews where one person's act of "terrorism" is another's "freedom fighting" (p 192). The authors further highlight that in all problem situations, there are not only different worldviews that prevail but also people that act "purposefully". SSM therefore emphasises the comprehensive inclusion of multi-perspectives of stakeholders.

Hildbrand and Bodhanya (2014) conclude that SSM should not be viewed as a prescriptive method, but rather as a flexible methodology that consists of principles that should be adjusted to specific situations.

A7.7.2 The SSM process

SSM has evolved from an original seven-stage learning cycle to the current four-stage continuous learning cycle (Checkland, 2007). The first stage is to describe the current problem situation "as is". In the second stage, conceptual models of purposeful human activity systems are created for issues that were identified in stage one. The third stage is discursive – the models of stage two are debated for desirable and feasible change that can be fulfilled in the final stage as action for improvement. The learning cycle is shown in Figure A7-5. However, following improvement of the problem situation, new problems may emerge, and the cycle therefore starts again (Checkland, 2007). Although the learning cycle is described in stages, it is not a linear process or a recipe, but may happen simultaneously (Checkland & Poulter, 2006). Van Rooyen and Labuschagne (2016) suggest that depicting the learning cycle as four stages is a helpful tool to guide novice SMS users. A discussion of the four stages of the learning cycle will now follow.

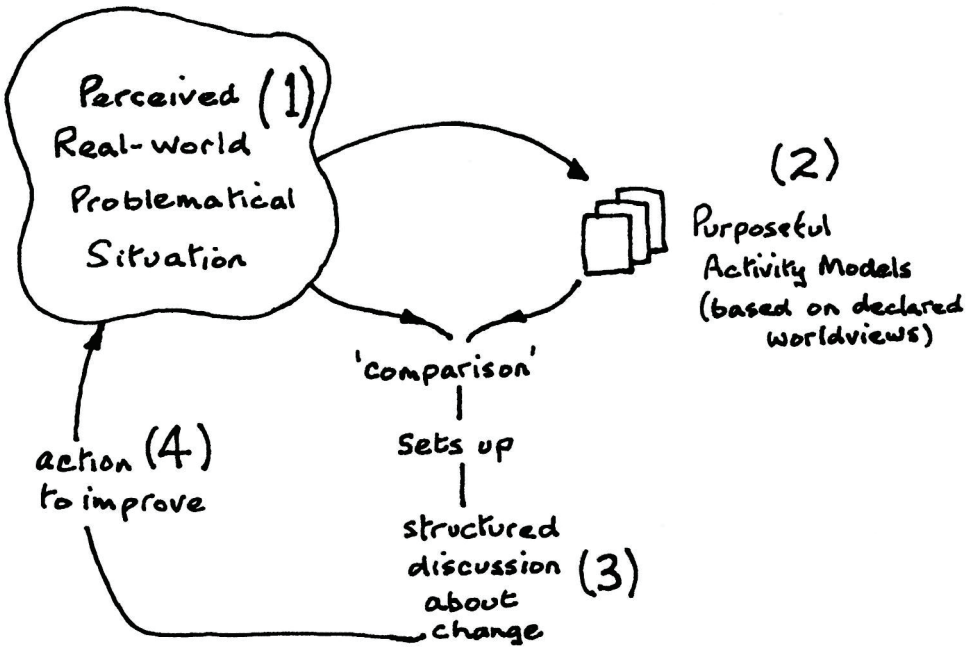


Figure A7-5 SSM learning cycle (Checkland & Poulter, 2006)

SSM learning cycle: finding out

According to Checkland and Poulter (2006), four techniques of finding out have survived the test of time and have become synonymous with the SSM finding-out phase, namely: making rich pictures, analysing with a focus on the intervention, social issues and political issues. The main goal of this stage is to view the problem situation holistically, to acknowledge different worldviews and to start recognising key concerns (Hindle, 2011).

Drawing rich pictures is a very effective way to comprehend complex situations where there are multiple interacting relationships, much more so than describing them in linear prose. The more worldviews in a rich picture, the “richer” it will be. Yet, a rich picture will never be saturated; it can always become “richer”. A rich picture represents only a snapshot of a current situation, which will not stay static for long (Checkland & Poulter, 2006).

In analysis 1, three key roles that are always part of an intervention should be established. The term roles is used for a person or a group of people who can fulfil more than one role. Checkland and Winter (2006) describe the three roles as follows:

- Client – who “caused the intervention (or inquiry) to happen?”.
- Problem solver – who “undertook to carry out organized work to bring about improvement?”.
- Problem owner – “whoever was in the role of ‘problem solver’ had the freedom to decide whom to regard as being the … problem owner”.

Analysis 2 explores the culture, history and social texture (consisting of roles, norms and values) of the situation. It is essential to be cognisant of these factors for improvement in social situations to be successful (Checkland & Poulter, 2006).

Analysis 3 ascertains the politics that prevail in a situation and how power is demonstrated, implemented, disseminated and regulated (Checkland & Poulter, 2006).

The SSM learning cycle: making purposeful activity models

To establish an organised process of investigation, models of purposeful human activity are generated. These models are utilised to enquire about real-life situations and to establish dialogue about them rather than to model the real world (Checkland, 2007).

A purposeful human-activity model is based on a specific worldview or root definition. Root definitions are described at the beginning of the model generation following specific guidelines. The first guideline, which assists to explain the worldview, is the PQR formula: “do ‘P’ by ‘Q’ in order to achieve ‘R’ or the ‘what’, ‘how’ and ‘why’ method.” (Van Rooyen & Labuschagne, 2016, p. 185). The second guideline is a mnemonic CATWOE that identifies the main stakeholders and concerns that need to be addressed in a root definition (Hildbrand & Bodhanya, 2014). The meaning of CATWOE is as follows:

C Customers: beneficiaries or victims affected by the systems activities.

A Actors: agents who carry out, or cause to be carried out, the main activities of the system, especially its transformation.

T Transformation: the means by which defined inputs are transformed into defined outputs.

W Worldview or Weltanschauung: an outlook, framework or image that makes this particular root definition meaningful.

O Owners: some agency having prime concern for the system and the ultimate power to cause the system to cease to exist.

E Environmental constraints: features of the system's environment and/or wider system that it has to take as 'given'." (Hildbrand & Bodhanya, 2014, p. 412)

SSM learning cycle: using models to structure discussion about the situation and its improvement

The purposeful human-activity conceptual models are utilised to steer conversation between the stakeholders in a problem situation. This conversation draws the attention to the different worldviews and focuses on identifying activities to improve the problem situation. These models do not represent how the stakeholders perceive the real world should look like (Checkland, 2007).

SSM learning cycle: defining action to improve

During this stage, the activities identified in stage three are discussed and implemented. In these discussions, it is fundamental that the focus is on "accommodation" rather than consensus. In the real world, consensus is seldom reached in messy problem situations (Van Rooyen & Labuschagne, 2016). Checkland and Poulter (2006) recommend thinking "richly" regarding change in human situations and to divide the concept of change into three parts for diagnostic reasons. These include "making changes to *structures*; changing *processes* or procedures; and changing *attitudes*." (p 231)

A7.7.3 Critique of SSM

Jackson (2000) states that SSM can be credited for contributing to “a paradigm revolution in systems thinking which liberated the discipline from the intellectual straitjacket in which it had been locked, and at the same time, made it much more obviously relevant to managers” (p 268).

SSM provides an opportunity to facilitate learning amongst stakeholders in formulating of the mess (Hildbrand & Bodhanya, 2014; Midgley, 2000). Hildbrand and Bodhanya (2014) conclude that SSM processes make stakeholders aware of the significance of soft issues in the formulation-of-the-mess phase. This is especially important in industries where little focus is placed on soft issues. SSM shows that holistic improvement of a system that is beneficial to all stakeholders, requires management of core soft issues. For the authors, systemic improvement can be enabled by an incremental process of managing soft issues. Improvement in one issue will lead to improvement in another. Soft issues support each other and provide a basis to deal with more tangible issues.

An important critique of SSM is that it is not possible to obtain true consensus through open and free participation. SSM cannot be effectively employed where there is underlying conflict, where worldviews do not change and/or where power regulates the debate (Jackson, 2000). Checkland (1985) response to the critique is that worldviews are amenable to change, either incrementally or radically. Of interest is that, although SSM is critiqued for not accommodating power and diverse worldviews, Hildbrand and Bodhanya (2014) find SSM to be an effective tool in the formulation of the mess to give stakeholders a better understanding of culture and power issues.

A7.8 Viable systems model

Stafford Beer started to develop VSM in the early 1950s. As a psychologist doing military service in the late 1940s he worked with a group of soldiers that had been diagnosed with psychopathological personalities and before that he worked with Gurkha Rifle soldiers. He started asking how these groups of unusual people function. This was the empirical beginning of the hypothesis that there may be

“invariances” in the behaviour of individuals that may also inform peer groups and even the society to which they belong. This idea continued to appear in his operational research in the steel industry during the 1950s. “The quest became to know how systems are viable; that is how they are ‘capable of independent existence’ …” (Beer, 1984, p. 7)

VSM is grounded in neurocybernetics and social sciences (Beer, 1984). VSM is a generic model that depicts a powerful image of any well-organised system. A system can be any entity such as a business or an organisation (Flood & Jackson, 1991). Although a generic model, VSM is mostly used in human activity organisations (Herrera, Thomas, Belmokhtar, & Pannequin, 2011). Johnson and Leydesdorff (2015) suggest that VSM provides an analytical framework, “It articulates a way of thinking about the different functions of the enterprise emphasizing regulatory balance between them.” (p 4) This is echoed by Espinosa et al. (2008) who propose that VSM offers a “language of viability” (p 640) that assists with making a paradigm shift in thinking of a system. Although the model of VSM is reminiscent of a system dynamic approach; it is different. System dynamics focuses on the structure of a system whereas VSM focuses on the organisation of the system and the evolution thereof (Flood & Jackson, 1991).

A7.8.1 Principles underpinning of VSM

VSM principles originated from the neurophysiology terminology as can be seen by titles of books by Stafford Beer: *Decision and Control* (Beer, 1967), *Brain of the Firm* (Beer, 1972) and *Heart of Enterprise* (Beer, 1979). The nervous system knows how to control and co-ordinate the multitude of functions that allow an organism to be adaptable and proactive in the physical and social world (Espinosa et al., 2008). Beer (1984) emphasises that VSM is not an analogical model (as it has been criticised), but that the neurophysiology terminology is used to gain insight into the functioning of the system.

The concept of viability is central to VSM. A viable system is a complex entity capable of sustaining its autonomy. This survival is not isolated from the systems environment – the system survives, amid changes, without loss of identity or separation from its function (Beer, 1984; Espinosa et al., 2008). Beer (1984)

incorporates Ashby's (1956) law of requisite variety – "only variety can destroy variety" (p 207) – to maintain viability.

The principle of recursion is also incorporated in VSM; this implies that, as a system increases in complexity, viable systems are nested within one another (Beer, 1984). Espinosa et al. (2008) compare the principle of recursion to a Russian doll: "any doll living within an outer doll and containing another" (p 642). Herrera et al. (2011) suggest that VSM transforms the traditional management view of the pyramid of demand and control as it changes the systems hierarchy by structural recursion.

A7.8.2 VSM Model

The model consists of five essential subsystems that are interactively involved in maintaining the system's identity in the environment (Beer, 1984). The first system (S1) is known as the operational units and the meta-system consists of systems 2 to 5 (S1-S5). The VSM is shown in Figure A7-6.

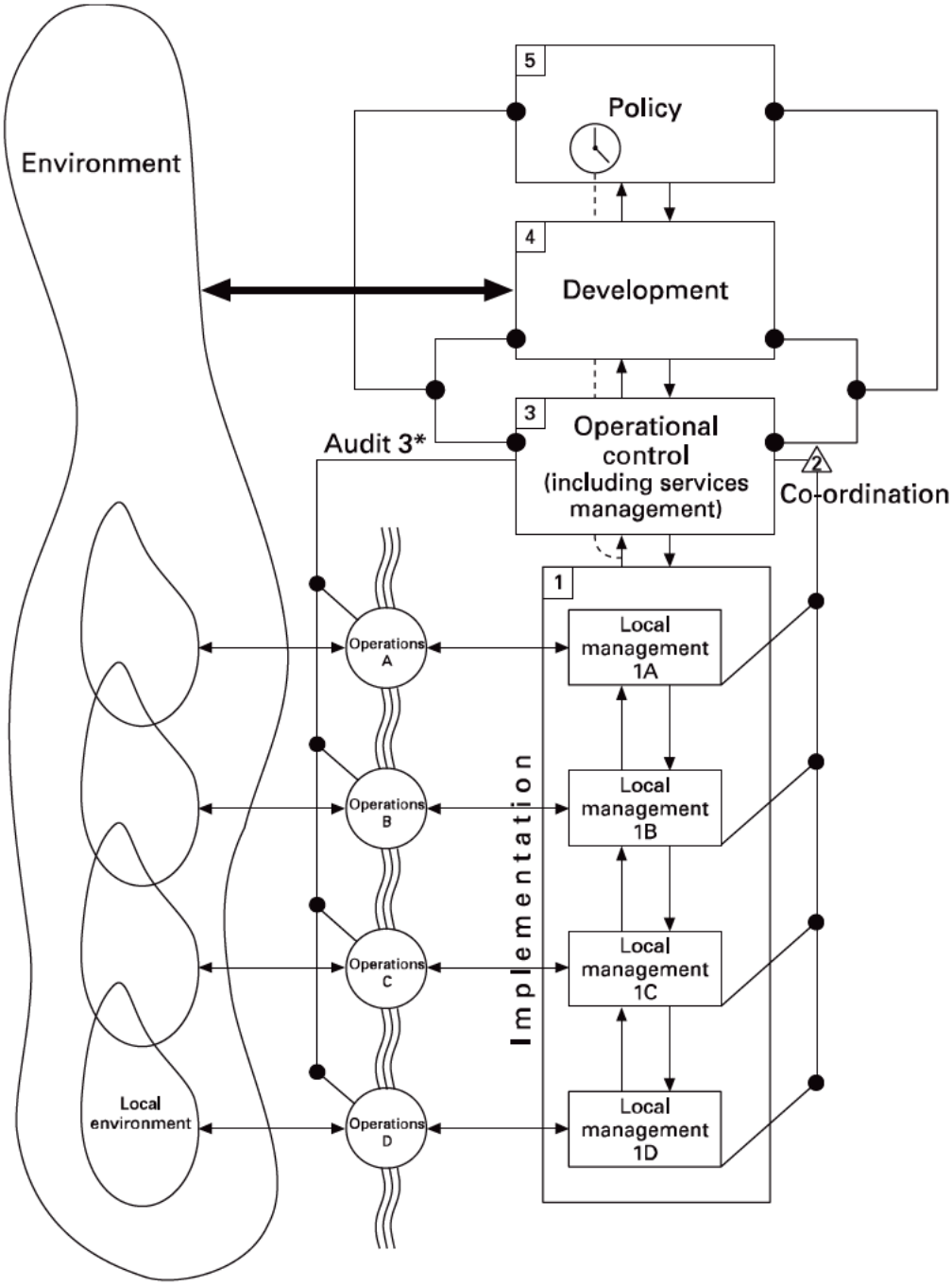


Figure A7-6 VSM model (Jackson, 2003)

S1 consists of a varying number of operational units, referred to as the "autopoietic generators" and this is where the fundamental functions of the system occur. S1 is always a viable system in itself and is therefore autonomous (Beer, 1984; Espinosa et al., 2008) and functions in the "here and now" (Schwaninger & Scheef, 2016, p. 3). The operational units connect to the local

environment and absorb a large amount of the environmental variety (Flood & Jackson, 1991).

Each operational unit of S1 is connected to the meta-system by the vertical command axis. S1 receives instructions from the meta-system via this command channel.

S2 co-ordinates the operational units to ensure the effective functioning of S1 and manages any fluctuations (Flood & Jackson, 1991). Johnson and Leydesdorff (2015) refer to S2's function as "tuning the engine" (p 5) to ensure harmony between S1 and S3.

S3 has a control function that upholds the internal stability of the system. It interprets policy from S5 and oversees the successful implementation thereof (Flood & Jackson, 1991). However, the implementation function should not be top-down management but a supportive function (Hildbrand & Bodhanya, 2017). S3 is responsible for resource bargaining with S1 to enhance the outcome of the whole system (Johnson & Leydesdorff, 2015). The S3* has an auditing function, asking: "is it doing what it should be doing?" (Johnson & Leydesdorff, 2015, p. 6).

S4 is the anticipatory system (Johnson & Leydesdorff, 2015) that has as its function "intelligence gathering and reporting" of internal and external information (Flood & Jackson, 1991). The focus of S4 is long-term (Schwaninger & Scheef, 2016).

S5 ascertains the identity of the system (Beer, 1984) and is responsible for the normative management of the system (Hildbrand & Bodhanya, 2017). It "establishes an equilibrium between present and future orientation, in a virtually timeless … horizon" (Schwaninger & Scheef, 2016, p. 4). S5 makes policies (Flood & Jackson, 1991), it manages the S3 and S4 homeostat (Johnson & Leydesdorff, 2015) and mediates the internal and external demands placed on the system.

A7.8.3 Critique of VSM

VSM can be used advantageously to contribute to management practices. VSM has the capability to deal with systems that are vertically and horizontally interdependent. The model requires that consideration be given to sources of command and control. With VSM, sources of control are distributed throughout the system allowing for self-organising and autonomy throughout the system; which results in problem solving close to the source of the problem. VSM can be used very effectively as a diagnostic tool (Jackson, 2000).

Checkland (1985), from an interpretive perspective, critiques VSM as understating the purposeful role of the individual and therefore only partially representing the system. There is a concern that the model can be exploited by a powerful group (Jackson, 2000).

When VSM is used as a diagnostic tool the practitioner must be cognisant that VSM language is not common, and that stakeholders are not always familiar with VSM. Therefore, the practitioner engaging with VSM needs to be creative and develop questions without using VSM language that will still generate suitable information to make a VSM diagnosis (Hildbrand & Bodhanya, 2015).

A7.9 Interactive planning

Interactive planning, an organisational development process, was developed by Russel L Ackoff in the 1970s and was based on work that he started in the 1950s. This approach allows organisations to use their innovation potential to move beyond the traditional problem-solving approach. Jackson (2000) describes Ackoff as one of the most influential pioneers of operations research in the post-war period in the United States of America. Ackoff was the leader of the “reformists” in the operational research movement and believed that: “To cling to optimization in a world of multiple values and rapid change is to lose one’s grip on reality. The emphasis has to be upon learning and adapting.” (Jackson, 2000, p. 233)

Interactive planning offers those who are expected to change, a chance to contribute to the process (Leemann, 2002). This will enable stakeholders to create a desirable future for themselves, the organisation and the environment in which it functions (Ackoff, 1981b). The subtitle of Ackoff's book *Creating the Corporate Future*, "Plan or be planned for", reflects the spirit of his work (Flood & Jackson, 1991).

Before the process of interactive planning is presented, the concepts of planning and approaches to problems will be briefly discussed.

Ackoff (2001) distinguishes between three planning methods: reactive, pre-active and interactive planning. Reactive planning has a bottom-up approach that aims to identify and eliminate deficiencies in an organisation. However, removing deficiencies does not always produce the anticipated results. This approach also does not engage with the organisation holistically, but rather with parts of the organisation independently (Ackoff, 2001).

Pre-active planning has a top-down approach that emphasises prediction and preparation. This approach does not attempt to "plan the future" but rather focuses on "planning *for* the future" (p 3). It is uncommon for pre-active planning to realise as the reality is more often than not unlike the predicted future (Ackoff, 2001).

The aim of interactive planning is to produce the future. According to Ackoff (2001), this approach to planning entails:

> *the design of a desirable present and the selection or intervention of ways of approximating it as closely as possible*. It creates the future by continuously closing the gap between where it is at any moment in time and where it would most like to be (p 3).

For Ackoff (1981a), there are three ways to approach problems: to resolve, solve or dissolve them. When a problem is resolved, the outcome is regarded as good enough; it "*satisfices* (satisfies and suffices)" (p 20). This approach, referred to as the clinical approach, depends on past experience, trial and error, common sense and subjective judgements. It is the most common approach managers

use to address problems and they justify their approach on lacking information and time and aiming for survival (Ackoff, 1981a).

To solve a problem, the best "possible outcome, that *optimizes*" (p 21) is selected. This approach, also known as the research approach, seeks objectivity and uses scientific methods, mathematical models, as well as real and simulated experimentations. Researchers "… often prefer an optimal solution to an incompletely formulated problem to a less than optimal solution to a completely formulated problem" (p 21) and they aim for growth (Ackoff, 1981a).

The design approach aims to rather dissolve a problem; this is achieved by altering the features of the larger system that contains the problem. The intention here is to change, "*idealized* rather than satisfice or optimize" (p 21), the system concerned to a state where the problem cannot or does not develop. The objective of this approach is development – to increase ability and quality of life.

A7.9.1 Principles of interactive planning

Interactive planning is based on three operating principles, namely: the participative principle, the principle of continuity and the holistic principle.

Participative principle

For Ackoff (1981b) the main benefit of planning is participating in it, which is in contrast with popular belief that the main benefit is from the use of the plan. The participation of members in the planning process enables them to develop and obtain an understanding of the organisation and ensures that they serve the organisational goals more effectively. This will result in the development of the organisation as well. Flood and Jackson (1991) conclude that it is also ethically important for Ackoff to include stakeholders affected by the planning in the planning process.

The participative principle has two implications for planning. Firstly, it will result in development of the member as "… no one can plan effectively for someone else. It is better to plan for oneself, no matter how badly, than to be planned for by others, no matter how well" (Ackoff, 1981b, p. 66). Development, as opposed to

growth, can be defined as the increase in one's ability and desire to enhance your own quality of life and that of others (Ackoff, 1981a). Secondly, the role of professional planners have changed to motivate and facilitate and not to plan for others (Flood & Jackson, 1991).

Principle of continuity

No plan, regardless how well formulated, will evolve as planned and not all events will be foreseen. Therefore, plans should be continuously reviewed and appropriately adapted. The changes that happen continuously modify the value placed on a plan and the values should similarly be continuously adapted. However, the fact that the main benefit of planning is participating in it, should be driving motivation not to discontinue it (Ackoff, 1981b).

Holistic principle

With this principle, Ackoff (1981b) addresses the short-comings of the sequential top-down or bottom-up approaches and suggests the "all-over-at-once" (p 74) approach. In this approach, as many units of an organisation as possible plan simultaneously and interdependently across all levels. Two different principles are distinguished: the principle of coordination and of integration – each focusing on different dimensions of the organisation. The principle of coordination infers that all units at the same level should be planned for simultaneously and interdependently, and the principle of integration entails interdependent planning across all levels.

The reasoning for this is that a threat or opportunity that appears in one unit may be more appropriately addressed in another unit or several units concurrently. Conflict between units at the same level and between levels are often the result of poor communication and a lack of awareness; the holistic principle is proposed to manage this conflict (Ackoff, 1981b).

A7.9.2 The process of interactive planning

Interactive planning consists of two parts: idealisation and realisation. Ackoff (1981b) presents a process of five interrelated phases for these parts: formulating

the mess, ends planning, means planning, resource planning, and design of implementation and control. Means planning, resource planning and the implementation and control phase are also collectively known as the realisation phase. These five phases do not follow a specific order but are interdependent aspects of a systemic process; the process is never completed – inferring a return to the various phases and continued planning.

Formulating the mess

Formulating the mess entails describing the problems, possibilities and risks that confront an organisation (Jackson, 2000). Ackoff (2001) aptly states that the goal in this phase is to "determine how the organization would eventually destroy itself if it were to continue behaving as it currently is; that is, if it were to fail to adapt to a changing environment" (p 5). Formulating the mess requires that a system analysis, an obstruction analysis and reference projections be done. Reference projections entail projections of the organisation's future should there be no change in either the organisation or the expected forthcoming environment. This information is then synthesised and a reference scenario is created which is the formulation of the current mess that the organisation is experiencing (Ackoff, 2001).

Ends planning

The process of ends planning starts with "idealised design" (Ackoff, 2001). Jackson (2000) states that idealised design is a vital component of interactive planning and distinguishes the approach from other planning approaches. Idealised design is done against the background of a destroyed organisation and planners are asked to design a new organisation. The planners have carte blanche but only technology that is feasible in the current situation is allowed and the organisation must be designed to survive in the current environment (Ackoff, 1981a; Flood & Jackson, 1991).

Ackoff (2001) warns that this design should not represent "an ideal" organisation or utopia, but an "ideal-seeking system" (p 8). The idealised design process has three parts: formulating a mission statement, stipulating a comprehensive list of

properties that should be built into the new design, and designing the new organisation, including the specified properties.

Means planning

In means planning, it is established what steps should be taken to remove or reduce the gaps identified between the reference scenario or mess and the idealised design (Ackoff, 2001).

Resource planning

In resource planning, five resources that are needed to implement the means planning are considered, namely: money, capital goods, human resources, consumables and data (information, knowledge, understanding and wisdom) (Jackson, 2000).

Implementation and control phase

The final phase, implementation and control, requires that the “who, what, where, when and how” (153) be established in order to implement the means planning. Implementation must be continuously monitored and feedback be given to the planning process to facilitate learning and the planning of new improvements (Flood & Jackson, 1991).

A7.9.3 The role of a facilitator in Interactive planning

It is important to note that, for interactive planning to be successful, a competent facilitator is essential. There are no exact rules that guide facilitation – it is regarded more of an art than a science. Lumbo (2007), however, suggests the following facilitation competencies. The facilitator needs knowledge of systems thinking, to understand group dynamics and different personality types and be able to use this knowledge to guide the group productively. It is necessary to maintain participants’ energy levels for them to remain focused on the task at hand. Outstanding communication and analytical skills and the ability to connect previous knowledge and experience to the current situation are vital. It is important that the facilitator ensures that all stakeholders’ voices are

appropriately heard. The facilitator must be valued by participants and must be able to create an ambiance where participants feel safe to share ideas and build on the ideas of others.

For Lumbo (2007), in addition to the mentioned competencies, the facilitator must have certain personality traits, the most important of which is being creative. The author concludes that facilitators that are creative:

- tend to be smart and naïve at the same time;
- alternate between imagination and fantasy at the one end, and a rooted sense of reality at the other;
- are remarkably humble and proud at the same time;
- have a combination of playfulness and discipline or responsibility and irresponsibility; and
- are thought to be rebellious and independent, yet traditional and conservative.

A7.9.4 Critique of interactive planning

Lumbo (2007) highlights seven advantages of interactive planning. Firstly, all stakeholders are given the chance to construct their future. The future planning is based on existing assumptions and possible scenarios of the future. This allows flexibility and responsiveness to be built into the system design that will ensure that the system can adapt to rapid change and retain control. More informed decisions are made as all subsystems and surrounding systems are part of the problem of conceptualisation and the solution thereof. The participants are cognisant of the effect of their decisions on the whole system as the methodology makes them aware of the web of relationships inside and outside of their organisation.

Interactive planning encourages participation, this in turn leads the participants to feel like they are important assets that can make a difference in the

organisation. Participants from various levels inside and outside of the organisation ensure that a holistic view of the problem is generated.

Furthermore, interactive planning contributes to employee empowerment that may lead to increased productivity. Creativity is encouraged by designing an ideal system and participants are not constrained by trying to improve the current system. This out-of-the box thinking can lead to breakthroughs that could have far-reaching influence – even beyond the current system.

The methodology of interactive planning is based on transparency and awareness of the project and this will contribute to easier implementation of changes. The participants who made the plan are also responsible for the implementation. Lastly, interactive planning can be used in diverse situations due to its flexibility.

For Jackson (2000), a strong advantage of interactive planning is that he sees systems-age thinking as complementary to machine-age thinking. Ackoff allows space for solving and resolving approaches in his dissolving approach.

Haftor (2011) did a case-based approach evaluation of interactive planning and concluded that this methodology is a powerful tool to direct organisational development, especially in operational efficiency and quality. However, he also identified some limitations. In his research, interactive planning failed to obtain participation from all stakeholders and did not manage power structures effectively. The author also noted that all stakeholders did not accept decentralised decision making – an assumption of interactive planning. A second observation is that low risk and low cost should be part of the ideal otherwise the converse can be difficult to avoid in the idealised design.

Jackson (2000) draws attention to Ackoff's inability to see organisations from an emancipatory perspective. This shortfall has led to critique that interactive planning has adopted consensus as a worldview that ignores power and conflict, further participation is taken for granted and is overestimated as a remedy for problems.

The concept of a clean slate may not appeal to everybody; moving out of one's comfort zone to create a new reality may be difficult for some. In situations where top-down decisions are made, decision makers might not be keen to give up their power for the democratic process required by interactive planning. The methodology requires a lot of coordination and can be time consuming. To obtain favourable results with interactive planning, an experienced and skilled facilitator is a prerequisite (Lumbo, 2007).

A7.10 Summary

The discipline of systems thinking is vast. The various documented systems methodologies have been investigated in depth. However, it is out of the scope of this thesis to engage in an exhaustive account of all systems methodologies. This appendix therefore provides an introduction to the concept of systems thinking, a brief overview of the systems movement and a more in-depth discussion of the relevant systems approaches applicable to the problems of understanding and improving of intensive care delivery.

Appendix 8: Public as a stakeholder

A8.1 The public as stakeholder

When trying to establish an understanding of intensive care delivery in South Africa, a first reaction was that the public was an essential stakeholder. Although, this is true, the public pose certain realities and challenges that made it difficult to include them in this research.

Members of the public are diverse and for the purposes of this research, were divided into three groups: firstly, members of the public who have had no previous personal exposure to intensive care – either as a patient or a close family member; secondly, members of the public who have been patients in ICU themselves and lastly, members of the public who have had a close family member admitted to the ICU.

A brief discussion will highlight some of the realities and challenges when engaging with the public as a stakeholder.

Public with no previous intensive care exposure

A person may have a preconceived idea of a serious illness and how they wish to be treated when seriously ill. An example is a patient that has a formal or informal “do not treat order”, but when in or having lived through a near-death situation reverses his/her position on treatment options. A further example is the person that is not happy that other members of his/her medical insurance receive expensive treatment in intensive care – believing that it is not cost and/or quality-of-life justified. However, when this person or a close family member is admitted to the ICU his/her expectations are that the medical insurance must pay and the ICU must continue with treatment, regardless of the cost.

Intensive care patients and their families

Intensive care patients and their families present with similar, but also different, challenges and realities.

Survival from intensive care brings its own a significant problems – not only for the patient but also for the family of intensive care survivors. Iwashyna (2010) defines survivorship from critical illness as “the complex burdens and legacies of surviving potential fatal disease, often after harsh and painful treatment” (p 204). The Society of Critical Care Medicine conference in 2010 on improving long-term outcomes after critical illness drew attention to intensive care survival. A key outcome of this conference was the development of the post-intensive care syndrome model that describes the potential problems that patients and their families may encounter after discharge from intensive care (Needham et al., 2012).

Post-intensive care syndrome – patients is the term used to describe new or worsening impairments in:

- physical function (pulmonary, neuromuscular and physical function);
- cognitive function (executive function, attention, visio-spatial and mental processing speed); and/or
- mental function (anxiety, depression and post-traumatic stress disorder) (Needham et al., 2012).

A significant but unidentified number of patients who survived intensive care manifest with these impairments. The manifestation of these impairments may be more than transient as symptoms may still be present five years post-intensive care discharge or even permanently for some patients (Elliot et al., 2014).

Family members of patients that were treated in intensive care are also at a high risk of developing depressive, anxiety and stress-related disorders, complicated grief and post-traumatic stress disorders (Jezierska, Borkowski, & Gaszynski, 2014). The Society of Critical Care Medicine has named this cluster of complications the *post-intensive care syndrome – family* (Needham et al., 2012).

Post-intensive care syndrome – family presents within months following the patient’s discharge from the ICU, regardless if the patient was a new-born, child or adult, and can persist for several years (Jezierska et al., 2014). The reported

incidence of post-intensive care syndrome – family varies, depending on the timing of the study. Jezierska et al. (2014) report in their review that the risk of post-traumatic stress syndrome in family members of adult patients discharged from the ICU is estimated to range between 33% and 49% and risk for depressive disorders between 6% and 26%. Between 14% and 56% family members of patients that died in the ICU have developed post-traumatic stress syndrome and between 8% and 42% have developed depressive disorders with an incidence of 27% for severe depressive disorders. It is important to note that in the study of Azoulay et al. (2005), only 25% of the family members (n=94) that were identified to have post-traumatic stress syndrome received medical care. Kentish-Barnes et al. (2015) found that complicated grief was experienced in 52% of family members (n=147) six months after the death of a relative in the ICU. The authors further noted that 21.3% of family members that experienced complicated grief at 12 months (n=113) after the death of a relative did not experience complicated grief at six months.

The risk factors that contribute to post-intensive care syndrome – family can be attributed to the family itself and to intensive care. Risk factors related to the family include:

- being female;
- being young;
- spouse being critically ill;
- being a single parent
- younger age of patients;
- education level of individual family members;
- having a history of anxiety, depression or mental illness; and
- experiencing increased levels of stress:
    - patient dies during ICU stay;

- high risk of death;
- sudden unexpected disease; and
- patient diagnosed with the disease fewer than five years ago. (Jezierska et al., 2014)

Intensive care factors that contribute to post-intensive care syndrome include the social support the family received while the family member was in ICU, the attitude of the ICU staff towards the family and specifically suboptimal communication with the family (Jezierska et al., 2014).

It is not currently known what the incidence of post-intensive care syndrome is among intensive care patients and family members of intensive care patients in South Africa. It would therefore be highly unethical to involve this group of stakeholders – who may have a high probability of experiencing post-intensive care syndrome – without the necessary support and referral systems, should any of the symptoms of the syndrome manifest. The support and/or referral system required to create a safety net for this group of stakeholders is varied, multidisciplinary and far outside the scope of this study.

Patients in intensive care present with a vast number of diagnoses with varying levels of acuity. Each of these diagnoses, and the subsequent outcome of their intensive care stay, will differently influence the patient and their families' perception of intensive care delivery. For example, an 18-year-old patient admitted with a gunshot wound to the abdomen and who died in the ICU is very different to an 87-year-old patient admitted with pneumonia, who survived the ICU and this is, in turn, very different to a 56-year-old patient admitted to the ICU post-operatively following elective surgery and that had a prolonged and complicated ICU stay. Furthermore, some intensive care patients may have fragmentary or delusional memories of their stay in the ICU (Jones et al., 2010).

It was decided that the public with no previous intensive care exposure should be excluded as a stakeholder in this research due to the reasons mentioned earlier. Former patients and their families, albeit a vulnerable stakeholder, were included in the research. However, certain measures were put in place to ensure that this

stakeholder group was treated ethically. Firstly, the former patients and their families were interviewed in a safe environment, in their homes, rather than at a workshop with other former patients and families. Secondly, the interviewer had experience working in ICUs and doing research in intensive care. This ensured sensitivity towards the former patients and their families and the insight to identify possible post-intensive care syndrome to appropriately refer patients or their families if necessary.

Appendix 9: Background information to workshops and interviews

Table A9-1 Workshop and interview venues

Stakeholder	Venue	Participant profile
ICU opinion leaders, mainly from public sector and academic institutions	CCSSA National Congress, Sun City	• Educators • Intensivists: adult and paediatric • ICU unit managers • Nurses
National Department of Health	National Department of Health	• Deputy Director General of Health
Private hospital groups management	OR Tambo International Airport	• Clinical advisors • Financial managers • Senior nursing managers
Private ICU health care workers	OR Tambo International Airport	• Clinical pharmacist • Dietician • Intensivists • Nurses • Physiotherapist
Medical funders	OR Tambo International Airport	• Medical advisors • Senior managers of fund administrators
Medical industry	Boardroom, Medical School University of the Witwatersrand	• Product managers • Sales representatives
Trade unions	Boardroom, Medical School University of the Witwatersrand	• Regional chairman

Stakeholder	Venue	Participant profile
Regional public sector ICU health care workers	CCSSA National Congress, Champagne Sports Resort, Central Drakensberg	• Non-intensivists
Non-intensivists doctors	Boardroom, Rosebank Clinic	• Non-intensivists doctors • Physiotherapist

Table A9-2 Patient and family interviews

Interview	Patient's status in the family	Family member's status in the family	Sector	Duration of interview (hours)
1	Son	Mother	Public	I:15
2	Mother	Son	Public	1:35
3	Mother	Daughter	Public	1:05
4	Son	Grandmother Uncle	Public	2:15
5	Husband	Wife	Public	1:50
6	Husband	Wife 3 Children	Private	3:30
7	Son	Mother	Private	2:15
8	Wife	-	Private	1:05
9	Wife	Husband	Private	2:14

Appendix 10: Synthesis of the understanding of intensive care delivery

A10.1 The story of the patients and their families

The majority of participants expressed that they experienced the “ICU” as a caring space but it became clear during the interviews that with the positive experiences there were experiences that reflected the hostility of the ICU environment. The caring and hostile environment became apparent at various levels of functioning in the ICU.

This dichotomous experience of participants was aptly illustrated by a young participant as shown in Figure A10-7 (the colour was added by me). Due to certain circumstances, he had to visit his mother without his family which made him feel very vulnerable. For this participant, in the ICU “the feeling is nice – there is sunshine, but it is also not nice – there is thunder – it is not a nice place to be. Sometimes when I leave my mom, I was not sure if she was going to be in the bed when I come back.” The empty bed represented the uncertainty of the ICU for him. This illustration of ICU summarised for me not only the functioning of the individual ICU experience but also the delivery of intensive care in general: the sunshine, the thunder and the uncertainty.

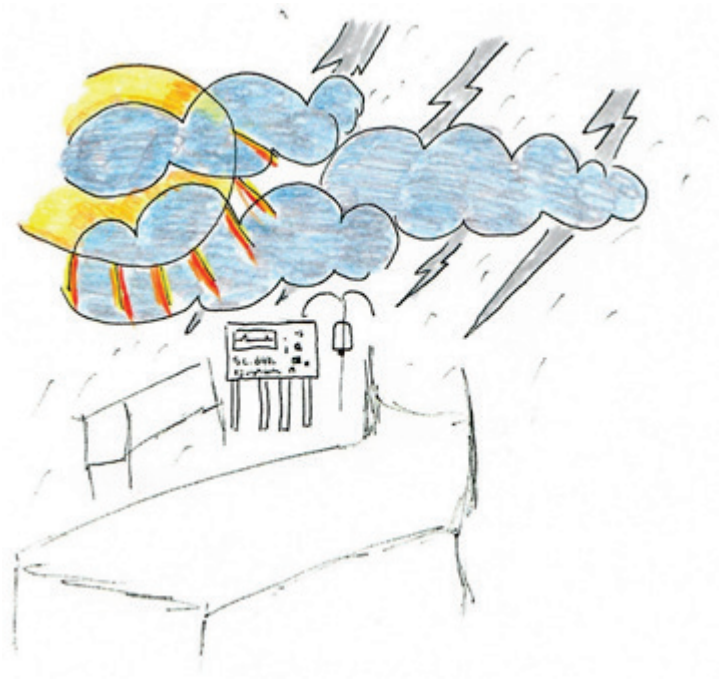


Figure A10-7 A participant's image of the ICU environment

Participants, from both the public and private sector, highlighted the well-known general challenges of the ICU. One participant drew his picture all in black, as that was how he experienced the ICU. He was mostly awake and aware of what was happening during his ICU stay. The ICU for him was not a "therapeutic environment", it "lacked colour, the natural look of nature – that in itself is healing. It looked a bid shabby having all the sophisticated machinery on Masonite board." The ICU currently is not conducive to healing, "I do not expect to see 'heaven' in … but still." All that he could see were the lights 24 hours of the day; there are no windows that would allow one to see the trees and birds. "I wish it could be more organised, everything was all over the place and there is no privacy."

The majority of the participants that were patients in the ICU highlighted that there were no windows, that they could not cannot see out of the room, tell whether it was day or night and that they could not see trees. One participant remembered that "I used to ask if I can see a tree, I needed to smell the tree."

Although the participants understood that ICU functions different to normal wards and that interventions are done in the interest of patients, there are certain things that is not pleasant when you are an ICU patient for a long period of time- for

example, the constant bright lights. One participant reflected that she struggled to sleep in ICU and as a result was given sleeping tablets but then as soon as she fell asleep, the nurses would come and shine a torch in her eyes to monitor her neurological status. A further challenge was being washed in bed.

It was interesting to note how diverse participants experienced the technology and equipment used in the ICU. Some participants were initially overwhelmed by the technology and equipment, “you wake up and then there is this big pipe filled with blood, you do not know what is going on.” The technology and equipment were experienced as extremely uncomfortable by participants. One participant explained “for three weeks I had to keep my head in one position and then you hear the sounds of the machines the whole time. I had pipes in my lung for air, for the blood, I had the pipe for the urine and the ECMO[6] and then you have to sit in the chair for the lungs, it is too much, I cried it was so sore.” It is very interesting to note that although the technology was very uncomfortable and irritating, it does become part of the patient in ICU, “when the ECMO was removed I was lost, you get so used to the machines.”

One participant related that she was very scared when she heard that her son was admitted to ICU which increased when she saw him with all the pipes. However, when she saw that he was well cared for, she became relieved and the technology and equipment did not matter any longer. For one participant, the technology and equipment felt in place, as if it had a function and should be there; for another participant, the technology in ICU was not of concern as she did not understand the purpose of the technology.

An overwhelming experience for participants – both patients and family members, were the “waiting”. A participant who was a family member recalled the waiting as: “waiting at home, waiting for the phone to ring, waiting outside ICU, not knowing what was going to happen next”. The son of another participant, who had a nursing background, had to go back to theatre several times for various

[6] ECMO: is a treatment that uses a pump to circulate blood through an artificial lung back into the bloodstream of a very sick patient. This system gives heart-lung bypass support external to the patient’s body.

surgeries during his stay in ICU. Knowing the risks involved made the waiting when he was in theatre a very traumatic experience.

Waiting was problematic for participants who were patients towards the end of their ICU stay. One participant remembered that the time went by very slowly “it felt like a year, patients were coming and going and I was the only one that remained.” She was desperate to go home, but the doctors were adamant that she had to remain in ICU until they were completely sure that she was ready for discharge, “they didn’t want me to come back”. Boredom at the end of ICU stay was very difficult for another participant, “you are not well enough to read or do cross word puzzle, you just lie there and wait, what made it worse the doctors that kept on saying for days – ‘soon’…”.

ICU patients are often positioned in specific positions for various therapeutic reasons. Although nursing staff try to make patients as comfortable as possible it remains difficult and uncomfortable for patients to lie in one position for an extended period and something as basic as your position in bed becomes a distressing experience. “Lying in ICU on your back, for nine weeks was extremely difficult, ‘to find a comfortable spot’ the nurses were screaming at me for being restless and moving the whole time.”

Another basic activity – eating was challenging for participants recovering in ICU, “it is very difficult to have to eat when you not hungry, and even more difficult when the food is inedible.” One participant felt that he had to proof that he was getting better by eating.

> Dit het gevoel of ek die heel tyd moes eet, dit het net nooit op gehou, hulle maak opnames daarvan, dit was asof ek moes bewys dat ek beter word, intussen wou my liggaam nie kos gehad het nie. [It felt that I had to eat the whole time, it just never stopped, they recorded it, it was as if I had to proof that I was getting better, in the meantime my body had no need for food.]

“Proofing” to the staff that you were getting better was also experienced by a participant who expressed that the staff expected her to smile as a reassurance that she was getting better.

Patients are sometimes restrained in ICU, a practice that is increasingly being criticised. Being restrained in ICU was a traumatic experience for participants and had a long-lasting effect on them. One participant said that he was very aware of and feared the nurse who “tied me up”. Another participant at times thought he was held hostage, he also thought the nurses restrained and gave him “injections” so that they could go and sleep or do other things. Months after a participant was discharged from ICU she still did not understand why she was restrained and she could still not recall if it was ever explained to her why she was restrained.

It is occasionally also necessary for patients to be placed in isolation for various reasons in ICU. Being isolated was a very difficult experience for all the participants that were patients.

> It made me feel very lonely going through all the processes alone, you need somebody there, you cannot, you cannot, you need to talk to somebody, you need to cry, you need somebody to give you hope, it was not easy. The psychologist that visited me in ICU suggested that my husband must bring me a teddy that I could touch and hold which helped me a lot.

Health care workers in the ICU are tasked to care for patients with a varying degree of acuity. Especially in patients that are very sick and unstable, their focus is mainly stabilising the patients’ physical condition and very little, if any, attention is given to the patients’ experience of ICU. Patients ability to communicate, see and hear as well as their understanding of what happened and are happening to them differ. They are left to make their own interpretations, which often result in misinterpretations of what is happening.

> When I got there, they took X rays, immediately starting to put pipes in me and rushed me to theatre, I then stop remembering. I know I was in ICU, but I do not remember much, I was drugged – on cloud nine, my system was poisoned.

> I was admitted to hospital with a very sore hip after my accident and expected to wake up in ICU with a sore hip, instead I woke up, my whole body plastered, a pole through my leg, I do not know why I was cut open, why I had a colostomy, nobody explained what they did, the back operations, nothing.

> I experienced it as very traumatic that the staff want to inject me with stuff, I did not know what it was, I did not know what was making me feel the way I do. I was scared when the injections, that at times was antibiotics, did not make me sleep. During the days that I was confused I thought I was in three different hospitals, but I was moved to different places in the hospital for different tests.
>
> My most intense experience of ICU was the hallucinations that I experienced in the beginning of my ICU stay. I remember most of the hallucinations yet remembering the hallucinations as such are not troublesome for me. However, the hallucinations and disorientation I experienced during my ICU stay made me extremely embarrassed during my latter part of ICU stay and after I was discharged from ICU. For me this does not reflect who I am and it is very embarrassing for me that other people had to see me like that.

What patients experience as difficult or traumatic in ICU is not what health care workers in ICU expect. One patient related that although he lost a limb and had a heart attack at a young age, not once during his whole stay in ICU did he experienced any emotional trauma.

> Ek weet nie of dit die medisyne was, maar ek dink die diens wat ek ontvang het, die mense se ondersteuning en bystand dit was oorweldigend. Maar ’n baie moeilike ervaring vir my was om 12 dae van my lewe te verloor, ek kan glad nie onthou wat die eerste 12 dae in ICU gebeur het nie. Dit pla my nog ’n jaar na dat ek in ICU was.
>
> [I do not know if it was the medication, but I think it was the care that I received, the peoples’ support and assistance were overwhelming. But a very difficult experience for me was to have lost 12 days of my life, I have no recall of the first 12 days in ICU. This is something that still worry me a year after being in ICU.]

It was noticeable that the ICU experience was much more traumatic for the family members than for the patients. In reality, family members are also ICU patients, but they do not have hospital numbers and therefore they do not always receive the necessary care that they need. Two experiences that was mentioned by most family members was the overwhelming experience of hopelessness and guilt.

The overwhelming experience of hopelessness and the impact it had on participants was aptly portrayed by a participant whose son was in ICU. She drew herself as getting smaller and smaller and, in the end, she had no arms and no mouth. This experience was verbalised by participants when they explained their drawings.

> My husband was receiving high dose of medications to prevent blood clotting when he was on ECMO, he developed an acute bleeding disorder. He was bleeding from every possible orifice, the staff was pouring blood into his veins and I could do nothing, just stand there and watch, I felt hopeless, I could do nothing to help him, it was very traumatic.

> It is not a nice experience to be in hospital, you not in ICU by choice. It was difficult to leave my wife at night, but what was worse when I come back and her heart rate is 153. There was nothing that I could do, her parents were too scared to visit her, they were even too scared to answer their phone, I felt so hopeless.

Participants experienced guilt on different levels. Families spend a lot of time in the ICU waiting room, and it is unavoidable that the families of the various patients start communicating with each other. It was immensely challenging for a participant when her husband was slowly stabilising and she was receiving “brokkies goeie nuus, terwyl ander pasiënte se families slegte nuus ontvang.” [snippets of good news whilst other patients’ families are receiving bad news]

Participants, especially mothers who had children, felt extremely guilty. Their focus was primarily on the unstable patient in ICU, they knew their children were cared for by family members and friends, but felt very guilty that they “were not there” for their children. A year after her husband’s discharge, one mother still felt guilty that she emotionally neglected her children. It was very comforting for her to hear during the interview that her daughter felt very close to her mother during her father’s ICU stay and that she was appreciative of her mother’s caring for the children.

Young children of patients in ICU present another challenge. Parents did not know how much information to share with their young children; they wanted to be

honest with them, but at the same time safeguard them as much as possible. Young children, for various reasons, are not usually allowed to visit patients in ICU- a stressor for both the patients and children. A participant, a father of three children who had an extended stay ICU, was allowed as a special favour two visits in ICU. The family was grateful for the opportunity but acknowledge the challenge to find the appropriate time for these visits – when will it be suitable for the ICU and the children attending school at the time. The daughter remembered that the month that her father stayed in ICU felt never ending, and they were happy when he was discharged to high care where they could visit more frequently. The experience of their father in his wheelchair going with them for tea and cake in the hospital coffee shop was an absolute highlight.

Of note was this young participant's insight in her father's ICU care. She was extremely thankful that her father had the privilege to receive ECMO as there were only two machines available in private hospitals in Gauteng. The fact that you had to enter ICU through two sets of doors and disinfect your hands before entering ICU made a big impression on her. She also fully understood the reason for the double doors and hand hygiene. Some of the adult participants mentioned that they had to clean their hands and put on masks in ICU but did not understand why they had to do this. Despite this, they simply excepted that it was the rules of ICU.

The "rules of ICU" were prominent in the pictures and discussions of participants. Participants appreciated that the ICU was different to other hospital wards and there are specific rules in the interest of the patients. It became clear that the rules were often used not in the interest of the patients and their family members. A participant spoke highly of the nursing staff, she had a very good relationship with them and tried her best to obey the ICU rules. However, there was one incident with a senior nursing staff member when she had arranged with the ICU nursing staff, as a special favour for the children and when convenient for the ICU, for them to visit their father. This nurse was not aware of the arrangement and reacted in a manner that made her feel humiliated and that she had no respect for "THE ICU".

It was especially in the public sector where the ICU rules were prominent and patient and family members just excepted the rules without understanding their value, for example the previously mentioned handwashing and the wearing of masks. The question arises if the rules are always in the interest of the patients and family members. It is known that not all nurses are in favour of an open visiting policy in ICU as there is a belief that it is not in the interest of the ICU. The public sector ICU had an open visiting policy, but none of the participants were aware of this policy. Prominent in the discussions and pictures were the challenges that family members had to visit their love ones in ICU during the normal hospital visiting hours.

Some of the participants from the public sector ICU was not only a traumatic, but also an angry experience when their family members private belongings got lost. For one participant and her family, their mothers stay in ICU was overshadowed by a negative incident in the pre-operative ward. The mother's cell phone was stolen and the family felt that not the ward staff nor ICU staff was supportive. It was determined during the interview that the respective staff members did not make the family aware of a formal hospital complaint process that the family should have followed. The cell phone was important means of communication with their mother when she was stable and recovering in ICU as it was difficult for the family to get to the hospital during hospital visiting hours. Another participant emphasised that it was very difficult for her to have a family member admitted to hospital for emergency surgery and then admitted to ICU. "You are very worried and then you must try and find his belongings, it is a very disappointing experience." She was very disillusioned that there was no system to assist them looking for her husband's belongings, she had to walk all-over the hospital, with no one taking time to assist them. She perceived the lack of assistance from the hospital staff, that "this" was an inside job. (The necessary information on how to lodge a formal complaint was provided to the participants during the interview.)

An aspect that is not always appreciated by health care workers in ICU is how important relationships at various levels becomes for both patients and family members. Their relationships can influence their well-being either positive or negative. A mother who had a nursing background worked in the hospital where

her son was admitted. She commented on the support that she received from doctors and nursing that treated her son. Her focus especially in the beginning of his ICU stay was that she was his mother not a nurse. Regardless of her nursing background and the support she received from all the hospital staff she felt very disempowered. She is a single mother with two boys and suddenly their family dynamics changed. Her son (the patient) that she relied on for support was lying in ICU fighting for his life; it made her feel very small. She was very concerned and was feeling that she was neglecting her younger son, who was being cared for by friends. The patient's father who was mostly absent when the children were growing up, visited her son in ICU and it was challenging dealing with him. She was extremely thankful for the support she received from family and friends. However, at times she felt "smothered" by the support and desperately wanted time alone.

A participant reflected that she had a lot of support from her daughters and friends, "when you are in a position like that, you realise who is your true friends and who are not. One close friend helped us with petrol, that helped a lot otherwise I could not go to the hospital that often."

Another participant was very worried about his parents while he was in ICU, as they both were ill, his mother needed surgery whilst his was in ICU. His father was at home was also sick with nobody to care for him.

It was interesting to note that the cleanness of the ICUs made a very big impression on all the participants. A participant whose family member was a patient in the public sector ICU was very surprise, "we did not think that … could be clean, we think … has improved". This cleanness of the ICUs was one of aspects that made it very difficult for both the patients and family members when patients were transferred to wards and/or rehabilitation facilities that were less clean.

"It was easier for me to be admitted from the ward to ICU than it was to be discharged from ICU to the ward", this sentiment was echoed by most participants. The participants perceived the standard of care in the wards as poor, and the health care workers as less professional and caring. Poor communication

between healthcare workers resulted in duplication of various tests such as laboratory and radiology tests.

Poor standard of care extended for some participants to their follow-up hospital visits. Three months after ICU a participant was still struggling, “I had big holes when they send me home – without medication, the first appointment with the ward doctor was a month later.” The patient could not understand why they work so hard to save his life, but then offer poor aftercare. When he attended the post-operative clinic, all the doctors were at meetings and one doctor had to attend to 70 or more patients, “they do not listen to your problems”. The doctor in the clinic just “gave tablets without explaining, we had to go to a private pharmacist that we know to explain.” Although the patient felt that he needed medical attention it was difficult to go back to the hospital, “you must play musical chairs for two days before you can speak to a doctor.”

The majority of participants experienced the health care workers working in ICU as excellent; “they went beyond the call of duty, they made me feel very humbled, some staff, they there to uplift you, they make you believe in yourself.”

I was deeply touched by the memory of a participant who was critically ill and that had a prolonged ICU stay. She developed a very special bond with one of the intensivists.

> I found it very difficult in ICU, but when Doctor… came I smiled Doctor … gave me that hope that everything will be fine, when she asks me to come and talk to other patients, I don’t complain, that is how I is with her, that women is a God send …when she comes in my room, I go, I am ok, she gave me hope. She always uses to come around eight at night, when she came, I knew I could go to sleep.

However, one participant, although she was in general very happy with the care of her son, found it very difficult when her son, who was busy recovering was infected with “superbugs”. She felt extremely angry and believed the health care workers was responsible for this setback, she saw how some of them did not adhere to the infection control standards.

It was interesting that the participants knew who the permanent nursing staff were; they there because it is their “calling” and who was the agency nursing staff; “they are there just for the money”. The agency nursing staff were also referred to as the “ones on the side”.

Participants were also exposed to hospital managers and administration staff that was at times in contrast with their experience of the ICU health care workers. A participant had a bad experience with his wife a few days before she was admitted at another private hospital. They did not receive the care his wife needed as it was perceived that they could not pay. They experienced no compassion at that hospital and they waited for hours just to be sent home. She became very ill at home, the ambulance and paramedic staff that attended to her at home was efficient and ignored the medical aid “network” and took her to her the most appropriate hospital at the time. The ICU where she was then admitted realised how sick she was, admitted her and started the appropriate treatment immediately. The hospital management then, with him and the medical aid sorted out what need to be done. “We had a picture of …, everything there is good, life is serious there, but we now have a different picture, that hospital is as good as a hospital in … they see the money, they do not care”

An outstanding feature of all the interviews was that ICU was a spiritual experience for all participants.

> It was very difficult, I could see she was very sick, coughing blood, that was why I had to pray, that was why had to pray with my pastor, God is the only one that has the key to life. She did not look like the person I knew, that make very worried and depressed. I sat in my car, I just prayed and forgot everything. Having had a family member in ICU made me respect, appreciate and enjoy life, it made me more religious.

> My stay in hospital was a period of growth. When I was in theatre lying under the big light, I felt very small and I was extremely scarred, I was not sure if I was going survive the operation. In ICU, although I had a lot of pain and I was still very worried, it was very comforting for me that my husband could sit next to my bed and hold my hand, and my family praying for me.

> I am a no-nonsense pragmatic Catholic that know bad things sometime happen, but you have to make most of it and carry on. It was very important and comforting for me to be surrounded by my religion and I had a very powerful experience when my priest prayed for me.

A participant was taken by ambulance to hospital and directly admitted to ICU. She remembered being told by the doctors that she was extremely ill. This did not concern her that much, but when her condition deteriorated during her ICU stay, she became very scared and anxious. She had a recent unpleasant divorce where she had lost everything and although she remarried before her ICU admission, she found it difficult to make sense and could not understand “why all this is happening to me”. ICU for this patient was an intense experience that remained with her long after her discharge “I will never forget ICU; it is part of my life. I was close to God; I am now back with a reason.” A special memory for her was that the ICU staff prayed for her.

Intensive care did not end for any of the participants when they, the patients were discharged from the ICU as they all took “the ICU” home with them. A participant acknowledged after the interview that up till the interview she was still “coping” and has not afforded herself much time to “feel”.

One year after her discharge from ICU, another participant still reflects back while she and her husband still discuss their experience in ICU. She remembers fondly when she went back to visit the ICU where she was first admitted (she was transferred to a second ICU for ECMO treatment), the ICU staffs disbelieve that “you are breathing, you are walking”. She noted that after her discharge from ICU, people sometimes experience her as angry and she is trying to address this “but I feel do not come to me with nonsense, you do not know what I went through.” She told me that she is now the “ECMO expert”, that she is “a miracle, and in the ECMO Top 5”. The intensivists now use her to share her experience and to explain to new patients that need ECMO and their families what to expect, “I give them hope.”

“My family and I still talk about ICU, but I do not think back of ICU in a bad way, I know that ICU saved my life.” This participant still has flashbacks of ICU,

remembering small, positive aspects that meant a great deal to him. He even admitted that he sometimes even misses ICU, as he experienced some security there. Now he is confronted to adopt to the realities of the real life as an amputee.

A participant concluded his interview that a real-life ICU experience is very different from the television shows and that there is a big need to educate the public about “real-life ICU”. This holds very true, but the different stakeholders involved in intensive care also need to be educated regarding patients and their family members experience of intensive care.

A10.2 The story of enabling intensive care delivery

The co-ordination, control audit development as well as the policy formulation and implementation are regarded collectively as the enabling functions of intensive care delivery.

The Deputy Director General acknowledged that there was no formally structured forum for ICU delivery at national level, as health care is varied, complex and extremely wide. Within the health system there are numerous subsystems and modalities of service delivery. It would be problematic if the national Department of Health (from now referred to as the Department) created a structure for each of these, because it would contribute to silos of care. There were structures that dealt with broad level modalities; they are generally related to health priorities both nationally and internationally. The way in which national and international health priorities were dealt with was with ministerial task teams. Examples of ministerial task teams were i.e. oncology, maternal health and, chronic diseases of lifestyle without any specific focus on any area of service delivery.

One of the problems the Department had in dealing with “high end service delivery” was that they did not have a structured tertiary services delivery plan. Around the period of 2006 - 2008, there was an attempt to develop a modernisation of tertiary services plan for South Africa. This plan attempted to map out what kind of tertiary service is rendered, where is it render it and to what quantum do you render the service. Three or four different scenarios were

developed, but one of the possible reasons why it was not implemented is that it was costed and found to be extremely expensive.

The initial aim of the Department was to ensure that every citizen in South Africa had excess to tertiary services and to develop tertiary services in all provinces. However, what has occurred in the last 10 to 15 years is that there have been various degrees of development, with some provinces' tertiary services being better than others.

Currently the Department have had a more global approach and attempts not to compartmentalise specific service delivery entities such as ICU. In the last three years, the Department are trying "to do an analysis what kind of specialised and highly specialised services are delivered where and to what these services are delivered, who is accessing the services and where are they coming from and to develop tertiary services in such a manner." The first thing that was done was to develop a situational analysis to develop a tertiary development plan and this was done by a tertiary service task team. At the time of the interview no specific analysis of ICU delivery had been done.

There was no standing committee for specific service delivery subsystems such as intensive care when the Department developed the policy. There was no standing committee for specific service delivery subsystems such as ICU. Standing committees only existed for service delivery specialities that represent the national health priorities such as maternal, neonatal and child care and oncology. In other specialist service delivery areas, when a policy gap was identified the approach had been that the Department engaged with experts in that field, as the Department had no specialised expertise. A focal person, such as the Deputy Director General in the Department, engaged with experts in the field, who then generated the motivation for the policy that needed to be developed. Experts would advise the focal person, but other stakeholders were not always part of the process. This focal person would then place the policy motivation on the national health agenda. Once the policy motivation and policy proposal had been developed it then went to the National Health Technical Committee, which comprised of the provincial head of departments. This committee examined the proposal and from here it was then taken to the National

Health Council, which was the policy making body in South Africa and chaired by the Minister of Health. Once the policy proposal was endorsed by the National Heath Council, it became national policy. If one was to ensure that recommendations for improvement was taken up in national policy and implemented in national policy, one had to make sure that it became formalised through this decision-making process. However, it was acknowledged that it is problematic that focal persons in the Department had tenure that resulted in turnover of staff that might have had influenced the process of policy development and endorsement.

The Department had stated explicitly that the principal health focus was primary health care. The reason for this was that if one considers public good as a priority and one only had a certain amount of money, one would have had to decide where one was going to place one's focus. Most of the money should have been spent where it was needed the most. Nevertheless, for the Deputy Director General primary health care approach was not limited to what happens in the clinics or in the homes. The primary health care approach should be applied across the whole health system including the tertiary health system. There is no way that you could deliver primary health care and ignore tertiary service, even highly specialised care, such as ICU, which would benefit only a small minority of the population. The Department's position on ICU care has changed; initially it was assumed that ICU could be delivered only at a tertiary hospital, now the Department appreciated that access to life sustaining care or ICU should be much more accessible to the wider public. The need for the country not to have a pure primary health care focus has also been accepted by the Department. Therefore, the Department has started the process of planning specialised and highly specialised tertiary services over the next 25 years.

Following the lesson learnt from the Soobramoney case where renal dialysis was withheld from the patient, the Department regarded standards, protocols and norms as essential. In the Soobramoney case, the patient took the Department to the Constitutional Court. The Department won the case since a protocol was in place regarding the criteria that qualify the patient to be entered on to the renal dialysis program. "This is in fact the role of the Department, there must be norms

and standards and there must be adherence to norms and standards. The norms and standards relate to a wide variety of issues." The Office of Standards Compliance was responsible for the technical standards that hospitals must adhere to. Unfortunately, it did not specify the detail for every speciality, for example for ICU they will only specify the minimum requirements for the resuscitation trolley. There was a need to develop a standard for essential equipment, technology and infrastructure which was required for each speciality. A further need was the development of essential standards for the qualifications and competency requirements of personnel working in ICU. "The Department is presently placing more emphasis on competency, what are people able to do, not what degrees you have." Thus, the Department was developing sets of competencies for various functionaries whether they are clinical, technical or managerial. Training courses were also being developed to ensure that these competencies were developed. Regarding the development of standards and norms the Department had a role of facilitation and therefore, the Department was dependent on the input of experts from the different specialities.

At the time of the interview, the Department was not engaging with private ICU service delivery. The Deputy Director General was of the opinion that the implementation of the NHI concerns itself with the improving of the health system to ensure access to everybody in the country to quality health care.

It is questionable if the Department shared an identity with other stakeholders from the participants' perspective. The medical industry perceived the Department and other authorities as "the kings" that have a "huge negative effect on ICU delivery, they actually choke ICU delivery". The kings were regarded as having a "huge negative impact on ICU delivery and that they actually 'choke' ICU delivery". There were unilateral relationships with subsequent one anyway communication between kings and the ICU staff. The kings also had no or limited clinical insight. A major concern for the participants was the corruption that prevailed amongst the kings which resulted in limited choice and availability of medication and equipment in ICU. Participants from the private hospital groups felt that the Department had very limited input in the regulation of intensive care in the private sector and that it was probably the funders that regulate private

intensive care. The participant from the trade union concluded at the end of the workshop that:

> The Government is the cause of the viscous circle, disenabling health-care workers by making reckless statements about health-care delivery but then they do not create a working environment that can deliver on the promises made by them. Especially in election time health care becomes a 'campaigning tool', the health care sector is used for political gain – politicians do not understand what is needed to deliver such a service.

Health care delivery in South Africa is a concurrent process involving the Department and the provincial Departments of Health – the Department was responsible for policy development and the provincial health departments were responsible for health service delivery. Levels of care (Level 1 – primary care and district hospitals, Level 2 – regional hospitals, Level 3 – tertiary hospitals and Level 4 – quaternary hospitals) and which hospitals were build were determined by the provincial health departments in concurrence with the Department who provided the majority of the budget for these hospitals.

In the public sector the national Health Department MEC and the provincial health departments were accountable for the quality of health care service delivered in the province. Accountability was a delegated function: from the MEC to the Head of the Provincial Department of Health to the CEO of a hospital. However, if something went wrong the Chief Executive Officer was not the person who was going to be sued but the MEC and the Minister of Health. The number of ICU beds in a hospital, how the ICU beds are resourced, the admission criteria to the ICU and referral criteria from or to other hospitals etc. were the responsibility of provincial health departments.

There was a relationship, although limited, between the provincial Departments of Health and ICUs and the relationship were regarded as autocratic by some stakeholders. It was perceived by the participants from regional ICUs that the provincial Department knows that there are problems, but not much has been done by the departments to address these problems. No formal audits of intensive care delivery were undertaken by the provincial Departments of Health.

The public tender system is a function of provincial Departments of Health and the private sector formularies were discussed extensively by participants from the medical industry. There was an understanding that there was a need for the tender system and formularies. Yet they contributed to anti-competitive behaviour, “they are just about money, there is no understanding of the science”. Again, the participants emphasised the unilateral relationship that existed between the tender system and the ICUs; there were no allowance or limited feedback from ICUs that actually used the products. There was often no clinician on the tender board, only a pharmacist with no clinical understanding. If doctors served on these boards they might not have had the necessary ICU expertise, for example a gynaecologist with no ICU background making recommendations on ICU products. If doctors did give appropriate input, their input were often ignored – but their names were used in documentation. The participants felt that the medical industry had limited input in the tender and formulary processes and that they often have valuable information to add.

The national Department of Health had very limited influence over the private sector intensive care deliveries. Similarly, to the public sector there existed an autocratic relationship between private hospital group management and the ICUs. Private hospital groups management were perceived by the participants as cost driven and not patient outcome driven, “they just see dollar signs”. The participants felt that the private hospital groups just told them what to do and that there was very little feedback from the ICU staff to the hospital groups, “you just work with what you are given”.

There was no formal development system in both the public and private sector S4 system and informally it was assumed that the CCSSA fulfil some of the development functions associated with S4. There was no formal relationship between the CCSSA and the Department, provincial Department private hospital group management and the community. Members of CCSSA, especially council members that were regarded as opinion leaders, were consulted on an ad hoc basis. The CCSSA did monitor future trends in intensive care delivery. There were no formal facilities to alert the Department of urgent developments in intensive care delivery. No management centre was provided by the CCSSA to

combine external, internal information and that served as an environment of decision-making. The main sphere of influence was the practical delivery of intensive care in the ICUs. However, in none of the workshops did participants acknowledged the authority of the CCSSA.

A10.3 The story of intensive care delivery

Intensive care was described as a trajectory that both started and ended in the community. Social determinants of health place a huge burden on demand for intensive care services, for example lack of housing, water, electricity as well as the communities' education level, culture and expectations of health care. The burden on intensive care services is further increased by the lack of, or not optimally functioning, primary and regional health care resources, slow admission to the emergency department and or hospital. When the patients are discharge to the hospital wards and eventually home, they take with them the long-term consequences of their critical illness and may require rehabilitation and social support.

It is difficult to discuss delivery of intensive care as ICUs differ according to whether the ICU are in the public or private sector, whether it is an open or a closed ICU and if the ICU is further influenced by the hospital within which it functions.

The participants who worked in both the open and closed ICU systems regarded the two systems as totally different. The open ICUs were regarded by participants as "moneybags" and there was a perception that closed ICUs delivered care better than open ICUs. However, both ICU systems, due to lack of outcome data, are reimbursed in the same manner.

The perception of ICU as moneybags were further explained by the fact that in the private sector there was no control over the number of new ICU beds that were commissioned. The example that was given was that there were currently only two paediatric intensivists practicing in Johannesburg but new ICUs with numerous paediatric ICU beds were built "everywhere". The patients that were admitted to these ICU beds were treated by general paediatricians with no or

limited ICU experience and “then they send you the patients 14 days down the line when the patients are half dead”. In contrast to this statement, it was repeatedly emphasised that there was a shortage of ICU beds.

The participants also perceived private ICUs as “a money spinner – for the hospitals, pharmacies, drug companies.” (Notably the doctor working in ICU was not mentioned.) The question was raised “do patients get the care that they deserve, what they need? The sickest patient is often cared for by the most inexperienced nurse, funders are paying for an ICU bed and they are not getting an ICU bed; again, this shows the different priorities.” Participants also had a sense that there is abuse of the system all around: funders abuse doctors, hospitals abuse funders and so forth.

It was also perceived that an unfair situation prevails between public and private ICUs due to the uneven distribution of resources. The private intensive care system is often abused, all patients are allowed in ICU, no matter how ill or well they are and money is the incentive. In private sector ICUs, for example Chris Hani Baragwanath Academic Hospital ICU, “the barriers go up, there are many patients that need a bed- but there is only room for one- and then it is not always the appropriate patient that gets admitted.” Intensive care delivery is further complicated by the continuum of diverse patients admitted to ICU that varies from very sick patients with a poor prognosis to patients that are not sick enough to be in ICU but are admitted to ICU due to poor ward nursing care.

Poor education at primary, secondary and tertiary level influenced the calibre of staff working in intensive care. A concern was raised that the pool of academics in intensive care was shrinking which has a ripple effect to both the public and the private sector ICUs. The result of the shrinking pool of academics and time constraints when working ICU was that much needed intensive care research was not done.

The lack of organisation in the public sector resulted not only in low productivity but also in a brain drain from public sector. This had dire consequences on the delivery of intensive care, as this was where doctors are trained as intensivists and a significant portion of nurses received their postgraduate nursing training.

Designated service provider rules were difficult to apply in private ICUs; the majority of the hospitals that one is allowed to choose from do not have the speciality care that patients need.

In the ICU, a participant concluded that health care workers felt helpless and not supported by hospital management or government and that a “no positive practice environment” prevailed. The “no positive practice environment” is further enhanced because there are no or not enough “tools of trade”, for example protective clothing and no medication which then leads to health care workers starting to improvise. Improvising, although it may lead to creative health care delivery, mostly influences the quality of health care delivered negatively.

The ICU was perceived as a hostile environment by most participants. “It is not the ideal world, sometimes there is an arrest, patients are admitted etc., it is difficult to do things as it should be done.” An example used to explain this perception was that families often complained about less important things, such as the patients’ bedlinen. When the ICU staff attempted to try and sort out the bedlinen, more important tasks were neglected, for example the patient did not receive medication on time. The design of ICUs was often poor, with crowded spaces and not enough beds. Poor unit design contributed to substandard infection control and consequences thereof.

The participants observed that not a lot of time was spent on reflection in ICU. Firstly, there was no reflection on outcomes and how quality of care can be improved, which was interesting as the private hospital groups all had quality control programmes. Further, one nurse manager mentioned that:

> the turnover is so high in ICU, a patient that died is hardly removed from his bed then the next patient is already there, ready to be admitted. There is no time to take a few moments to reflect what just happened. A factor that may contribute to burnout amongst ICU staff.

Intensive care delivery was hamstrung by equipment that was either inadequate, broken or just not available- a problem that seemed to be common in both public and private sector ICUs. Pharmacy stores were regarded as empty as there were not enough or not appropriate medication available. This scenario is generally

thought to be true for public sector ICUs but “contrary to popular believe, drug shortage and failure of equipment is well and alive in private ICUs”. However, some private ICUs were spoiled for medication choice, presenting problems of its own – “it causes chaos”. In the private sector ICUs availability of appropriate technology is often a problem, for example it was difficult to get a sonar examination done as it was not a money producing procedure.

Individual hospital stores were also identified as culprits in constraining intensive care delivery. When the stores received appropriate stock, often no stock was available due to mismanagement and lack of product knowledge – they sometimes did not even know that they had a product in stock.

There was a perception that doctors and nurses who are the primary caregivers were often excluded from communication between funders, hospital groups and hospital management and the tender process in the public sector. Doctors were excluded from communication between funders and pharmaceutical companies. The implication was that, for example, medication X was manufactured by three different companies. Company B offered the hospital group the most cost-effective package, but from a clinical perspective, research has shown that company B’s medication X was less effective for use in ICU patients than the other two companies medication X, thus making it a more expensive option. The same argument applied to generic medication, not all generic medication is on par with the original medication and clinical expertise in making appropriate choices is vital.

Another example that was given was the negotiation with medical equipment companies without including the primary caregivers. A ventilator is not a ventilator – certain technical capabilities make them more appropriate for certain patient populations and follow-up service from the manufacturer is extremely important to mention only two of the variables that would influence a clinician choice of ventilator. The most expensive or the cheapest ventilator is not always the most appropriate choice. A third example highlighted that the level of payment that different ICU patients were required to pay was established between hospital groups and funders and the doctors and patients were excluded from this decision-making process.

Technical support for the maintenance and repair of ICU equipment varied. Nevertheless, in the opinion of the participants, there was not enough money for the correct maintenance of ICU equipment in the public sector ICUs as a significant share of the provincial health budget was spend towards legal claims.

Private hospital groups and private hospital management were cost driven and not outcome driven, “they just see dollar signs, hospital groups just tell you what to do, and there is very little feedback from the ICU staff to the hospital groups; you just work with what you are given”.

Radiology departments were viewed by the participants as having very important input into ICU procedures, but these departments also contributed to adverse events such as pulling out of intravenous catheters and endotracheal tubes and radiographers not adhering to good infection control practices. Radiology departments can further be problematic as they were sometime located too far away from ICU and were also not equipped to deal with ICU patients, especially when things went wrong and posed an infection control nightmare.

There was a need for extensive research and audits in ICU since there was a shortage of intensive care delivery information or, as was commonly referred to, data at various levels. Outcome is influenced by everything that happens in ICU – it required an evaluation of information such as acuity scores, ICU and in-hospital mortality rates, length of ICU stay, clinical governance and long-term follow-up. “We think we do a fantastic job, but there is no, or very limited short and long term follow up in ICU”. Data should also be analysed to determine the outcome of patients treated by intensivist’s versus “other doctors”. It was not known whose responsibility it was to collect and collate the data. The following questions were posed:

- is it the responsibility of the individual doctor to look after the data of his patients?
- should the individual doctor bear the cost of collecting data?
- are doctors prepared to take an hour or two of their day to engage with data?

- if the doctor has data who does the doctor share it with as there are very few people who are interested?

The participants acknowledged the need for acuity scoring of intensive care patients. However, there were generally not a good understanding of acuity scoring while the scores that were used were not always appropriate for intensive care and were not always done by people with insight. Also, acuity scoring could not be used on a day to day basis or even on a shift to shift basis in ICU to determine nurse: patient ratios. ICU was just too unpredictable, the one minute it was empty and the next it was full of highly unstable patients. It was not feasible before a shift to run around finding staff, inevitably this was done by the senior staff who were best qualified to care for patients. Sending staff home to be on standby when the ICU was quiet was also not ideal. Often staff was not contactable when needed to return to ICU and again time, that could have been spend next to the patient's bed, was wasted next to the telephone. The participants were also of the opinion that it is important for nursing staff to have time away from the ICU and being on standby does not offer this opportunity. The participants further emphasised that although acuity scores do recommend nurse patient ratios, the competency level of nurses must also be considered.

There was a perception that the available data at the different levels are "dodgy". For example, the funders base their data on ICD coding and that is not always correct. Hospital and ICU data are also questionable as it is not always known who collects the data and the credibility of the data collector is questioned. The question how the ICU could influence the stakeholders to collect appropriate data was posed.

It was highlighted that doctors were not accountable and therefore they did not have personal patient databases, but they did have a lot of billing data. The participants felt that funders will be the role player that would benefit the most from more comprehensive ICU data, however it would probably be the hospitals that would have to pay for it.

It was noted by the participants that many of the hospital groups had a huge amount of data that they did not share. According to participants, the reasons

why they did not share the data was that they were possibly concerned about the integrity of the data, the legality and because their data and the funders' data might be different.

The funders' main focus with ICU data was to measure the cost of health care. But unfortunately, they did not always compare apples with apples. For example, with the paediatric governance programme, intensivist paediatricians were compared to general paediatricians.

Mortality and morbidity meetings in ICU were regarded as important, but they do not always happen and if they do, they are not run ethically. Nurse participants expressed a need for these meetings, "from the nurses' point of view they see patients dying around them and they do not always know, should they have died or not, there are no outcome measures".

It was further mentioned that South Africa was lacking behind with electronic record keeping but that electronic record keeping was "very expensive, the available systems are not always good, are designed by people with no medical insight and if they appropriately designed, the systems are not user friendly."

The "route into" ICU was perceived as very difficult for patients, "there are many patients standing outside the door begging to come in." However, in private ICUs it was not unusual to find inappropriate patients in ICU, "patients managing their stocks, watching television, drinking their glass of wine". In both the public and private sector, patients in ICU "can also be too sick to be in ICU". Conversely, the "route out" was also problematic: patients were often discharged prematurely due to a high demand for beds or their discharge was delayed due to low standard of care in the ward.

Health care workers depicted ICU patients as unhappy, with no names, having diverse diagnosis and a lot of things being done to them. The patients' family were drawn away from the patient in the corner, having a limited relationship with the patient and a broken relationship with the ICU staff.

Participants admitted that the cultural backgrounds of patients and families were not always acknowledged in ICU, for example there are different interpretations

of privacy. ICU visiting hours were often restrictive and not scheduled to accommodate the patient and their families. Very few ICU's, this is especially important for neonatal and paediatric patients, offered accommodation for close family. Patient confidentiality was not always respected and maintained in ICU. It was perceived by participants that patients' advocacy in ICU were not what it should be.

Participants highlighted that the families' expectations of ICU were not known. However, some participants in private ICUs felt that patients and their families have very high expectations regarding, for example, the cleanliness of the hospital, waiting times, friendliness, availability of medicines etc. and all of that contribute to high costs. Some patients' sentiments that were expressed by participants were:

> I paid for these benefits and I want everything available to make sure that I get the right outcome.

> I pay baie [many] thousands of Rands to be lying in this bed. I didn't see a cent of that and not that's not why I am here.

The prevailing sub optimal infection control in ICU had a huge impact outcome of individual ICU patients and placed enormous pressure on the already strained intensive care resources. It was emphasised that it was not always appreciated that infection control started before ICU and that poor practices elsewhere in the hospital also impacted on ICU delivery.

According to the participants, evidence-based practice was not always practised in ICU as ICU staff were not always aware of current best practice. Evidence based practice in itself also posed a problem due to "swings" in evidence, "what is in today is out tomorrow", and the level of evidence was not always convincing enough to change practice.

Hospital management was not perceived in a positive light by participants working in ICU. Hospital managers are often a non-medical person. Especially in the private sector, hospital managers were not patient focussed but rather "money" focussed. Hospital management communication, in both the public and private

sectors, was limited and usually top down. Corruption at management level also posed a big concern for participants.

ICU costs were a predominant focus of the rich pictures of the hospital management. A statement was made that “the cost of everything is a lot more than you think…one thin pre-printed ICU chart cost a R100”. This resulted in pressure to do more with less – less staff, less equipment. It was emphasised that quality care is expensive, for example the high cost associated with record keeping.

The hospital management participants highlighted that the private sector could regulate all of their employees, except the doctors who they did not have the authority to regulate. The doctors were perceived to pressurise hospital management for new technology, for example robotic surgery. However, it was interesting to note that during both formal and informal lunch discussions of the hospital managers, technology, especially robotic surgery, was the focus of discussion. It seemed that the cutting-edge technology was as important, if not more, for the hospital management as it was for the doctors.

The medical industry was of the opinion that it is sometimes difficult to get access to doctors, especially the more senior doctors and some ICUs. The participants did acknowledge that there were opportunities for the medical industry to interact with doctors and other health care workers at congresses and continuous professional development workshops. On the other hand, there was a high expectation from ICU staff for various sponsorships, for example sponsorship for congress attendance.

The participants’ perception was that there is a big need for training regarding medical equipment and products in ICU and that the medical industry had a role to play. However, the contribution of the industry training programmes towards the improvement of quality care in ICU was questioned. Concerning was that staff often attend these training sessions, but equipment and products were still incorrectly or inappropriately used.

The participants acknowledged that there was a relationship between the medical industry and the CCSSA. The CCSSA did thank the medical industry for their contribution to ICU delivery in South Africa on a wide variety of platforms. However, it was felt that a different acknowledgement was lacking, one where the medical industry could have a collective voice and where the medical industry has representation on the Critical Care Society of Southern Africa Council for communication purposes and, not to influence the council. This collective voice could help to address hurdles such as costs, compliance, sponsorship and industry representation. One example to illustrate the value of a collective medical industry voice was during the organising of the annual ICU congress. When the annual ICU congress was organised, the medical industry was often just informed via the professional congress organiser what was expected of them. The medical industry's financial contribution to the annual ICU congress was enormous, without their financial contribution congresses of current calibre will not be possible. Therefore, to have a collective voice representing the medical industry on the congress organising committee would go a long way.

The relationship between the Treasury, national and provincial Departments of Health were seen as broken and that corruption prevails in these departments. The Health Provisional Council of South Africa was perceived as non-functional.

The participants regarded professional bodies as dysfunctional, that they have no impact, have their own agenda and move in their own direction. It seems for the participants that there are very little or no feedback from members back to the bodies and that the bodies are not really interested in their members' feedback.

Regarding regulating standards in ICU, the participants were of the opinion that professional medical societies have no teeth in contrast with some international societies that set standards for practice. The professional societies were referred to accept generically the SANC which was regarded as being dead.

The South African Health Product Regulatory Authority (previously known as the South African Medical Control Council) was regarded as insufficient and the

extensive time delays in reviewing and approving applications poses a major problem for health delivery including ICU delivery.

The ICU personnel felt that they were under constant media scrutiny resulting in the media and health care workers working against each other. This scrutiny of the media took place in a community where the members knew their rights, but they did not know their responsibilities. “We acknowledge that we lack expertise, but we try the very best we can, yes corners are cut when we creatively try and do our job in an imperfect system.” For the participants, the media report failures in the system but they are also looking for individuals to blame.

For the participant, the relationships in health care can be depicted as a pyramid illustrating the “social distance” that exist between stakeholders. Nurses are at the bottom of the pyramid with the least status, regardless of the fact they are the ones that spend the most time with patients. The doctors and allied health care workers make up the layer above the nurses followed by a layer consisting of the community while the tip of the pyramid consists of the hospital management. Above the pyramid hovers the government.

The community was further empowered by statements made by the government – “reckless statements made by politicians about health workers and health care in general”. The community feels protected by government, and they no longer respected health care workers. Health care workers experience that they have less status in the community, that they are no longer part of the community. For example, “a few years ago, when 200 babies died in one hospital, the community was very cross with the health care workers, not the government or hospital management, regardless that the inquest showed that there were not enough incubators, soap etc., - no tools of the trade to do the job.” It was emphasised by a participant that: “Government, politicians and hospital management need health care workers, they cannot deliver health care without them, they cannot deliver health care themselves”

It was felt that there was no support for nurses, “nurses always regarded as being wrong, however, there are always two even three sides to a story.” Hospital boards and management are politicians on the side of the community, but they

are the ones that “add extra beds, but there is no increase in staff, nurses are seen as objects.” It was noted that it was well known that enrolled nurses were given crash courses and were expected to practice beyond their scope of practice

ICU delivery in the private sector were even more compromised by the fact that the focus in the private sector was “on cheap labour to save money whilst charging exorbitant fees for nothing, they employ less RN’s [registered nurses] and enrolled nurses and rather care workers with no formal nursing education.”

The Health Professionals Council of South Africa was perceived to also entertain ICU patient and their family claims, often these claims were not justified.

Regional ICUs in the public sector varied from new modern to debilitated structures. One of the participants worked in beautiful newly built 16 bed ICU, that was not utilised to its full potential due to nurse shortages. There was a need for a 16 bed ICU in the community as the hospital was the referral centre for a large number of district hospitals. The ICU served a community where there was a high incidence of trauma, malnutrition and HIV/AIDS. Poor primary health care delivery in the community resulted in the high incidence of co-morbidities such as diabetes and hypertension. It was not known who designed the ICU, as the person(s) had no understanding of the functioning of an ICU, as there was no provision made for any storage facilities.

Regionals ICUs were open units where the primary doctor (mostly with very limited ICU experience and no formal ICU training) admit and treat patients in ICU. There may be a doctor (also with limited ICU experience and no formal ICU training) from another department such as anaesthesiology working in the ICU during office hours. After hours, the primary doctor is again responsible for the patients. This results not only in patients not always receiving appropriate care but also fragmented care. There are very limited, if any, expert medical support available for doctors working in regional ICUs. In this particular ICU, there was no formal outreach program from a tertiary ICU.

The number of doctors allocated to work in this ICU fluctuated and depended on the availability of staff from the anaesthesiology department. It was usually junior

doctors, such as interns and medical officers that were allocated to work in ICU and in exceptional circumstances, registrars and consultants. There was therefore no “go to person” for these junior doctors working in regional ICUs.

The doctors working in regional ICUs are often confronted with ethical dilemmas and frequently feel helpless. The participants felt that there is not enough ICU teaching and training of lower level doctors and nurses in South Africa. Junior staff do not get early exposure to ICU, “your first exposure to ICU is when you specialise in a specific field like anaesthesiology or internal medicine, the other medical specialities have minimum exposure to ICU.” No one person was responsible for ICU delivery in a regional ICU. Attending the annual national ICU congress was experienced by the participants as overwhelming. “There is a lot of new information to digest, we realise that we still have to learn a lot, but we also had confirmation that there are some things that we do correctly.”

Number of functioning beds were determined by the available nursing staff. There was a high demand for ICU beds internally and from referring hospitals. “It is difficult to refuse a patient that is referred to a regional ICU, however it is impossible to refer a patient from a regional ICU to a higher-level ICU for appropriate care, as seen with example quadriplegic patients.” When ICU patients were ready for discharge, there were no resources to send them back to their referral hospital in their own community.

The hospital did not have all the necessary facilities such as cardiac catheterisation laboratory, and these patients are referred to Port Elizabeth which is 288 kilometres away. However, before patients could be transferred, they need to be stabilised, not be ventilated and on no inotropic support. Patients were transferred in non-ICU ambulances and the availability of ambulances were also not guaranteed. As mentioned before, there were no means to refer the more severely ill patients even though there were no doctors with appropriate ICU expertise to care for them. On rare occasions one of the senior doctors, due to personal contacts, have managed to transfer severely ill patients to Cape Town with a Red Cross helicopter ambulance.

Patients in this regional ICU received intermittent renal dialysis and not continues renal dialysis that is more accepted practice in ICU as it is associated with less complications. This ICU did have a continuous renal dialysis machine, the problem was that this machine was not the machine that was demonstrated to the ICU personnel. None of the ICU staff know how to use this machine. The doctors were not consulted in the procurement process, the machine was procured from a company outside the tender process that offered no after sale service. When a very unstable patient requires continuous renal dialysis, the hospital pay a doctor from the private sector to bring a dialysis machine and to continuous dialyse the patient.

This regional ICU owned a cooling machine that was purchased for half a million rand; nobody knows why the machine was bought. It is not known who motivated for or approved the procurement of the machine. To make matters worse, everybody in ICU and the hospital knew about the machine, but nobody actually knew where it was.

Some equipment in regional ICUs, such as the computer screens next to each patient's bed, is more advanced than the equipment in academic ICUs in tertiary hospitals. None of the screens next to the patients' bedside in this regional was used, only the main computer screen at the nurses' station. "There are all these nice gadgets, but we need 'bodies' next to the ICU beds. There is nobody to assist smaller ICUs to determine essential appropriate equipment and to assist with procurement."

A high standard of infection control is essential in all ICUs to ensure that patients are not compromised. According to the participants, there was a poor standard of infection control due to lack of infection control expertise and a shortage of essential infection control equipment such as disposables and soap.

Laboratory services to the ICU varied. Microbiology laboratory results were delayed and this resulted in patients receiving inappropriate antibiotic treatment as treatment was not adjusted aptly to the patients' needs.

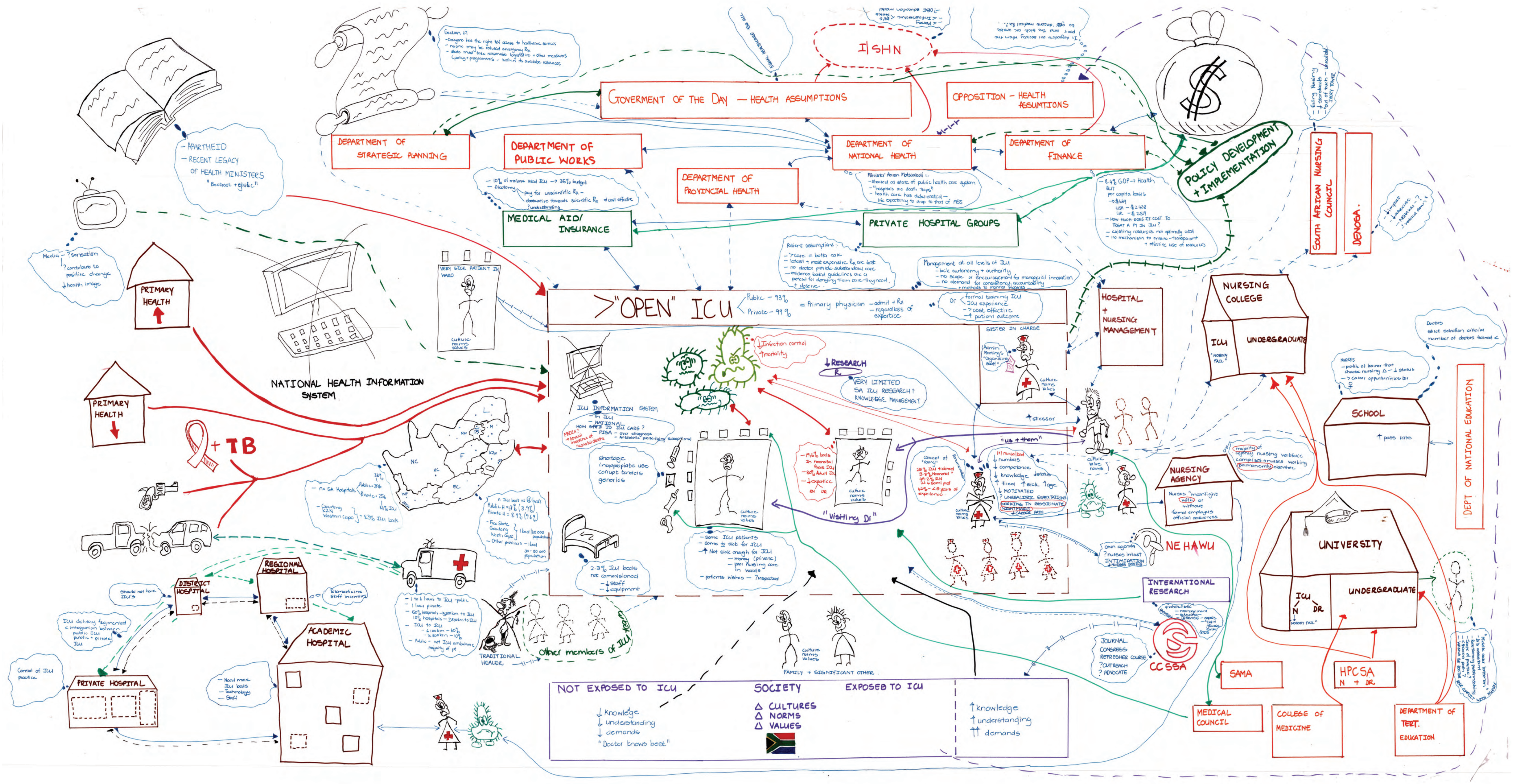
Appendix 11: Groot gemors

The rich picture on the page hereafter is titled “Die Groot Gemors” (“The Big Mess”) and has been reduced to A3 size for inclusion here.

A full-sized version (72.7MB) can be downloaded in pdf format for the time being from the following URL:

https://www.dropbox.com/s/7xayxwnl9uyncn9/Die_Groot_Gemors_2.pdf?dl=0

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GOVERMENT OF THE DAY — HEALTH ASSUMPTIONS
OPPOSITION - HEALTH ASSUMTIONS
NHI
DEPARTMENT OF STRATEGIC PLANNING
DEPARTMENT OF PUBLIC WORKS
DEPARTMENT OF NATIONAL HEALTH
DEPARTMENT OF FINANCE
DEPARTMENT OF PROVINCIAL HEALTH
POLICY DEVELOPMENT + IMPLEMENTATION
MEDICAL AID/ INSURANCE
PRIVATE HOSPITAL GROUPS
- APARTHEID
- RECENT LEGACY
OF HEALTH MINISTERS
PRIMARY HEALTH
NATIONAL HEALTH INFORMATION SYSTEM
+ TB
"OPEN" ICU
Public - 93%
Private - 99%
= Primary physician - admit + Rx - regardless of expertise
HOSPITAL + NURSING MANAGEMENT
NURSING COLLEGE
ICU
UNDERGRADUATE
SOUTH AFRICAN NURSING COUNCIL
DENOSA
SCHOOL
DEPT OF NATIONAL EDUCATION
NURSING AGENCY
UNIVERSITY
NEHAWU
INTERNATIONAL RESEARCH
CCSSA
SAMA
HPCSA
N + DR
MEDICAL COUNCIL
COLLEGE OF MEDICINE
DEPARTMENT OF TERT. EDUCATION
ICU INFORMATION SYSTEM
↓ RESEARCH
VERY LIMITED SA ICU RESEARCH + KNOWLEDGE MANAGEMENT
"VISITING Dr"
"us + them"
SISTER IN CHARGE
REGIONAL HOSPITAL
DISTRICT HOSPITAL
ACADEMIC HOSPITAL
PRIVATE HOSPITAL
TRADITIONAL HEALER
Other members of ICU team
FAMILY + SIGNIFICANT OTHER
NOT EXPOSED TO ICU
↓ Knowledge
↓ understanding
↓ demands
"Doctor knows best"
SOCIETY
Δ CULTURES
Δ NORMS
Δ VALUES
EXPOSED TO ICU
↑ knowledge
↑ understanding
↑↑ demands
JOURNAL
CONGRESS
REFRESHER COURSE
? OUTREACH
? ADVOCATE

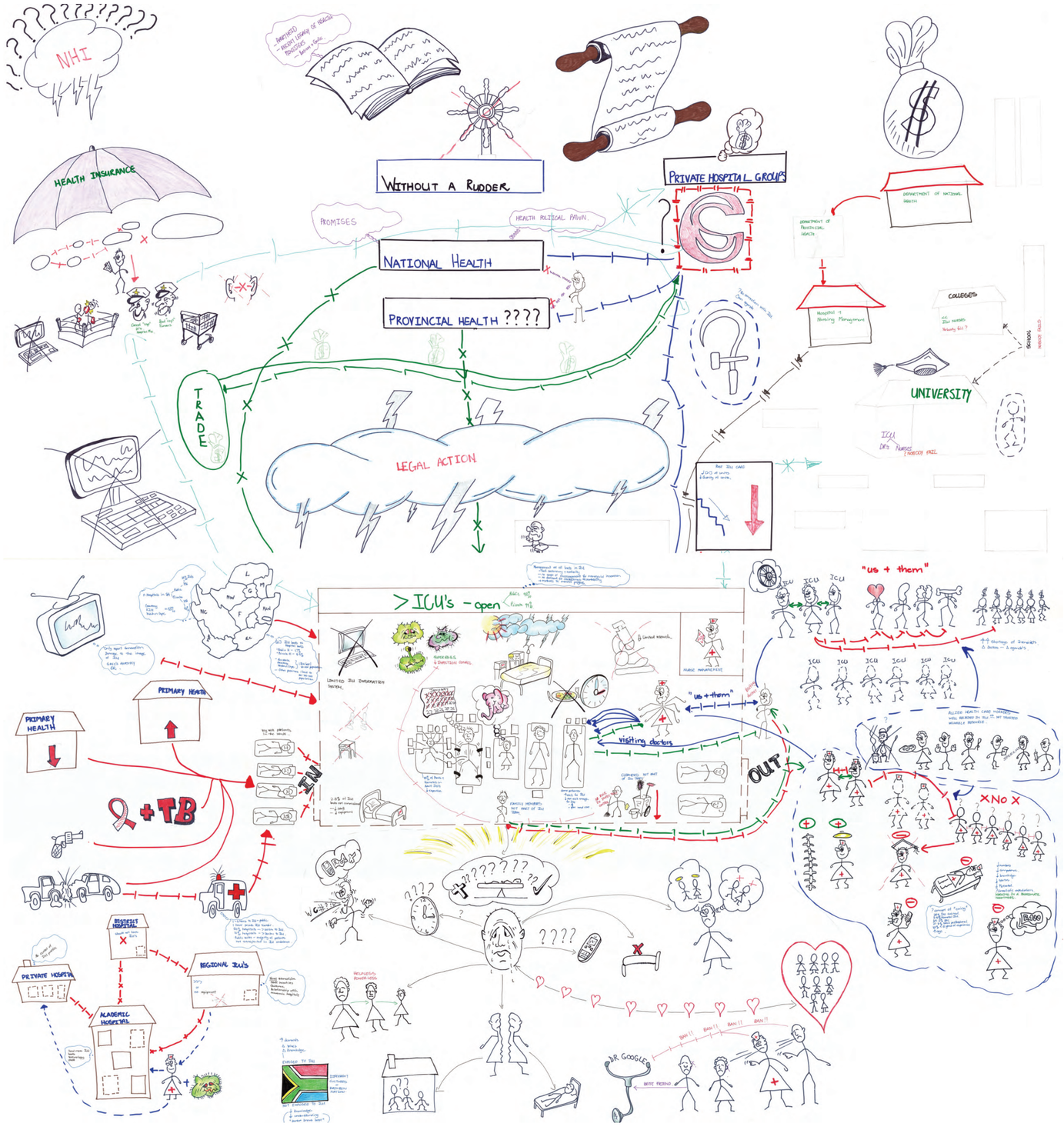
Appendix 12: Without a rudder

The rich picture on the page hereafter is titled “Without a Rudder” and has been reduced to A3 size for inclusion here.

A full-sized version (167.2MBMB) can be downloaded in pdf format for the time being from the following URL:

https://www.dropbox.com/s/j3e6z8deoaw1njn/Without_a_Rudder.pdf?dl=0

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WITHOUT A RUDDER
PROMISES
HEALTH POLITICAL PAWN.
NATIONAL HEALTH
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DEPARTMENT OF PROVINCIAL HEALTH
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COLLEGES
UNIVERSITY
TRADE
LEGAL ACTION
> ICU's - open
"us + them"
visiting doctors
IN
OUT
PRIMARY HEALTH
+TB
DISTRICT HOSPITAL
REGIONAL ICU's
PRIVATE HOSPITAL
ACADEMIC HOSPITAL
No X
DR. GOOGLE
BEST FRIEND
BAN !!

References

Ackoff, R. L. (1974). *Redesigning the future: A systems approach to societal problems*. New York, NY: Wiley.

Ackoff, R. L. (1981a). The art and science of mess management. *INTERFACES, 11*(1), 20 - 26. doi:10.1287/inte.11.1.20

Ackoff, R. L. (1981b). *Creating the corporate future: Plan or be planned for*. New York, NY: Wiley.

Ackoff, R. L. (2001). A brief guide to interactive planning and idealized design. Retrieved from http://www.ida.liu.se/~steho/und/htdd01/AckoffGuidetoIdealizedRedesign.pdf, Date accessed: 18 June 2016

Adam, T. (2014). Advancing the application of systems thinking in health. *Health Research Policy and Systems, 12*(50), 1 - 5. doi:10.1186/1478-4505-12-50

Adhikari, N. K. J., Fowler, R. A., Bhagwanjee, S., & Rubenfeld, G. D. (2010). Critical care and the global burden of critical illness in adults. *Lancet, 375*, 1339 - 1346. doi:10.1016/S0140-6736(10)60446-1

Adhikari, N. K. J., & Rubenfeld, G. D. (2011). Worldwide demand for critical care. *Current Opinion in Critical Care, 17*, 620 - 625. doi:10.1097/MCC.0b013e32834cd39c

Adler, D. C., & Shoemaker, N. J. (1979). *AACN organization and management of critical care facilties*. St. Louis, MO: Mosby.

Albanese, M., Mejicano, G., Xakellis, G., & Kokotailo, P. (2009a). Physician practice change I: A critical review and description of an integrated system model. *Academic Medicine, 84*(8), 1043 - 1055. doi:10.1097/ACM.0b013e3181ad1d45

Albanese, M., Mejicano, G., Xakellis, G., & Kokotailo, P. (2009b). Physician practice change II: Implications of the integrated system model (ISM) for the future of continuing medical education. *Academic Medicine, 84*(8), 1056 - 1065. doi:10.1097/ACM.0b013e3181ade83c

Amalberti, R., Auroy, Y., Berwick, D., & Barach, P. (2005). Five system barriers to achieving ultrasafe health care. *Annuals of Internal Medicine, 142*(9), 756 - 764. doi:10.7326/0003-4819-142-9-200505030-00012

Amaravadi, R. K., Dimick, J. B., Pronovost, P. J., & Lipsett, P. A. (2000). ICU nurse-to-patient ratio is associated with complications and resource use after esophagectomy. *Intensive Care Medicine, 26*(12), 1857 - 1862. doi:10.1007/s001340000720

Angus, D. C., & Black, N. (2004). Improving care of the critically ill: Institutional and health-care system approaches. *Lancet, 363*, 1314 - 1320. doi:10.1016/S0140-6736(04)16007-8

Angus, D. C., Shorr, A. F., White, A., Dremsizov, T. T., Schmitz, R. J., & Kelley, M. A. (2006). Critical care delivery in the United States: Distribution of services and compliance with Leapfrog recommendations. *Critical Care Medicine, 34*(4), 1016 - 1024. doi:10.1097/01.CCM.0000206105.05626.15

Aronson, D. (2006). Overview of Systems Thinking. Retrieved from http://www.jantzmorgan.com/pdfs/SystemsThinking.pdf, Date accessed: 21 June 2009

Ashby, W. R. (1956). *Introduction to cybernetics*. London, United Kingdom: Chapman-Hall.

Ashton, D. (Ed.) (1983). *Commemorative book: Official opening - Johannesburg Hospital*. Johannesburg, South Africa: Dee Aye Promotions.

Azoulay, E., Pochard, F., Kentish-Barnes, N., Chevret, S., Aboab, J., Adrie, C., . . . Schlemmer, B. (2005). Risk of post-traumatic stress symptoms in family members of intensive care unit patients. *American Journal of Respiratory and Critical Care Medicine, 171*, 987 - 994. doi:10.1164/rccm.200409-12950C

Bagby, J. W. (1957). A cross-cultural study of perceptual predominance in binocular rivalry. *Journal of Abnormal and Social Psychology, 54*, 331 - 334. doi:10.1037/h0046310

Banville, C., Landry, M., Martel, J., & Boulaire, C. (1998). A stakeholder approach to MCDA. *Systems Research and Behavioral Science, 15*(1), 15 - 32. doi:10.1002/(SICI)1099-1743(199801/02)15:1<15::AID-SRES179>3.0.CO;2-B

Bar-Yam, Y. (2005). *Making things work: Solving complex problems in a complex world*. Cambridge, MA: NECSI Knowledge Press.

Barros, R., Midgley, G., & Pinzóen, L. (2011). *A systemic intervention approach to research on computer-supported collaborative learning.* Paper presented at the 55th annual meeting of ISSS, Hull, United Kingdom.

Bate, P., & Robert, G. (2002). Studying health care "quality" qualitatively: The dilemmas and tensions between different forms of evaluation research within the UK National Health Service. *Qualitative Health Research, 12*(7), 966 - 981. doi:10.1177/104973202129120386

Bateson, G. (1970). Form, substance and difference. In G. Bateson (Ed.), *Steps to an ecology of mind* (pp. 455 - 471). London, United Kingdom: Intertext Books.

Bateson, G. (1972). *Steps to an ecology of the mind*. Chicago, IL: University of Chicago Press.

Beer, S. (1967). *Decision and control*. Chichester, United Kingdom: Wiley.

Beer, S. (1972). *Brain of the firm*. Chichester, United Kingdom: Wiley.

Beer, S. (1979). *Heart of enterprise*. Chichester, United Kingdom: Wiley.

Beer, S. (1984). The viable system model: Its provenance, development, methodology and pathology. *Journal of the Operational Research Society, 35*(1), 7 - 25. doi:10.1057/jors.1984.2

Begun, J. W., Zimmerman, B., & Dooley, K. (2003). Health care organizations as complex adaptive systems. In S. M. Mick & M. Wyttenbach (Eds.), *Advances in health care organization theory* (pp. 253 - 288). San Francisco, CA: Jossey-Bass.

Bell, S., & Morse, S. (2013). Rich pictures: A means to explore the 'sustainable mind'? *Sustainable Development, 21*, 30 - 47. doi:10.1002/sd.497

Berwick, D. M. (2003). Improvement, trust, and the healthcare workforce. *Quality and Safety in Health Care, 12*(6), 448 - 452. doi:10.1136/qhc.12.6.448

Berwick, D. M. (2004). Lessons from developing nations on improving health care. *British Medical Journal, 328*, 1124 - 1129. doi:10.1136/bmj.328.7448.1124

Berwick, D. M. (2007). The stories beneath. *Medical Care, 45*(12), 1123 - 1125. doi:10.1136/bmj.328.7448.1124

Bhagwanjee, S., & Scribante, J. (2007). National audit of critical care resources in South Africa – Unit and bed distribution. *South African Medical Journal, 97*(12), 1311 - 1314. doi:10.7196/SAMJ.555.

Bhagwanjee, S., & Scribante, J. (2008). National audit of critical care resources: How long before we act? *Southern African Journal of Critical Care, 24*(1), 4 - 6. doi:10.7196/SAJCC.57

Bhagwanjee, S., & Ugarte, S. (2014). Sepsis in vulnerable populations. *Global Heart, 9*(3), 281 - 288. doi:10.1016/j.gheart.2014.08.008

Bhaskar, R. (1986). *Scientific realism and human emancipation*. London, United Kingdom: Verso.

Boje, D. (1991). The storytelling organization: A study of story performance in an office-supply firm. *Administrative Science Quarterly, 36*(1), 106 - 126. doi:10.2307/2393432

Boyd, A., Geerling, T., Gregory, W. J., Kagan, C., Midgley, G., Murray, P., & Walsh, M. P. (2007). Systemic evaluation: A participative, multi-method approach. *Journal of the Operational Research Society, 58*, 1306 - 1320. doi:10.1057/palgrave.jors.2602281

Brailsford, S., Harper, P., LeRouge, C., & Payton, F. C. (2012). Editorial. *Health Systems, 1*, 1 - 6. doi:10.1057/hs.2012.9

Braun, V., & Clark, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*(2), 77 - 101. doi:10/1191/1478088706

Browning, L., & Boudès, T. (2005). The use of narrative to understand and respond to complexity: A comparative analysis of the Cynefin and Weickian models. *Emergence: Complexity and Organisation, 7*(3 - 4). doi:10.emerg/10.17357.69421b2dab204467eb06670e53cc73e6

Brunkhorst, F. M., Engel, C., Bloos, F., Meier-Hellmann, A., Ragaller, M., Weiler, N., . . . Reinhart, K. (2008). Intensive insulin therapy and penstarch resuscitation in severe sepsis. *New England Journal of Medicine, 358*(2), 125 - 139. doi:10.1056/NEMJoa070716

Buregeya, E., Fowler, R. A., Talmor, D. S., Twagirumugabe, T., Kiviri, W., & Riviello, E. (2014). Acute respiratory distress syndrome in the global context. *Global Heart, 9*(3), 289 - 295. doi:10.1016/j.gheart.2014.08.003

Burrel, G., & Morgan, G. (1979). *Sociological paradigms and organisational analysis*. London, United Kingdom: Heinemann.

Cabrera, D. A. (2006). *Systems thinking.* (Unpublished doctor's thesis), Cornell University, Ithaca, NY.

Carman, K. L., Maurer, M., Yegian, J. M., Dardess, P., McGee, J., Evers, M., & Marlo, K. (2010). Evidence that consumers are sceptical about evidence-based healthcare. *Health Affairs, 29*(7), 1400 - 1406. doi:10.1377/hltaff.2009.0296

Carter, C. A. (2008). From ICU to outreach: A South African experience. *Southern African Journal of Critical Care, 24*(2), 50 - 55. doi:10.7196/SAJCC.64

CCSSA. (2009). Critical Care Society of Southern Africa. Retrieved from http://www.criticalcare.org.za/abouthistory.html, Date accessed: 20 June 2009

Chaung, S., & Inder, K. (2009). An effectiveness analysis of healthcare systems using a systems theoretic approach. *BMC Health Services Research, 9*(195), 1 - 11. doi:10.1186/1472-6963-9-195

Checkland, P. (1985). From optimizing to learning: A development of systems thinking for the 1990s. *Journal of the Operational Research Society, 36*(9), 757 - 767. doi:10.1057/jors.1985.141

Checkland, P. (1995). Model validation in soft systems practice. *Systems Research, 12*(1), 47 - 54. doi:10.1002/sres.3850120108

Checkland, P. (2007). *Systems thinking, systems practice: Including a 30 year retrospective*. Chichester, United Kingdom: Wiley.

Checkland, P., & Poulter, J. (2006). *Learning for action: A short definitive account of soft systems methodology, and its use for practitioners, teachers and students*. Chichester, United Kingdom: Wiley.

Checkland, P., & Winter, M. (2006). Process and content: Two ways of using SSM. *Journal of the Operational Research Society, 57*(12), 1435 - 1441. doi:10.1057/palgrave.jors.2602118

Chen, D. T., Mills, A. E., & Werhane, P. H. (2008). Tools for tomorrow's health care system: A systems-informed mental model, moral imagination, and physicians professionalism. *Academic Medicine, 83*(8), 723 - 732. doi:10.1097/ACM.0b013e31817ec0d3

Christens, B. D., Hanlin, C. E., & Speer, P. W. (2007). Getting the social organism thinking: strategy for systems change. *American Journal of Community Psychology, 39*(3 - 4), 229 - 238. doi:10.1007/s10464-007-9119-y

Churchman, C. W. (1970). Operations research as a profession. *Management Science, 17*(2), B37 - B53. doi:10.1287/mnsc.17.2B37

Churchman, C. W. (1979). *The systems approach and its enemies*. New York, NY: Basic Books.

Cilliers, P. (1998). *Complexity and post-modernism: Understanding complex systems*. London, United Kingdom: Routledge.

Cilliers, P. (2001). Boundaries, hierarchies and networks in complex systems. *International Journal of Innovation Management, 5*(2), 135 - 147. doi:10.1142/S1363919601000312

Cilliers, P. (2004). A framework for understanding complex systems. In P. Andriani & G. Passiante (Eds.), *Complexity theory and the management of networks* (pp. 23 - 27). London, United Kingdom: Imperial College Press.

Clayton, J., & Gregory, W. J. (2000). Reflections on critical systems thinking and the management of chance in rule-bound systems. *Journal of Organizational Change Management, 13*(2), 140 - 161. doi:10.1108/09534810010321472

Cloete, F. (2006). Public policy in more and lesser developed states. In F. Cloete, H. Wissink, & C. de Coning (Eds.), *Improving public policy: From theory to practice* (pp. 83 - 101). Pretoria, South Africa: Van Schaik.

Colvin, M. (2007). Heraclitean flux and unity of oppsites in Plato's "Theaetetus" and "Cratylus". *The Classical Quarterly, 57*(2), 759 - 769. doi:10.1017/S0009838807000705

Confidential communication (2009).

Connelly, D., Veriava, Y., Roberts, S., Tsotetsi, J., Jordan, A., DeSilva, E., . . . Bachman DeSilva, M. (2007). Prevalence of HIV infection and median CD4 counts among health care workers in South Africa. *South African Medical Journal, 97*(2), 1115 - 1120. doi:10.7196/SAMJ.459

Cooper, H., Bray, S., & Geyer, R. (2004). Complexity and interprofessional education. *Health and Social Care, 3*(4), 179 - 189. doi:10.1111/j.1473-6861.2004.00076.x

Cortese, D. A., & Smoldt, R. K. (2006). Healing America's ailing health care system. *Mayo Clinic Proceedings, 81*(4), 492 - 496. doi:10.4065/81.4.492

Creswell, J. W. (2009). *Research design: Qualitative, quantitative and mixed methods approaches* (3rd ed.). Thousand Oaks, CA: Sage.

Dang, D., Johantgen, M. E., Pronovost, P. J., Jenckes, M. W., & Bass, E. B. (2002). Postoperative complications: Does intensive care unit staff nursing make a difference? *Heart & Lung, 31*(3), 219 - 228. doi:10.1067/mhl.2002.122838

De Jager, P., Hofman, K., Khan, T., Volmink, H., & Jina, R. (2012). Recommendations to improve the national development plan for health. *South African Medical Journal, 102*(11), 827 - 829. doi:10.7196/SAMJ.6160

De Savigny, D., & Adam, T. (2009). *Systems thinking for health systems strengthening*. France: Alliance for Health Policy and Systems Research, WHO.

Degoricija, V., Sefer, S., Kujundzic-Tiljak, M., & Gjurasin, M. (2002). Intensive Care Units in Croatia: 2001 survey. *Croatian Medical Journal, 43*(6), 713 - 721.

Dellinger, R. P., Levy, M. M., Rhodes, A., Annane, D., Gerlach, H., Opal, S., . . . Osborn, T. M. (2013). Surviving sepsis campaign: International guidelines for management of severe sepsis and septic shock 2012. *Critical Care Medicine, 41*(2), 580 - 673. doi:10.1097/CCM.0b013e31827e83af

Department of Health. (2009). Modernisation of tertiary services. Retrieved from http://www.doh.gov.za/mts/index.html, Date accessed: 20 June 2009

Doherty, J., Gilson, L., & EQUINET. (2006). Health Systems Knowledge Network (KN) discussion document number 1. Retrieved from https://www.researchgate.net/profile/Lucy_Gilson/publication/237464954_PROPOSED_AREAS_OF_INVESTIGATION_FOR_THE_KN_AN_INITIAL_SCOPING_OF_THE_LITERATURE/links/5416e0120cf2bb7347db7a79/PROPOSED-AREAS-OF-INVESTIGATION-FOR-THE-KN-AN-INITIAL-SCOPING-OF-THE-LITERATURE.pdf, Date accessed: 27 November 2017

Dominguez-Cherit, G., De la Torre, A., Rishu, A., Pinto, R., Namendys-Silva, S. A., Camacho-Oritz, A., . . . Quesada-Sanchez, A. (2016). Influenza A(H1N1pdm09) related critical illness and mortality in Mexico and Canada. *Critical Care Medicine, 44*(10), 1861 - 1870. doi:10.1097/CCM0000000000001830

Don't get ill. (2010, 5 June). *The Economist,* pp. 12-13.

Donabedian, A. (1972). Models for organizing the delivery of personal health services and criteria for evaluating them. *The Milbank Memorial Fund Quarterly, 50*(4), 103 - 154. doi:10.2307/3349436

Douglas, M. (1986). *How institutions think*. Syracuse, NY: Syracuse University Press.

Dünser, M. W., Baelani, I., & Ganbold, L. (2006). A review and analysis of intensive care medicine in the least developed countries. *Critical Care Medicine, 34*(4), 1234 - 1242. doi:10.1097/01.CCM.0000208360.70835.87

Edgren, L. (2008). The meaning of integrated care: A systems approach. *International Journal of Integrated Care, 8*(4), e68. doi:10.5334/ijic.256

Edgren, L., & Barnard, K. (2012). Complex adaptive systems for management of integrated care. *Leadership in Health Services, 25*(1), 39 - 51. doi:10.1108/17511871211198061

Elliot, D., Davidson, J. E., Harvey, M. A., Bermis-Dougherty, A., Hopkins, R. O., Iwashyna, T. J., . . . Needham, D. M. (2014). Exploring the scope of post-intensive care syndrome therapy and care: Engagement of non-critical care providers and survivors in a second stakeholders' meeting. *Critical Care Medicine, 42*(12), 2518 - 2526. doi:10.1097/CCM000000000000525

Engel, E. (1956). The role of content in binocular resolution. *American Journal of Psychology, 69*(1), 87 - 91. doi:10.2307/1418119

Engelhardt, H. T. (1998). Critical care: Why there is no global bioethics. *Journal of Medicine and Philosophy, 23*(6), 643 - 651. doi:10.1076/jmep.23.6.643.2555

Espejo, R., & Harnden, R. J. (1989). The VSM: An on-going conversation. In R. Espejo & R. J. Harnden (Eds.), *The viable systems model: Interpretations and applications of Stafford Beer's VSM* (pp. 441 - 460). Chichester, United Kingdom: Wiley.

Espinosa, A., Harnden, R., & Walker, J. (2008). A complexity approach to sustainability - Stafford Beer revisited. *European Journal of Operational Research, 187*(2), 636 - 651. doi:10.1016/j.ejor.2007.03.023

Espinosa, A., & Walker, J. (2013). Complexity management in practice: Aviable system model intervention in an Irish eco-community. *European Journal of Operational Research, 225*, 118 - 129. doi:10.1016/jejor.2012.09.015

Esteban, A., Frutos-Vivar, F., Ferguson, N. D., Arabi, Y., Apezteguia, C., Gonzalez, M., . . . Anzueto, A. (2004). Non-invasive positive-pressure ventilation for respiratory failure after extubation. *New England Journal of Medicine, 350*(24), 2452 - 2460. doi:10.1056/NEMJ09032738

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and "Mode 2" to a triple helix of university-industry-government relations. *Research Policy, 29*(2), 109 - 123. doi:10.1016/S0048-7333(99)00055-4

Fathulla, K. (2008). Understanding diagrams: A pointer to the development of diagramming software. *Visible Language, 42*(3), 265-284.

Finfer, S., Chittock, D. R., Su, S. Y., Blair, D., Foster, D., Dhinga, Y., . . . Henderson, R. W. (2009). Intensive versus conventional glucose control in critically ill patients. *New England Journal of Medicine, 360*(13), 1283 - 1297. doi:10.1056/NEMJoa0810625

Flanagan, L. (2009, 3 June). Millions spent on UV lights that don't work. *The Star*. Retrieved from http://www.highbeam.com/doc/1G1-201023210.htm

Flood, R. L. (2010). The relationship of systems thinking to action research. *Systems Practice and Action Research, 23*(4), 269 - 284. doi:10.1007/s11213-010-9169

Flood, R. L., & Jackson, M. C. (1991). *Creative problem solving: Total systems intervention*. Chichester, United Kingdom: Wiley.

Fodor, J. A. (1974). Special sciences (or: The disunity of science as a working hypothesis). *Synthese, 28*(2), 97 - 115. doi:10.1007/BF00485230

Fölscher, C. W. (1983). *'n Evaluering van die opleiding in intensiewe algemene verpleegkunde in die Republiek van Suid-Afrika.* (Unpublished doctoral thesis), Randse Afrikaanse Universiteit, Johannesburg, South Africa.

Foucault, M. (1982). The subject and power. *Critical Inquiry, 8*(4), 777 - 795.

Fowler, R. A., Abdelmalik, P., Wood, G., Foster, D., Gibney, N., Bandrauk, N., . . . Bagshaw, S. M. (2015). Critical care capacity in Canada: Results of a national cross-sectional study. *Critical Care, 19*(133), 1 - 8. doi:10.1186/s13054-015-0852-6

Fowler, R. A., Adhikari, N. K. J., Scales, D. C., Lee, W. L., & Rubenfeld, G. D. (2009). Update in critical care 2008. *American Journal of Respiratory and Critical Care Medicine, 179*, 743 - 758. doi:10.1164/rccm200902-0207UP

Fraser, S. W., & Greenhalgh, T. (2001). Coping with complexity: Education for capability. *British Medical Journal, 323*(7316), 799 - 803. doi:10.1136/bmj.323.7316.799

Garland, A. (2005a). Improving the ICU: Part 1. *Chest, 127*(6), 2151 - 2164. doi:10.1378/chest.127.6.2151

Garland, A. (2005b). Improving the ICU: Part 2. *Chest, 127*(6), 2165 - 2179. doi:10.1378/chest.127.6.2165

Gatrell, A. C. (2005). Complexity theory and geographies of health: A critical assessment. *Social Science and Medicine, 60*(12), 2661 - 2671. doi:10.1016/j.socsimed.2004.11.002

Gerretsen, B. (2009, 13 June). Moonlighting nurses' tired and threat to patient care and their own health'. *Saturday Star*. Retrieved from http://www.highbeam.com/doc/1G1-201707821.html

Gharajedaghi, J. (2011). *Systems thinking: Managing chaos and complexity: A platform for designing business architecture* (3rd ed.). Burlington, MA: Elsevier.

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The new production of knowledge: The dynamics of science and research in contempory societies.* London, United Kingdom: Sage.

Giddens, A. (1985). Reason without revolution? Habermas's theorie des kommunikativen handelns. In R. J. Bernstein (Ed.), *Habermas and modernity* (pp. 95 - 121). Cambridge, United Kingdom: Polity Press.

Golden, B. R., & Martin, R. L. (2004). Aligning the stars: Using systems thinking to (re)design Canadian health care. *Healthcare Quarterly, 7*(4), 34 - 42. doi:10.12927/hcq..16803

Gondwe, W. T. M., Bhengu, B. R., & Bultemeier, K. (2011). Challenges encountered by intensive care nurses in meeting patients' families' needs in Malawi. *Africa Journal of Nursing and Midwifery, 13*(2), 92 - 102.

Gorelik, G. (1987). Bogdanov's tektologia, general systems theory, and cybernetics. *Cybernetics and Systems: An International Journal, 15*(2), 157 - 175. doi:10.1080/01969728708902134

Gray, A., & Pillay, K. (2006). Health Legislation and Policy. *South African health review 2006.* Retrieved from http://www.hst.org.za, Date accessed: 14 June 2015

Green, L. W. (2006). Public health asks of systems science: To advance our evidence-based practice, can you help us get more practice-based evidence? *American Journal of Public Health, 96*(3), 406 - 409. doi:10.2105/AJPH.2005.066035

Gregory, A. (2007). Target setting, lean systems and viable systems: A systems perspective on control and performance measurement. *Journal of the Operational Research Society, 58*(11), 1503 - 1517. doi:10.1057/palgrave.jors2602319

Gregory, W. J. (1992). *Critical systems thinking and pluralism: A new constellation.* (Unpublished doctoral thesis), City University, London, United Kingdom.

Grenvik, A., & Pinsky, M. R. (2009). Evolution of the intensive care unit as a clinical center and critical care medicine as a discipline. *Critical Care Clinics, 25*(1), 239 - 250. doi:10.1016/j.ccc.2008.11.001

Grol, R. (2001). Improving the quality of medical care: Building bridges among professional pride, payer profit, and patient satisfaction. *JAMA, 286*(20), 2578 - 2585. doi:jsc10284 [pii]

Gundo, R., Lengu, E. S., Maluwa, A., Mtalimanja, O., Chipeta, D., & Kadyaudzu, C. (2014). An audit of admissions to intensive care unit at Kamuzu Central Hospital in Malawi. *Open Journal of Nursing, 4*, 583 - 589. doi:10.4236/ojn.2014.44036

Gutsche, J. T., & Kohl, B. A. (2007). Who should care for intensive care unit patients? *Critical Care Medicine, 35*(2), S18 - 23. doi:10.1097/01.CCM.0000252907.47050.FE

Habermas, J. (1976). *Communication and the evolution of society* (English, 1979 ed.). London, United Kingdom: Heinemann.

Habermas, J. (1984a). *The theory of communative action: Reason and the rationalisation of society* (T. McCarthy, Trans. Vol. 1). Boston, MA: Beacon Press.

Habermas, J. (1984b). *The theory of communicative action: The critique of functionlist reason* (Vol. 2). Boston, MA: Beacon Press.

Haftor, D. M. (2011). An evaluation of R.L. Ackoff's interactive planning: A case-based approach. *Systemic Practice and Action Research, 24*(4), 355 - 377. doi:10.1007/s11213-010-9188-y

Halpern, S. D. (2011). ICU capacity strain and the quality and allocation of critical care. *Current Opinion in Critical Care, 17*, 648 - 657. doi:10.1097/MCC.0b013e32834c7a53

Hamstra, C. (2017). Complexity storytelling: The science of complexity within the art of communication. *Emergence: Complexity and Organisation, 19*(1), 1 - 6. doi:10.emerg/10.17357.076ac0318796a9ab519c0a5463154e88

Hegel, G. W. F. (1807). *The phenomenology of mind* (J. B. Baillie, Trans.). Adelaide, Australia: eBooks@Adelaide.

Hensher, M., Edwards, N., & Stokes, R. (1999). International trends in the provision and utilization of hospital care. *British Medical Journal, 319*, 845 - 854. doi:10.1136/bmj.319.7213.845

Heron, J., & Reason, P. (1997). A participatory enquiry paradigm. *Qualitative Enquiry, 3*(3), 274 - 294. doi:10.1177/107780049700300302

Herrera, C., Thomas, A., Belmokhtar, S., & Pannequin, R. (2011). *A viable system model for product-driven systems*. Paper presented at the International Conference on Industrial Engineering and Systems Management, Metz, France.

Higgins, T. L., McGee, W. T., Steingrub, J. S., Rapoport, J., Lemeshow, S., & Teres, D. (2003). Early indicators of prolonged intensive care unit stay: Impact of illness severity, physician staffing, and pre-intensive care unit length of stay. *Critical Care Medicine, 31*(1), 45 - 51. doi:10.1097/01.CCM.0000038743.29876.3C

Hildbrand, S., & Bodhanya, S. (2014). Applying SSM to explore the complexity in a multi-stakeholder setting. *Journal of Contemporary Management, 11*(1), 406 - 430.

Hildbrand, S., & Bodhanya, S. (2015). Guidance on applying the viable system model. *Kybernetes, 44*(2), 186 - 201. doi:10.1108/K-01-2014-0017

Hildbrand, S., & Bodhanya, S. (2017). Exploring the complexity of sugarcane supply chains via systemic approaches. *Kybernetes, 44*(2), 310 - 329. doi:10.1108/K-05-2014-0094

Hindle, G. A. (2011). Teaching soft systems methodology and a blueprint for a module. *INFORMS Transactions on Education, 12*(1), 31 - 40. doi:10.1287/ited.1110.0068ca

Hodgson, A., & Midgley, G. (2014, 27 July - 1 August). *Bringing foresight into systems thinking: A three horizons approach.* Paper presented at the 58th annual meeting of the International Society for the Systems Sciences, Washington, DC.

Holden, L. M. (2005). Complex adaptive systems: Concept analysis. *Journal of Advanced Nursing, 52*(6), 651 - 657. doi:10.1111/j.1365-2648.2005.03638.x

Hugonnet, S., Harbarth, S., Sax, H., Duncan, R. A., & Pittet, D. (2004). Nursing resources: A major determinant of nosocomial infection? *Current Opinion in Infectious Diseases, 17*(4), 329 - 333. doi:10.1097/01qco0000136931.83167.d2

Iwashyna, T. J. (2010). Survivorship will be the defining challenge of critical care in the 21st century. *Annals of Internal Medicine, 153*(3), 204 - 205. doi:10.7326/0003-4819-153-3-201008030-00013

Jackson, M. C. (1987). New directions in management science. In M. C. Jackson & P. Keys (Eds.), *New directions in management science* (pp. 133 - 164). Aldershot, United Kingdom: Glower.

Jackson, M. C. (2000). *Systems approaches to management* (1st ed.). New York, NY: Cluver Academic.

Jackson, M. C. (2001). Critical systems thinking and practice. *European Journal of Operational Research, 128*(2), 233 - 244. doi:10.1016/S0377-2217(00)00067-9

Jackson, M. C. (2003). *Systems thinking: Creative holism for managers*. Chichester, United Kingdom: Wiley.

Jackson, M. C., & Keys, P. (1984). Towards a system of systems methodologies. *Journal of Operational Research Society, 35*(6), 473 - 486. doi:10.2307/2581795

Jezierska, N., Borkowski, B., & Gaszynski, W. (2014). Psychological reactions in family members of patients hospitalised in intensive care units. *Anaesthesiology Intensive Therapy, 46*(1), 42 - 45. doi:10.5603/AIT.2014.0009

Jochberger, S., Ismailova, F., Lederer, W., Mayr, V. D., Luckner, G., Wenzel, V., . . . Dünser, M. W. (2008). Anesthesia and its allied disciplines in the developing world: A nationwide survey of the Republic of Zambia. *Anesthesia & Analgesia, 106*(3), 942 - 948. doi:10.1213/ane.0b013e31866ecb8

Johnson, M. W., & Leydesdorff, L. (2015). Beer's viable system model and Luhmann's communication theory: 'Organizations' from the perspective of meta-games. *Systems Research and Behavioral Science, 32*(3), 266 - 282. doi:10.1002/sres2222

Jones, C., Bäckman, C., Capuzzo, M., Egerod, I., Flaatten, H., Granja, C., . . . Griffiths, R. D. (2010). Intensive care diaries reduce new onset post traumatic stress disorder following critical illness: A randomised, controlled trial. *Critical Care, 14*(5), R168. doi:10.1186/cc9260

Kalim, K., Carson, E., & Cramp, D. (2006). An illustration of whole systems thinking. *Health Service Management Research, 19*(3), 174 - 185. doi:10.1258/095148406777888116

Kentish-Barnes, N., Chaize, M., Seegers, V., Legriel, S., Cariou, A., Jaber, S., . . . Azoulay, E. (2015). Complicated grief after death of a relative in the intensive care unit. *European Respiratory Journal, 45*, 1341 - 1352. doi:10.1183/09031936.00160014

Kerr, S. (1975). On the folly of rewarding A, while hoping for B. *Academy of Management Journal, 18*, 769 - 783. doi:10.2307/255378

Kerry, V. B., & Sayeed, S. (2014). Leveraging opportunities for critical care in resource-limited settings. *Global Heart, 9*(3), 275 - 279. doi:10.1016/j.gheart.2014.09.002

Kochevar, L. K., & Yano, E. M. (2006). Understanding health care organization needs and context. *Journal of General Internal Medicine, 21*, S25 - S29. doi:10.1111/j.1525-1497.2006.00359.x

Kuhn, T., S. (1970). *The structure of scientific revolutions*. Chicago, IL: University of Chicago Press.

Landry, M. (1995). A note on the concept of 'problem'. *Organization Studies, 16*(2), 315 - 343. doi:10.1177/017084069501600206

Landry, M., Banville, C., & Oral, M. (1996). Model legitimisation in operational research. *European Journal of Operational Research, 92*(3), 443 - 457. doi:10.1016/0377-2217(96)00003-3

Landry, M., Malouin, J., & Oral, M. (1983). Model validation in operational research. *European Journal of Operational Research, 14*(3), 207 - 220. doi:10.1016/0377-2217(83)90257-6

Lane, D. C., & Jackson, M. C. (1995). Only connect! An annotated bibliography reflecting on the breadth and diversity of systems thinking. *Systems Research, 12*(3), 217 - 228. doi:10.1002/sres.3850120306

Leape, L., Berwick, D. M., Clancy, C., Conway, J., Gluck, P., Guest, J., . . . Isaac, T. (2009). Transforming health care: A safety imperative. *Quality and Safety in Health Care, 18*, 424 - 428. doi:10.1136/qshc.2009.036954

Leapfrog. (2009). Fact sheet: ICU Physician staffing. Retrieved from http://www.leapfroggroup.org/media/file/Leapfrog-ICU_Physician_Staffing_Fact_Sheet.pdf, Date accessed: 20 June 2009

Leapfrog Group. (2016). Factsheet: ICU physician staffing. Retrieved from http://www.leapfroggroup.org/sites/default/files/Files/IPS%20Fact%20Sheet.pdf, Date accessed: 1 September 2016

Leemann, J. E. (2002). Applying interactive planning at DuPont: The case of transforming a safety, health and environmental function to deliver business value. *Systemic Practice and Action Research, 15*(2), 85 - 109. doi:10.1023/A:1015236423688

Leischow, S. J., Best, A., Trochim, W. M., Clark, P. I., Gallagher, R. S., Marcus, S. E., & Mathews, E. M. (2008). Systems thinking to improve the public's health. *American Journal of Preventive Medicine, 35*(2S), S196 - S203. doi:10.101`6/jamepre.2008.05.0145

Leischow, S. J., & Milstein, B. (2006). Systems thinking and modelling for public health practice. *American Journal of Public Health, 96*(3), 403 - 405. doi:10.2105/AJPH.2005.082842

Levy, M. M. (2006). Finding out what we do in the ICU. *Critical Care Medicine, 34*(1), 227 - 228. doi:10.1097/01.CCM.0000196215.13080.54

Lingrad, L., McDougall, A., Levstik, M., Chandok, N., Spafford, M. M., & Schryer, C. (2012). Representing complexity well: A story about teamwork, with implications for how we teach collaboration. *Medical Education, 46*(9), 869-877. doi:10.1111/j.1365-2923.2012.04339.x

Lopez, A., Lorente, J. A., Steingrub, J., Bakker, J., McLuckie, A., Willats, S., . . . Grover, R. (2004). Multi-center, randomised, placebo-controlled, double blind study of nitric oxide synthase inhibitor 546C88: Effect on survival in patients with septic shock. *Critical Care Medicine, 32*(1), 21 - 30. doi:10.1097/01.CCM.0000105581.01815.C6

Lorenz, E. (1972). *Predictability; does the flap of a butterfly's wings in Brazil set off a tornado in Texas?* Paper presented at the 139th meeting of the American Association for the Advancement of Science, Washington, DC.

Lumbo, D. A. (2007). *Applications of interactive planning methodology.* (Unpublished master's dissertation), University of Pennsylvania, Philadelphia, PA.

Madonna visits hospital in Malawi to view paediatric unit. (2016, 21 July). *Independent. IE*. Retrieved from http://www.independent.ie/world-

news/madonna-visits-hospital-in-malawi-to-view-paediatric-unit-34871712.html

Matau, G. A., Van der Wal, D. M., & Locsin, R. C. (2015). Ebola hemorrhagic fever outbreaks: Strategies for effective epidemic management, containment and control. *The Brazilian Journal of Infectious Diseases, 19*(3), 308 - 313. doi:10.1016/j.bjid.2015.02.004

Maturana, H. R. (1988). Reality: The search for objectivity or the quest for a compelling argument. *The Irish Journal of Psychology, 9*(1), 25 - 82. doi:10.1080/03033910.1988.10557705

McDaniel, R. R., Lanham, H. J., & Anderson, R. A. (2009). Implications for complex adaptive systems theory for the design of research on health care organizations. *Health Care Management Review, 34*(2), 191 - 199. doi:10.1097/HMR.0b013e31819c8b38

McDonald, L. (2003). *Florence Nightingale's radical approach to public health care.* Paper presented at the American Association for the History of Nursing with the Canadian Association for the history of Nursing 20th Annual Congress, Milwaukee, Wisconsin.

McDonald, L. (2006). *Florence Nightingale on public health: Collected works of Florence Nightingale* (Vol. 6). Ontario, Canada: Wilfoid Larier University Press.

Mer, M., Schultz, M. J., & Adhikari, N. K. J. (2017). Core elements of general supportive care for patients with sepsis and septic shock in resource-limited settings. *Intensive Care Medicine, Advanced online printing*. doi:10.1007/S00134-017-4831-2

Midgley, G. (1992a). Pluralism and the legitimation of systems science. *Systems Practice, 5*(2), 147 - 172. doi:147. doi:10.1007/BF01059938

Midgley, G. (1992b). The sacred and profane in critical systems thinking. *Systems Practice, 5*(1), 5 - 16. doi:10.1007/BF01060044

Midgley, G. (2000). *Systemic Intervention: Philosophy, methodology and practice*. New York, NY: Kluwer Academic.

Midgley, G. (2006a). Systemic intervention for public health. *American Journal of Public Health, 96*(3), 466 - 472. doi:10.2105/AJPH.2005.067660

Midgley, G. (2006b). Systems thinking for evaluation. In B. Williams & I. Imam (Eds.), *Systems consepts in evaluation: An expert anthology*. Point Reyes, CA: Edge-Press.

Midgley, G. (2008). Systems thinking, complexity and the philosophy of science. *E:CO, 10*(4), 55 - 73. doi:10.emerg/10.17357.a7ba7e7cf2ed80ce4517c6052dc486de

Midgley, G. (2015). *Systemic Intervention. Research Memorandum 95*. Hull, United Kingdom: University of Hull, Center for Systems Studies.

Midgley, G., & Ochoa-Arias, A. E. (2001). Unfolding the theory of systemic intervention. *Systemic Practice and Action Research, 14*(5), 615 - 649. doi:10.1023/A:1011977220479

Midgley, G., & Richardson, K. A. (2007). Systems thinking for community involvement in policy analysis. *E:CO, 9*(1), 167 - 183. doi:10.emerg/10.17357.d22b830ea6933de83264adc23ee3ae33

Minas, H. (2005). Leadership for change in complex systems. *Australasian Psychiatry, 13*(1), 33 - 39. doi:10.1111/j.1440-1665.2004.02147.x

Mingers, J. C. (1980). Towards an appropriate social theory for applied systems thinking: Critical theory and soft systems methodology – A critique. *Journal of Applied Systems Analysis, 11*, 85 - 103.

Mingers, J. C. (2006). *Realising Systems Thinking: Knowledge and action in management science*. New York, NY: Springer.

Monk, A., & Howard, S. (1998). The rich picture: A tool for reasoning about work context. *Interactions, 5*(2), 21 - 30. doi:10.1145/274430.274434

Moreno, R. P., & Rhodes, A. (2010). Intensive care medicine: A speciality coming to life. *Lancet, 376*, 1275 - 1276. doi:10.1016/S0140-6736(10)61502-4

Motsoaledi, A. (2010, 6 July). [Minister of National Health].

Mula, C., Ncama, B. P., & Maluwa, A. (2014). Nurses' competency and challenges in enteral feeding in the intensive care unit (ICU) and high dependency units (HDU) of a referral hospital, Malawi. *Malawi Medical Journal, 26*(3), 55 - 59.

Murray, C., & Frenk, J. (2001). World health report 2000: A step towards evidence-based health policy. *Lancet, 357*, 1698 - 1700. doi:10.1016/S0140-6736(00)04826-1

Murthy, S., Leligdowicz, A., & Adhikari, N. K. J. (2015). Intensive care unit capacity in low-income countries: A systematic review. *PLoS One, 10*(1), e0116949. doi:10.1371/journal.pone.0116949

National Planning Commission. (2011). National Development Plan: Vision for 2030. Retrieved from http://data.worldbank.org/indicator/SI.POV.GINI?order=wbapi_data_value_2012+wbapi_data_value+wbapi_data_value-last&sort=asc, Date accessed: 23 October 2103

National Research Council. (2001). Crossing the quality chasm: A new health system for the 21st Century. Retrieved from http://www.nap.edu/openbook.php?record_id=10027, Date accessed: 13 May 2011

Needham, D. M., Davidson, J., Cohen, H., Hopkins, R. O., Weinert, C., Wunsch, H., . . . Harvey, M. A. (2012). Improving long-term outcomes after discharge from intensive care unit: Report from a stakeholders' conference. *Critical Care Medicine, 40*(2), 502 - 509. doi:10.1097/CCM.0b013e318232da75

Neuman, W. L. (2006). *Social research methods: Qualitative and quantitative approaches* (6th ed.). Essex, United Kingdom: Pearson.

Nowotny, H., Scott, P., & Gibbons, M. (2001). *Re-thinking science: Knowledge and the public in an age of uncertainity*. Cambridge, United Kingdom: Polity.

Nowotny, H., Scott, P., & Gibbons, M. (2003). Introduction 'Mode 2' revisted: The new production of knowledge. *Minerva, 41*(3), 179 - 194. doi:10.1023/A:1025505528250

Paina, L., & Peters, D. H. (2011). Understanding pathways for scaling up health services through the lens of complex adaptive systems. *Health Policy and Planning, 2011*, 1 - 9. doi:10.1093/heapol/crz054

Paley, J. (2007). Complex adaptive systems and nursing. *Nursing Inquiry, 14*(3), 233 - 242. doi:10.1111/j.1440-1800.2007.00359.x

Paley, J. (2010). The appropriation of complexity theory in health care. *Journal of Health Services Research and Policy, 15*(1), 59 - 61. doi:10.1258/jhsrp.2009.009072

Parbhoo, N. (1993). *Five Decades: The South African Society of Anaesthetists 1943 - 1993*. Cape Town, South Africa: National Book Printers.

Paruk, F., Richards, G., Scribante, J., Bhagwanjee, S., Mer, M., & Perrie, H. (2012). Antibiotic prescription practices and their relationship to outcome in South African intensive care units: Findings of the prevalence of infection in South African intensive care units (PISA) study. *South African Medical Journal, 102*(7), 613 - 616. doi:10.7196/SAMJ.459

Pentstone, J. (2011). Statistic-based research – A pig in a poke. *Journal of Evaluation in Clinical Practice, 17*, 862 - 867. doi:10.1111/j.1365-2753.2011.01717.x

Perrie, H. (2006). *Knowledge of intensive care nurses in selected care areas commonly guided by protocols.* (Unpublished master's dissertation), University of the Witwatersrand, Johannesburg, South Africa.

Peters, D. H. (2014). The application of systems thinking in health: Why use systems thinking? *Health Research Policy and Systems, 12*(51), 1 - 6. doi:10.1186/1478-4505-12-51

Plesk, P. E., & Greenhalgh, T. (2001). The challenge of complexity in health care. *British Medical Journal, 323*(7313), 625 - 628. doi:10.1136/bmj.323.7315.746

Plesk, P. E., & Wilson, T. (2001). Complexity, leadership, and management in health care organisations *British Medical Journal, 323*(7315), 746 - 749. doi:10.1136/bmj.323.7313.625

Plochg, T., & Klazinga, N. S. (2002). Community-based integrated care: Myth or must? *International Journal of Quality in Health Care, 14*(2), 91 - 101. doi:10.1370/afm.18

Polit, D. F., & Beck, C. T. (2008). *Nursing Research* (8th ed.). Philedelphia: Wolters Kluwer Lippincot Williams & Wilkens.

Popper, K. R. (1959). *The logic of scientific discovery*. London, United Kingdom: Hutchinson.

Prigogine, I. (1987). Exploring complexity. *European Journal of Operational Research, 30*(2), 97 - 103. doi:10.1016/0377-2217(87)90085-3

Rajagopalan, R., & Midgley, G. (2015). Knowing differently in systemic intervention. *Systems Research and Behavioral Science, 32*, 546 - 561. doi:10.1002/sres.2352

Rastegar, D. A. (2004). Health care becomes an industry. *Annals of Family Medicine, 2*(1), 79 - 83. doi:10.1370/afm.18.

Reason, J. T., Carthey, J., & De Leval, M. R. (2001). Diagnosing "vulnerable system syndrome": An essential prerequisite to effective risk management. *Quality in Health Care, 10 (Supplement II)*, ii21 - ii25. doi: 10.1136/qhc.0100021

Rhodes, A., Evans, L. E., Alhazzani, W., Levy, M. M., Antonelli, M., Ferer, R., . . . Nunnally, M. E. (2017). Surviving sepsis campaign: International guidelines for management of sepsis and septic shock: 2016. *Critical Care Medicine, 45*(3), 1 - 67. doi:10.1097/CCM.0000000000002255

Richmond, B. (1994). System dynamics/systems thinking: Let's just get on with it. Retrieved from http://www.iseesystems.com/resources/Articles/SDSTletsjustgetonwithit.pdf, Date accessed: 12 October 2016

Riviello, E., Kiviri, W., Fowler, R. A., Mueller, A., Novack, V., Banner-Goodspeed, V. M., . . . Twagirumugabe, T. (2016). Predicting mortality in

low-income country ICUs: The Rwanda mortality probability model (R-MPM). *PLoS One, 11*(5), e0155858. doi:10.1371/journal.pone.0155858

Riviello, E., Letchford, S., Achieng, L., & Newton, M. (2011). Critical care in resource-poor settings: Lessons learned and future directions. *Critical Care Medicine, 39*(4), 860 - 867. doi:10.1097/CCM.0b013e318206d6d5

Robnett, M. K. (2006). Critical care nursing: Workforce issues and potential solutions. *Critical Care Medicine, 34*(3 Suppl), S25 - S31. doi:10.1097/01.CCM.0000203087.42439.53

Rouse, W. B. (2008). Health care as a complex adaptive system: Implications for design and management. *The Bridge, 38*(1), 17 - 25.

Rowe, A., & Hogarth, A. (2005). Use of complex adaptive systems metaphor to achieve professional and organizational change. *Journal of Advanced Nursing, 51*(4), 396 - 405. doi:10.1111/j.1365-2648.2005.03510

Russell, E., Swanson, R. C., Atun, R., Nisthar, S., & Chunharas, S. (2014). Systems thinking for the post-2015 agenda. *Lancet, 383*, 2124 - 2125. doi:10.1016/S0140-6736(14)61028-X

Sambo, L. G. (2009). *Health systems thinking: The need for a more critical approach.* (Unpublished doctoral thesis), University of Hull, Hull, United Kingdom.

Sanal, R. P. (2004). Systems thinking. Retrieved from http://www.scienceindia.net, Date accessed: 16 June 2009

Sargut, G., & McGrath, R. (2011). Learning to live with complexity. Retrieved from https://hbr.org/2011/09/learning-to-live-with-complexity, Date accessed: 18 January 2018

SCCM. (2009). Practicing CCM. Retrieved from http://www.sccm.org/AboutSCCM/Public%20Relations/Media_Kit/Pages/Practicing_CCM.aspx, Date accessed: 18 June 2009

Schreiber, L., & Gillwald, J. (1990). *Johannesburg Hospital 1890 - 1990: History of the hospital*. Johannesburg, South Africa: Persekor.

Schwaninger, M., & Scheef, C. (2016). A test of the viable system model: Theoretical claims vs. emperical evidence. *Cybernetics and Systems, 47*(7), 544 - 569. doi:10.1080/01969722-2016.1209375

Schyve, P. M. (2005). Systems thinking and patient safety. In K. Henrikson, J. B. Battles, & E. S. Marks (Eds.), *Advances in patient safety: From research to implementation (Volume 2: Concepts and methodology)* (pp. 1 - 4). Rockville MD: Agency for Healthcare Research and Quality.

Scott, L. D., Rogers, A. E., Hwang, W., & Zhang, Y. (2006). Effects of critical care nurses' work hours on vigilance and patient safety. *American Journal of Critical Care, 15*(1), 30 - 37.

Scribante, J., & Bhagwanjee, S. (2007a). National audit of critical care resources in South Africa – Nursing profile. *South African Medical Journal, 97*(12), 1315 - 1318. doi:10.7196/SAMJ.557

Scribante, J., & Bhagwanjee, S. (2007b). National audit of critical care resources in South Africa – Open versus closed intensive and high care units. *South African Medical Journal, 97*(12), 1319 - 1322. doi:10.7196/SAMJ.554

Scribante, J., & Bhagwanjee, S. (2007c). National audit of critical care resources in South Africa – Research methodology. *South African Medical Journal, 97*(12), 1308 - 1310. doi:10.7196/SAMJ.553

Scribante, J., & Bhagwanjee, S. (2007d). National audit of critical care resources in South Africa – Transfer of critically ill patients. *South African Medical Journal, 97*(12), 1323 - 1326. doi:10.7196/SAMJ.556

Scribante, J., Bhagwanjee, S., Paruk, F., & Perrie, H. (2007). *PISA: The prevalence of infection in South African intensive care units.* Paper presented at the 27th International symposium on intensive care & emergency medicine, Brussels, Belgium.

Scribante, J., Gross, E., Kearns, I., & Perrie, H. (2008). *Motivation, perceptions and expectations of the 2008 critical care nursing students at the Chris Hani Baragwanath Nursing College*. Paper presented at the South African Critical Care and Thoracic Societies Congress Cape Town, South Africa.

Scribante, J., Schmollgruber, S., & Nel, E. (2005). Perspectives on critical care nursing: South Africa. *Connect: The World of Critical Care Nurses, 3*, 111 - 115.

Seely, A. J., & Christou, N. V. (2000). Multiple organ dysfunction syndrome: Exploiting the paradigm of complex nonlinear systems. *Critical Care Medicine, 28*(7), 2193 - 2200.

Selanders, L. C. (2010). The power of environmental adaption: Florence Nightingale's original theory of nursing practice. *Journal of Holistic Nursing, 28*(1), 81 - 88. doi:10.1177/0898010109360257

Serrao, A. (2010, 24 July). What the MEC didn't say. *The Star*.

Shisana, O. (2004). High HIV/AIDS prevalence among health workers requires urgent attention. *South African Medical Journal, 97*(2), 108-109. doi:10.7196/SAMJ.451

Sibthorpe, B., Glasgow, N., & Duncan, L. (2004). Complex adaptive systems: A different way of thinking about health care systems. Retrieved from www.anu.edu.au/aphcri, Date accessed: 22 February 2010

Siedner, M. J. (2014). HIV and critical care delivery in resource-constrained settings. *Global Heart, 9*(3), 343 - 346. doi:10.1016/j.gheart.2014.08.006

Silva, S. A., & Wyer, P. C. (2009). Where is the wisdom II – Evidence-based medicine and the epistemological crisis in clinical medicine. Exposition and commentary on Djulbegovic, B., Guyatt, G.H. & Ashcroft, R.E. (2009) Cancer Control, 16, 158 - 168. *Journal of Evaluation in Clinical Practice, 15*, 899 - 906. doi:10.1111/j.1365-2753.2009.01324.x

Simon, H. A. (1962). The architecture of complexity. *Proceedings of the American Philosophical Society, 106*(6), 467 - 482.

Simon, K. H. (2009). Critical systems thinking. In F. Parra-Luna (Ed.), System sciences and cybernetics Volume II. Paris, France: Eloss. Retrieved from http://www.eolss.net.

Size, M., Borgstein, E. S., & Haisma, H. J. (2005). One-year audit of admissions to the intensive care unit of the Queen Elizabeth Central Hospital, Blantyre. *Malawi Medical Journal, 17*(1), 12 - 14.

Smith, M., Halvorson, G., & Kaplan, G. (2012). What is needed is a health care system that learns recommendations from the IOM report. *JAMA, 308*(16), 1637 - 1638. doi:10.1001/jama.2012.13664

Snowden, D. (1999). Storytelling: An old skill in a new context. *Business Information Review, 16*(1), 30 - 37.

South Africa. (1996). *Constitution of the Republic of South Africa, 1996*. Pretoria, South Africa: Goverment Printer.

South Africa. (2009). *Competition Amendment Act, Number 1 of 2009*. Pretoria, South Africa: Goverment Printer.

South African Nursing Council. (2017). South African Nursing Council Statistics. Retrieved from http://www.sanc.co.za/stats.htm, Date accessed: 27 November 2017

Stacey, R. D. (2007). *Strategic management and organisational dynamics*. Essex, United Kingdom: Pearson.

Stacey, R. D., Griffin, D., & Shaw, P. (2000). *Complexity and management: Fad or radical challenge to systems thinking*. New York, NY: Routledge.

Sturmberg, J. P., & Martin, C. M. (2009). Complexity in health – Yesterday's traditions, tomorrow's future. *Journal of Evaluation in Clinical Practice, 15*(3), 543 - 548. doi:10.1111/j.1365-2753.2009.01163.x

Sturmberg, J. P., O'Halloran, D. M., & Martin, C. M. (2010). People at the centre of complex adaptive health systems reform. *Medical Journal of Australia, 193*(8), 474 - 478.

Sturmberg, J. P., O'Halloran, D. M., & Martin, C. M. (2012). Understanding health care reform – A complex adaptive systems perspective. *Journal of Evaluation in Clinical Practice, 18*, 202 - 208. doi:10.1111/j.1365-2753.2011.01792.x

Sweeney, K. G., & Mannion, R. (2002). Complexity and clinical governance: Using the insights to develop strategy. *British Journal of General Practice, 52*, S4 - S9.

Takala, J., Ruokonen, E., Webster, N. R., Nielsen, M. S., Zandstra, D. F., Vundelinckx, G., & Hinds, C. J. (1999). Increased mortality associated with growth hormone treatment in critically ill adults. *New England Journal of Medicine, 341*(11), 785 - 792. doi:10.1056/NEMJ1999093411102

Tang, K. L., Caffrey, N. P., Nobrega, D. B., Cork, S. C., Ronksley, P. E., Barkema, A. J., . . . Ghali, W. A. (2017). Restricting the use of antibiotics in food-producing animals and its associations with antibiotic resistance in food-producing animals and human beings: A systematic

review and meta-analysis. *Lancet Planet Health, 1*, e316 - e 327. doi:10.1016/s2542-5196(17)3014-9

Tarnow-Mordi, W. O., Hau, C., Warden, A., & Shearer, A. J. (2000). Hospital mortality in relation to staff workload: A 4-year study in an adult intensive-care unit. *Lancet, 356*, 185 - 189. doi:10.1016/s0140-6736(00)02478-8

Thomas, A. R., & Lockett, M. (1979). Marxism and systems action-research: Values in practical action. In R. F. Ericson (Ed.), *Improving the human condition: Quality and stability in social systems* (pp. 284 - 293). Louisville, KY: Society for General Systems Research.

Tranfield, D., & Starkey, K. (1998). The nature, social organization and promotion of management research: Towards policy. *British Journal of Management, 9*(4), 341 - 353. doi:10.1111/1467-8551.00103

Tropello, S. P., Ravitz, A. D., Romig, M., & Pronovost, P. J. (2013). Enhancing the quality of care in the intensive care unit. A systems engineering approach. *Critical Care Clinics, 29*, 113 - 124. doi:10.1016/j.ccc.2012.10.009

Tsasis, P., Evans, J. M., & Owen, S. (2012). Reframing the challenges to integrated care: A complex-adaptive systems perspective. *International Journal of Integrated Care, 12*(5), 1 - 12. doi:10.5334/ijic.843

Ulrich, W. (1983). *Critical heuristics of social planning: A new approach to practical philosophy*. Bern, Switzerland: Haupt.

Ulrich, W. (1987). Critical heuristics of social systems design. *European Journal of Operational Research, 31*(3), 276 - 283. doi:10.1016/0377-2217(87)90036-1

Ulrich, W. (1994). *Critical heuristics of social planning: A new approach to practical philosophy*. Chichester, United Kingdom: Wiley.

Ulrich, W. (1996). *A primer to critical systems heuristics for action researchers*. Hull, United Kingdom: Unversity of Hull, Centre for Systems Studies.

Ulrich, W., & Reynolds, M. (2010). Critical Systems Heuristics. In M. Reynolds & S. Howell (Eds.), *Systems approaches to managing change: A practical guide*. London, United Kingdom: Springer.

Van Olmen, J., Marchal, B., Van Damme, W., Kegels, G., & Hill, P. S. (2012). Health systems frameworks in their political context: Framing divergent agendas. *BMC Public Health, 12*(774), 1 - 13. doi:10.1186/1471-2485-12-774

Van Rooyen, C. E., & Labuschagne, F. J. J. (2016, 4 - 7 July). *Soft systems methodology as a potential approach to understanding non-motorised transport users in South Africa.* Paper presented at the 35th Southern African Transport Conference, Pretoria, South Africa.

VanDeusen, L. C., Holmes, S. K., Cohen, A. B., Restuccia, J., Cramer, I. E., Shwartz, M., & Charns, M. P. (2007). Transformational change in health care systems: An orginazational model. *Health Care Management Review, 32*(4), 309 - 320. doi:10.1097/01.HMR.0000296785.29718.5d

Varpio, L., Ajjawi, R., Monrouxe, L. V., O'Brien, B. C., & Rees, C. E. (2017). Shredding the cobra effect: Problematising thematic emergence, triangulation, saturation and member checking. *Medical Education, 51*, 40 - 50. doi:10.1111/medu.13124

Vincent, J. L., & Singer, M. (2010). Critical care: Advances and future perspectives. *Lancet, 376*, 1354 - 1361. doi:10.1016/S0140-6736(10)60575-2

Von Bertalanffy, L. (1968). *General systems theory: Foundations, development, applications*. New York, NY: George Braziller.

Vroom, V. (1973). A new look at managerial decision making *Organizational Dynamics, 1*(4), 66 - 80. doi:10.1016/S0090-2616(73)80024-5

Vukoja, M., Riviello, E., Gavrilovic, S., Adhikari, N. K. J., Kashyap, R., Bhagwanjee, S., . . . Kilickaya, O. (2014). A survey on critical care

resources and practices in low- and middle-income countries. *Global Heart, 9*(3), 337 - 342. doi:10.1016/j.gheart.2014.08.002

Waitt, P. I., Mukaka, M., Goodson, P., SimuKonda, F. D., Waitt, C. J., Feasey, N., . . . Heyderman, R. S. (2005). Sepsis carries a high mortality among hospitalised adults in Malawi in the era of antiretroviral therapy scale-up: A longitudinal cohort study. *Journal of Infection, 70*, 11 - 19. doi:10.1016/j.jinf.2014.07.004

Waldman, J. D. (2007). Thinking systems need systems thinking. *Systems Research and Behavioral Science, 24*, 271 - 284. doi:10.1002/sres.828

Waldman, J. D., & Schargel, F. P. (2006). Twins in trouble (II): Systems thinking in health care and education. *Total Quality Management, 17*(1), 117 - 130. doi:10.1080/14783360500250040

Walsh, J. A., & Warren, K. S. (1979). Selective primary health care: An interim strategy for disease control in developing countries. *New England Journal of Medicine, 301*(18), 967 - 974. doi:10.1056/NEMJ199711013011804

Weaver, W. (1948). Science and complexity. *American Scientist, 536*, 536 - 544.

Weick, K. E., Sutcliffe, K., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organizational Science, 16*(4), 409 - 421. doi:10.1287/orsc.1050.0138

Westcott, M., Martiniuk, A. L. C., Fowler, R. A., Adhikari, N. K. J., & Dalipanda, T. (2012). Critical care resources in the Solomon Islands: A cross sectional survey. *BMC International Health and Human Rights, 12*(1), 1 - 9. doi:10.1186/1472-698X/12/1

WHO. (2000). The World health report 2000. Health systems: Improving performance. *Health systems: improving performance.* Retrieved from http://www.who.int/whr/2000/en/whr00_en.pdf?ua=1, Date accessed: 12 May 2014

WHO. (2007). Every body's business: Strengthening health systems to improve health outcomes: WHO's framework for action. Retrieved from http://www.wpro.who.int/NR/rdonlyres/5BA80B95-DC1F-4427-8E8B-0D9B1E9AF776/0/EB.pdf, Date accessed: 7 February 2013

WHO. (2017). Stop using antibiotics in healthy animals to prevent the spread of antibiotic resistance. Retrieved from http://who.int/mediacentre/news/releases/2017/antibiotics-animals-effectiveness/en/, Date accessed: 20 November 2017

Wiener, N. (1948). *Cybernetics or control and communication in the animal machine*. Cambridge, MA: MIT Press.

Williams, B., & Hummelbrunner, R. (2011). *Systems concepts in action: A practitioner's toolkit*. Stanford, CA: Stanford University Press.

Williams, G., & Clarke, T. (2001). A consensus driven method to measure the required number of intensive care nurses in Australia. *Australian Critical Care, 14*(3), 106 - 115. doi:10.1016/S1036-7314(01)80027-8

Willmott, H. (1993). Breaking the paradigm mentality. *Organization Studies, 14*(5), 681 - 719. doi:10.1177/017084069301400504

Wilson, T., & Holt, T. (2001). Complexity and clinical care. *British Medical Journal, 323*(7314), 685 - 688. doi:10.1136/bmj.323.7314.685

Windsor, S. (2005). *An educational programme for critical care nurses on interpretation of ventilator graphics.* (Unpublished masters dissertation), University of Pretoria, Pretoria, South Africa.

WMA. (2013). World Medical Association Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. Retrieved from http://www.wma.net/en/30publications/10policies/b3/, Date accessed: 24 October 2013

World Bank. (2012). GINI index. Retrieved from http://data.worldbank.org/indicator/SI.POV.GINI?order=wbapi_data_value_2012+wbapi_data_value+wbapi_data_value-last&sort=asc, Date accessed: 23 October 2013

World Bank. (2017a). World development indicators. Retrieved from http://data.worldbank.org/indicator/SH.XPD.TOTL.ZS, Date accessed: 29 June 2017

World Bank. (2017b). World development indicators. Retrieved from http://data.worldbank.org/indicator/SH.XPD.PCAP.PP.KD, Date accessed: 29 June 2017

Worrall, L., Lubbe, S., & Klopper, R. (2007). Academic research and management practice: Is the relevance gap closing? *Alternation, 14*, 292 - 316.

Wunsch, H., Angus, D. C., Harrison, D. A., Collange, O., Fowler, R. A., Hoste, E. A. J., . . . Rowan, K. M. (2008). Variation in critical care services across North America and Western Europe. *Critical Care Medicine, 36*(10), 2787 - 2793. doi:10.1097/CCM.0b013e318186aec8

Xaba, J., & Phillips, G. (2001). *Understanding nurse emigration: Final report*. Pretoria: Democratic Nurses Organization of South Africa (DENOSA).

Zille, H. (2009). SA Today – The health of our people is more important than ideology. Retrieved from

http://www.da.org.za/newsroom.htm?action=view-news-item&id=6861, Date accessed: 2 August 2010

Zinsstag, J., Schelling, E., Waltner-Toews, D., & Tanner, M. (2011). From "one medicine" to "one health" and systemic approaches to health and well-being. *Preventive Veterinary Medicine, 101*, 148 - 156. doi:10.1016/j.prevetmed.2010.07.003.