AN INTEGRATED APPROACH TO MANAGING SINGLE-USE-PLASTICS

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Supervisor Date

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Outcomes from Masters Activities

- Attendance at the Y20 Summit 2021 – Italy. Some of the events included Vienna International Energy Conference as well as UNICEF, UN, FAO International Workshops
- Attendance at the Y7 2022 – Germany. Some of the events included engagements at the Ministries of Foreign Affairs, Defence and Social Development and interactions with the German Chancellery.
- Best Presentation at the BRICS Postgraduate Forum in Sao Paulo, Brazil in September of 2022.

Abstract

Societies' reliance on plastic materials and excessive consumption off Single-Use-Plastics (SUP) associated with poor regulations and conglomeration of plastic waste in the environment has had radical and far-reaching consequences on food chains, strained landfill territory and declined tourism, to name a few. The expanse of these effects suggests that the negative impact of SUP warrants urgent attention. There are urgent calls from the Group of Seven (G7), Group of Twenty (G20) and Brazil, Russia, India, China and South Africa (BRICS) intergovernmental bodies along with the United Nations Sustainability Development Goals to control the detrimental effects of SUP.

This study aimed to develop an Integrated Quality and Environmental Management System (IQEMS) to control the consumption, use and pollution caused by SUP in the South African context. Accordingly, the objectives of this study explored selected quality (ISO 9001:2015) and environmental Standards (ISO 14001:2015) with their applications and a SWOT analysis in order to inform the integration process.

This study followed a qualitative research approach and gathered data using a systematic literature review and thematic analyses. Two-hundred and twenty-three articles were selected from different databases such as Pubmed, Web of Science, Emerald, Scopus and Taylor and Francis. Some of the keywords that were used to search the databases were "SUP", "ISO 9001", "ISO 14001" "Industry 4.0", "Risk Management", "Plastic Pollution", "Integrated Management Systems" and "SUP regulation". Following these analyses, the study Benchmarked different legislative and economic strategies undertaken by other countries for both the private and public sector to mitigate the impact of SUP and developed an integrated management system (IQEMS). Thereafter, a perception study, using interviews was undertaken with experts to determine the usefulness of the proposed IQEMS.

The research concluded that the integrative system was useful and the study presented a way forward for South Africa from the legislative level for both the private and public sectors in the management of SUP. It is envisaged that the integrated system can assist in developing guidelines and protocols for the facilitation of active involvement of municipal management in sustainable programmes. The outcomes of this can spur the development of different niche markets, thereby stimulating employment and the local economy.

Keywords: Single-Use-Plastics, Integrated Management Systems, Quality Management, Environmental Management

Abbreviations

AOC	Advisory and Oversight Committee
BPA	Bisphenol-A
DUT	Durban University of Technology
EMS	Environmental Management System
HDPE	High Density Polyethylene
IMS	Integrated Management System
IQEMS	Integrated Quality and Environmental Management System
ISO	International Organisation for Standardisation
LDPE	Low Density Polyethylene
PDCA	Plan, Do, Check, Act
PET	Polyethylene Terephthalate
PP	Polypropylene
PS	Polystyrene
PVC	Polyvinyl Chloride
QMS	Quality Management System
SUP	Single Use Plastics
SWOT	Strengths, Weaknesses, Opportunities and Threats
UNEP	United Nations Environment Programme
UN	United Nations

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Glossary

Benzene	: A colourless volatile liquid hydrocarbon present in coal tar and petroleum, and used in chemical synthesis. Its use as a solvent has been reduced because of its carcinogenic properties.
Biodegrade	: Of a substance or object that will be decomposed by bacteria or other living organisms.
Bio plastics	: A type of biodegradable plastic derived from biological substances rather than petroleum.
Biosphere	: The regions of the surface and atmosphere of the earth or another planet occupied by living organisms.
Bisphenol-A	: A synthetic organic compound used in the manufacture of epoxy resins and other polymers.
Biotic degradation	: Is the process by which organic substances are broken down by living organisms such as bacteria and fungi.
Buoyancy	: The ability or tendency of something to float in water or other fluid.
Carbon Dioxide	: A colourless, odourless gas produced by burning carbon and organic compounds and by respiration. It is naturally present in air and is absorbed by plants in photosynthesis.
Carcinogenic	: Having the potential to cause cancer.
Degradable	: Break down or deteriorate chemically.
Dengue	: A debilitating viral disease of the tropics, transmitted by mosquitoes, and causing sudden fever and acute pains in the joints.
Entanglement	: Cause to become twisted together with or caught in.
Ethylene	: A flammable hydrocarbon gas of the alkene series, occurring in natural gas, coal gas, and crude oil and given off by ripening fruit. It is used in chemical synthesis, especially in the manufacture of polyethylene.
Geomembrane	: A geomembrane is very low permeability synthetic membrane liner or barrier used with any geotechnical engineering related material to control fluid (or gas) migration in a human-made project, structure, or system.
HDPE	: A type of plastic that is a linear polymer (a polymer that does not branch or cross-link) generated from ethylene using a catalysing process.

Ingestion	: The process of taking food, drink, or another substance into the body by swallowing or absorbing it.
Inorganic chemicals	: Relating to or denoting compounds that are not organic.
Leachate	: Leachate from a landfill varies widely in composition depending on the age of the landfill and the type of waste that it contains. It usually contains both dissolved and suspended material. The generation of leachate is caused principally by precipitation percolating through waste deposited in a landfill.
LDPE	: A tough, light, flexible synthetic resin made by polymerizing ethylene, chiefly used for plastic bags, food containers, and other packaging.
Neurotoxic	: Poisonous to the nervous system.
Photo degradation	: Photo degradation is the alteration of materials by light. Typically, term refers to the combined action of sunlight and air. Photo degradation is usually oxidation and hydrolysis.
Polystyrene	: A synthetic resin that is a polymer of styrene, used chiefly as lightweight rigid foams and films.
Polyvinylchloride	: A tough chemically resistant synthetic resin made by polymerizing vinyl chloride and used for a wide variety of products including pipes, flooring, and sheeting.
Saline conditions	: Containing or impregnated with salt.
Single Use Plastic	: Plastics that are designed to be used once and then disposed of or destroyed.
Sulphur Dioxide	: A colourless pungent toxic gas formed by burning sulphur in air.
Tropic level	: The position an organism occupies in a food web.

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Chapter 1

1.1 Introduction

This chapter introduces the background and conceptual foundation of the study, which focuses on the effects of Single-Use-Plastics (SUP). SUPS are plastic products that are disposed of after a single use, such as plastic bags, plastic cups, plastic cutlery and takeaway food containers. The study explores the effects of (SUP) on the ecology, its impact on the economy and initiatives to mitigate its usage. The chapter will review various management systems that lends itself to the concept of integrated management systems which can be useful as a tool for managing and controlling SUP. It will then present the statement of the problem, aim, objectives and the scope of the research. The chapter will conclude with a disposition of the structure of the dissertation.

1.2 Background

Drawing on studies [Reddy and Subbaiah (2014), Sebille, Spathi and Gilbert (2016), Crawford and Quinn (2017), Alimi, Budarz, Hernandez and Tufenkji (2018), Forrest, Giacovazzi, Dunlop, Reisser, Tickler, Jamieson and Meeuwig (2019), Alabi, Ologbonjaye, Awosolu and Alalade (2019) and Verster and Bouwman (2021)] society's reliance and use of SUP, has negatively affected the planet at a catastrophic level. Of concern, statistics purported by United Nations Environmental Programme (2022) suggest that internationally, approximately one million plastic bottles are consumed every minute. Furthermore, they report that globally, five trillion plastic bags are used annually. Consequently, the rapid accumulation of plastic waste is causing destruction of both terrestrial and aquatic ecosystems. World Wide Fund for Nature (2022) indicates that more than 8 million tons of plastic waste enters the oceans annually and resultantly single use plastic waste kills approximately one hundred million marine animals every year. They refer to current pollution trends and suggest that by the year 2025, the ocean will contain one tonne of plastic waste for every three tonnes of fish. By the year, 2050 there will be more plastic waste in the oceans than all marine life. This preliminary research advocates the radical and far-reaching consequences of over dependence on SUP.

A significant problem raised by, Schmaltz, Melvin, Diana, Gunady, Rittschof, Somarelli, Virdin and Dunphy-Daly (2020) is that around eight million metric tonnes of plastic waste enters our oceans each year. Marine life is then affected by the plastic waste entering the ocean, particularly by entanglement and ingestion of plastic debris. The Food and Agricultural Organisation (2018) reports potential concerns, in that approximately four billion three hundred thousand people obtain fifteen per-cent of their protein from fish. According to Jambeck and Johnsen (2015) by the year 2050, ninety-nine per-cent of all seabirds would have ingested plastic debris, thus causing further disruption and loss of food sources and biodiversity through the tropic levels of food webs. It is reasonable to surmise that the amount of plastic entering the oceans could consequently cause the deterioration

along the food chain and will eventually create a risk to food security. North and Halidin (2013) and Lebreton, Laurent, Andrady and Anthony (2019) advise that the by-products of plastic production have carcinogenic, neurotoxic and hormone disruptive effects to life forms. For example, this is evident from the by-products such as phthalates from the production of polyvinyl chloride and benzene from the production of polystyrene. Moreover, other toxins such as sulphur dioxide, dioxins and furans, are leeched into the environment and can adversely affect the health and lives of humans and animals exposed to the leachate. Figure 1.1 is a visual presentation of the quantities and sources of plastic waste in the ocean and further highlights the effects of plastic waste.

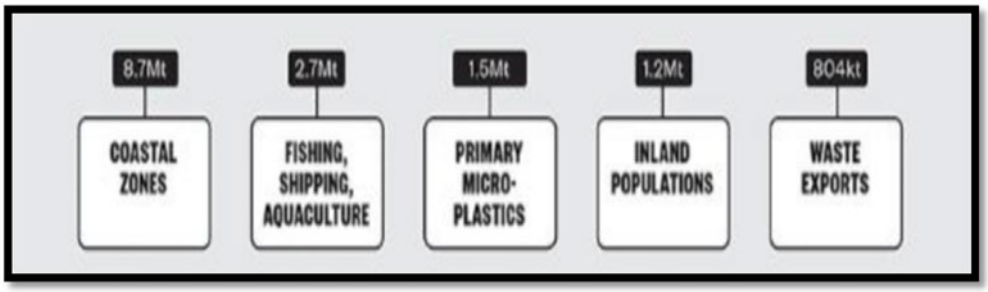

Figure 1.1: Graphic depicting the sources of ocean plastic waste in tonnes.
(Adapted from: UN Trade Statistics, 2018 and Lebreton, Slat, Ferrari, Sainte-Rose, Aitken, Marthouse, 2018)

A study published by the United Nations (2021) reports that only nine per-cent of the nine billion tonnes of plastic waste that has been produced this decade has been recycled. From this trajectory, it can be assumed that by the year 2050, there will be twelve billion tonnes of plastic waste in landfills with its leachate flowing into the environment. This plastic waste generated will account for approximately twenty per-cent of the global oil production and use at that point. This points to the notion that, by controlling SUP, it can also have a significant impact on saving from the production, distribution and usage of oil. In congruence with the finding above, Gewert (2018) moots that the destruction of the food chain and ecosystems caused by SUP, will directly affect human civilisation by impacting food security and producing poisonous by-products that will be leeched into the water systems. Moreover, there is the risk of potential housing, and agricultural land being reassigned by landfills and dumpsites. From the narrative presented in the foregoing discourse, it is reasonable to believe that the use of SUP has a global impact and thus the global community faces a predicament that is urgent and that extreme action is needed to preserve and prevent the potential collapse or irreversible damage to the ecosystems.

Wilson and Campbell (2018), Carrillo-Labell, Fort and Parras-Rosa (2020) and Zimon, Madzik and Sroufe (2020) point to the notion that the tools offered by different management systems can be perused to combat complex problems by simplifying different aspects of each problem and streamlining measures to combat obstacles as well as minimise inefficiencies and losses.

Fonseca and Domingues (2016) and Galli (2019) assert that management systems can provide a framework for developing processes and policies for organisations to manage their activities responsibly. Each type of management system provides a code of practice that is

specific to what an organisation wants to achieve. They explain that over the years, the implementation of different quality and environmental management systems have become popular in various types of organisations due to their ability to fast track and streamline processes, facilitating active management involvement and improving customer perceptions of products and services. Ismyrlis and Moschidis (2015), Zimon, Gajewska, and Bednárová (2016) Rybski, Jochemband Homma (2017) and Ahmudi, Purwanggon and Handayani (2018) assert that the, International Organisation for Standardisation (ISO) developed Quality Management Systems (QMS) such as ISO 9001:2015 which is a generic quality standard that can be applied to any industry that wants to improve the quality of their processes, services and products.

Jørgensena, Remmena and Mellado (2005), Fonseca and Domingues (2016), Rybski, Jochemband Homma (2017) Galli (2019) and Ain and Wahid (2022) express that the development of international quality standards has become paramount to maintain a sustainable and profitable organisation. ISO 9001:2015 is the latest version of the ISO quality management systems standard. When the first version of the standard was released in 1984, it provided basic organisational structure for documentation and processes that organisations could implement. In the succeeding years, the standard was updated four more times. The changes were due to the evolving customer and regulatory requirements. The first revision was made in 1994, to highlight Preventative Action. The second revision of the standard occurred in the year 2000. The change was primarily made in order for the standards ISO 9001 and ISO 14001 to be aligned with each other. This was to aid organisations which were running parallel systems to work with both standards harmoniously. The next version was published ISO 9000:2008. This revision occurred to harmonise generic quality management systems and supporting technologies that were presented in TC 176 - Quality management and Quality assurance. The last updated revision was in the year 2015. The main change in this revision was the substitution of Preventive Action with Risk Management and the deployment of the Deming's Plan-Do-Check-Act (PDCA) Cycle at all levels of an organisation. Bhuiyan and Baghel (2005), Moen and Norman (2010) and Yang (2017) report that Deming's continuous improvement model Plan Do Check Act cycle has evolved throughout the decades and has become an integral part of the ISO 9000 series. The evolution of the ISO 9000 series over the years highlights the ever-changing concept of traditional quality concepts such as process quality control, product design and customer service. This can allow for the use of international quality standards such as ISO 9001:2015 to extend beyond traditional quality concepts and can aid in providing a framework to guide different areas of research and management.

Balle (2007), Psomas, Fotopoulos, Kafetzopoulos and Motives (2011), Schoenherr (2012) , Ciravegna and Fonseca (2015), Lira, Salgado, Beijo and Da Silva (2021) and Abid, Ikram, Wu and Ferasso (2021) report that similar to the ISO 9000 series in the quality fraternity, the ISO 14000 series has become a predominant structure in the development of environmental management systems. After the initial publication of this Standard, the Standard was updated twice. The updated versions over the years addressed the changing technology, the awareness of environmental decay and the increase in public knowledge of the origins of products and

services. The first version of the Standard was published in the year 1996, which provided the basic framework for implementing environmental management documentation and procedures. The first revision of the Standard was published in the year 2004. The revision made minimal changes in the Standard that allowed for more focus on regulatory requirements. The second revision was introduced in the year 2015. The revision provided major structural changes in the standard such as the inclusion of the Plan-Do-Check-Act (PDCA) Cycle at all levels in an organisation. Additionally, the standard also entailed increased emphasis on environmental protection and not just pollution prevention as with the previous versions. Environmental protection could now include climate change mitigation, sustainable use of resources and deforestation initiatives. Thus, it is noteworthy, that the ISO 14001:2015 Standard in this format can be used in the development of a new management system to control SUP. An argument can be made that due to the structural layout of this Standard, it could possibly facilitate the development of a framework that can aid in other areas of sustainability.

Rebelo, Santos and Silva (2015) suggest that in order for an organisation to achieve sustained success, there are three pillars fundamental to sustainability that needs to be considered. These are economic growth of an organisation, considerations to the surrounding environment and social cohesion of employees. According to Asif, de Bruijn, Fisscher (2010) the modern definition of Quality has evolved to more than just the requirements of a product or service by different stakeholders and customers. The definition now includes promoting sustainability, ethical economic growth and transparency. Given the requirements, to achieve this, the emergence of operating multiple systems has become the norm in many organisations. Georgiev and Georgiev (2015), Gianni and Gotzamani (2015) and Purwanto, Putri, Ahmad, Asbari, Bernarto, Santoso and Sihite (2020) posit that due the difficulty associated with operating multiple systems in parallel, for example: high administrative and audits costs, cumbersome documentation and repetitive processes, integrating management systems are recommended as an alternative to stand alone individual systems. Rebelo, Santos and Silva (2015) are of the view that the integration of different management systems is vital for the developmental and economic growth. In recent years, the integration of management systems has become a necessity to achieve the optimum structure for different organisations.

ISO 9001:2015 is a standard developed by the International Organisation for Standardisation that provides a framework for implementing and managing a quality management system. While ISO 9001:2015 is primarily focused on quality management, its principles and structure can be adapted and applied to other management systems such as ISO 14001:2015 as well. By incorporating ISO 9001:2015 as a foundation, organisations can establish a consistent approach to management and leverage its proven framework to enhance other aspects of their operations.

Considering this commentary, it can be argued that quality is no longer seen as a restrictive concept but rather as a concept that integrates global perceptions on sustainability and ethical economic growth that facilitates the integration of quality and environmental management systems that could develop robust platforms system that could mitigate the impact of SUP.

Against the backdrop thus far, it can be appreciated that SUP has become a major problem with undesirable effects globally and poses several major environmental and social problems. The United Nations and several intergovernmental bodies have urgently called for action to be taken regarding SUP. This section will now elaborate on these bodies and the specific problems posed by SUP in South Africa.

Mankelow, Nyakinye and Petavratzi (2021) and Sianes, Vega-Muñoz, Tirado-Valencia and Ariza-Montes (2022) detail the development of the United Nations goals regarding sustainability. In September 2015, leaders from 193 countries came together at the United Nations assembly hall in New York City to agree upon a list of goals to tackle; climate change, economic stability, social inequality and energy. This list culminated in seventeen goals, called The United Nations Sustainability Development Goals (UNSDGs) that each of the one hundred ninety-three signatory countries agreed. Each of these goals underpins specific global problems that require urgent attention towards a 2030 Agenda for Sustainable Development.

The United Nations Sustainable Development Goals (2022) number twelve, Responsible Consumption and Production, calls for urgent intervention to be taken by organisations to ensure that it is achieved. This goal specifically targets SUP and its lifecycle. This goal has three specific sub points that relates to SUP that can form the basis for the development of a system to manage SUP;

- Goal 12.5: By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
- Goal 12.6: Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
- Goal 12.7: Promote public procurement practices that are sustainable, in accordance with national policies and priorities

Further to this, international bodies such as the Group of Seven (G7), Group of Twenty (G20) and Brazil, Russia, India, China and South Africa (BRICS) have made calls for urgent action to be taken regarding SUP and have reaffirmed the UNSDGs. Hajnal (2022) highlights that the G7 is an intergovernmental forum encompassing major economic powers such as the USA, UK, Canada, France, Germany, Italy and Japan and invited South Africa as a partner country in 2022. Cabernard, Pfister and Hellweg (2022) reports that the G20 is a broader intergovernmental forum that includes many developing countries along with the G7 countries. This grouping includes South Africa along with Australia, Saudi Arabia, Argentina, Brazil, Mexico, Turkey, South Korea, China, Russia, Indonesia and the European Union.

The G20 Summit (2019) in Osaka, Japan agreed to decrease plastic waste entering the ocean to zero per-cent by the year 2050. All nineteen countries and the EU had agreed to this commitment. However, there is no substantive plan or policy in place to achieve that target other than a commitment. There have been individual actions and policy decisions taken place by some countries in isolation but to achieve such an ambitious target holistic policies

and implementation plans are required. Herein creates a gap that requires a system to be developed to tackle SUPs over consumption.

At the G7 (2022) and the G20 (2022), all countries involved reaffirmed their commitment to the UNSDGs and the 2030 Agenda for Sustainable Development. The G7 (2022) went beyond that and agreed to implement policies that will align their financial markets to combat what is now coined as the "triple global crisis" of climate change, biodiversity loss, and pollution. Along with a commitment for sustainable management of chemicals and waste and possible options to reduce pollution overflow into developing countries. Alarmingly, Grant, Reid, Buesseler and Addiss (2022) and Whittingham, Earle, Leyva-de la Hiz, and Argiolas (2022) state that almost six years since the UNSDGs were agreed upon, little progress has been made towards them.

In an attempt to push countries to act faster against SUP, The United Nations (2022) adopted a resolution titled: "End plastic pollution: towards an international legally binding instrument". The resolution seeks to establish an international committee to develop international legally binding regulations on plastic pollution. However, the International Union for Conservation of Nature (2022) reports that the work of this committee will only be completed by the end of the year 2024, with possible implemented within two to five years. Given the urgency that is required to deal with SUP, a system has to be developed of urgency to tackle the massive problem of SUP.

1.3 Statement of the problem

A precautionary note issued by Kumar and Vani (2014), Godfrey and Oelofse, (2017) and United Nations (2021) is that South Africa is falling behind the European countries in managing SUP with initiatives like recycling and diverting plastic and other waste from landfilling and incineration along with a lack of legislation to manage SUP.

Of significant importance, Katircioglu, Feridun and Kilinc (2014), Ahmad, Draz, Su, Ozturk and Rauf (2018), Botha (2018), Maione (2019) and Vasarhelyi (2021) report that pollution from SUP has a detrimental effect on tourism in developing countries. As the aesthetic appeal and cleanliness of beaches, game reserves, nature reserves and rivers decline particularly due to plastic pollution, tourist numbers decline to these sites. Accordingly, small businesses, the local hospitality industries and vendors on the value chain suffer loss of revenue thus affecting their potential employment. In recent times, the repercussions of this have been starvation, homelessness and social unrest.

Chindasombatcharoen, Chatjuthamard, Jiraporn and Treepongkaruna (2021), Kostetckaia and Hametner (2022) and Singh, Singh, Alam and Agrawal (2022) underscore that there must be a nexus between economic and sustainable development that must be underscored in any policy or system that South Africa develops to ensure that employment and environmental targets are met. Hence, it can deduced that the problem experienced by Governments, is that the lack of legislation, inadequate landfill territory and detrimental effects to the tourism

industry has prompted the impetus to investigate and develop different measures and methods that could alleviate the impact of SUP in South Africa.

The integration of legislation and quality involves aligning the requirements of ISO 9001:2015, which is a globally recognised standard for quality management systems, with applicable legal and regulatory requirements in a specific industry or country. This integration must ensure compliance with ISO 9001:2015 and relevant legislation, which could result in effective quality management and legal compliance.

1.4 Aim

In light of the preceding discourse, the aim of this study will be to develop an Integrated Quality and Environmental Management System (IQEMS) to control the consumption, use and pollution of SUP in the South African context.

1.5 Objectives of this study

1. To explore selected quality and environmental standards and their applications in order to inform the development an integrative quality and environmental management system approach.

2. To conduct a strength, weakness, opportunity and threat (SWOT) analysis on the integrated management systems from literature and peer reviewed journals to select appropriate measures that can be included in the in the integrated management system developed in this study.

3. To conduct a systematic review to identify and consolidate legislative and economic initiatives undertaken by different countries, to mitigate or alleviate the impact of SUP, with a view to inform policy development for an IQEMS.

4. To develop an IQEMS to control the consumption, use and pollution of single use plastic for application in South Africa at the legislative level.

5. To conduct a perception study of the IQEMS developed to determine its feasibility to control the consumption, use and pollution of SUP by interviewing key role players in the industry.

1.6 Rationale of the study

Ahmad, Draz, Su, Ozturk and Rauf (2018) state that by ensuring, the optimum and responsible use of natural resources and protecting ecosystems can lead to economic and social sustainability for people living in developing countries. They encourage that securing legislation and policies to minimise or eliminate SUP will encourage the participation of local groups in the economy without deteriorating the biosphere. Cognisance of these recommendations will be explored throughout this study.

This study can provide various organisations with a generic integrated system that can manage their SUP use responsibly and ensure compliance to regulations and consistency of practice. Moreover, this study can be applicable to both local and international industries that may or may not comply with ISO 9001:2015 and ISO 14001:2015 individually. This integrated approach can be dovetailed to the organisations' existing systems or can be adopted as a new initiative. This will allow organisations, regulators and governments a uniform platform to base their practices and develop policies.

1.7 Outline of the Methodology

Chapter 3 will outline the research design adopted to accomplish the key objectives of the study. This study will follow of a qualitative study and will review the literature to consolidate appropriate recommendations into a suitable integrated management system for a South African perspective. Data will be collected using National Library of Medicine Catalogue Journals Search Tool PubMed, Scopus, Google and Web of Science to determine saturation and the sample size will be established once saturation is reached. These search engines have the latest database of peer-reviewed literature. A systematic review will be conducted to retrieve suitable data and the results will be presented in the form of graphs and tables.

The study will undertake a non-probability sampling technique and use purposeful sampling. The concepts of trustworthiness (credibility, transferability, confirmability and dependability) will be discussed to indicate the validity of this study. The chapter will then demonstrate Thematic Analysis and its use for the purposes of this study. Thereafter, the reliability of this study will be discussed in reference to the repetition and transferability of results from the data and the perception study to establish the potential applicability and usefulness of the IQEMS to current practice. The preliminary and Thematic Analysis results will then be presented.

1.7 Outline of the study

The layout of the dissertation will be as follows

Chapter 2: Review of literature

A review of literature will be conducted to gather information regarding various management systems commonly used in organisations. Further investigations will be conducted into international legislation regarding SUP and initiatives undertaken by the private sector to decease their reliance on single use plastic.

Chapter 3: Design of research and methodology

This chapter will illustrate the design of this research, introduce the Thematic Analysis to be conducted and present preliminary research.

Chapter 4: Results and discussion

This chapter will first present the theoretical grounding and development of the IQEMS. Thereafter, the chapter will evaluate the findings from the perception study conducted. These findings will be presented graphically with an interpretation of the results. The benefits hoped to be achieved from the use of the integrated quality management system will also be shown.

Chapter 5: Conclusions and recommendations

The study will close with conclusions and recommendations for use of the integrated quality management system. It will also highlight the opportunity for future research.

Chapter 2

The literature review will be guided by the objectives of this study. Accordingly, the literature review will be divided into eight sections. The first two sections, will evaluate quality and environmental management systems. First, examining their purpose, secondly investigating their development and lastly identifying their strengths and weaknesses. Thereafter, salient information will be extracted and applied to the IQEMS.

The third section will scrutinise the purpose, use, strengths, weaknesses and advantages of integrated management systems. This part of the literature will also show the results of the SWOT analysis conducted on integrated management systems.

The following two sections of the literature review will investigate the research and initiatives that the private sector has undertaken with regard to mitigating the use of SUP.

The last section of this chapter will highlight legislation from different countries in relation to their management of SUP.

Pertinent information from each section will be extracted and applied to inform the development of the IQEMS. The chapter will close with a summary of the literature presented.

2.1 Quality Management

This section will review Quality Management Systems – ISO 9001:2015. The generic nature of ISO 9001:2015 means that it is designed to be applicable to any organisation, regardless of its size, industry, or sector. It follows a Process-Based Approach and emphasises the importance of compliance, Continuous Improvement, and the involvement of Top Management. It is envisaged that the literature presented in this section will aid in development of the IQEMS.

2.2.1 Quality Management and ISO 9001:2015

This subsection will introduce quality management and the ISO 9001:2015 Standard. It will show the relevance of the Standard to this study and its position in the IQEMS that will be proposed.

Chaitanya, Chinni, Jyothia, Reddy (2018), Demilly, Charki, Jeoffrion, Lyonnet, O'Brien and Martin (2018) and Al-Saffara, and Obeidat (2019) propose that any successful organisation depends on three prime aspects: quality of products or services, safety of products or services and the efficacy of processes to drive its viability. They further advise that adhering to these aspects can reduce expenses, minimise inefficiencies in processes and improve customer satisfaction. It can be inferred that quality management can be used to develop formal systems, in order to achieve the optimum use of quality, safety and efficacy.

Katerina and Aneta (2014) and Zeibote, Volkova and Todorov (2019) express that there is a high degree of correlation between globalisation and competition. This has resulted in elevated levels of competition in supply chains and has forced organisations to adapt to new economic, social and environmental challenges. Accordingly, Quality Management Systems (QMS) were developed in order to sustain growth accompanied with competitiveness. Furthermore, Bhuiyan and Alam (2014) and Dupendant (2016) report that globalisation and competition incentivised the development of international standards for quality management systems. International Organisation of Standardisation (ISO) is an international body that sets and develops standards for organisations. This Body is composed of representatives from various national standards' organisations and member states. The role of the Body is to ensure the efficient operation of different types of organisations globally while managing financial sustainability and determining product and service risks. Their goal is to strengthen the links between standardisation and public policy.

There is a consensus among authors; Tukiran (2016), Rybski (2017), Ahmudi, Purwanggon and Handayani (2018), Galli (2019), Domingues, Reis, Fonseca, Avila and Putnik (2019), Purwanto, Asbari and Santoso (2020), Demir, Budur, Omer and Heshmati (2021) and Ain and Wahid (2022) that quality management systems can aid in advancing an organisation in the following ways:

- Increase focus on process improvement, audit processes and management reviews. This aids in ensuring that processes have a positive contribution to the strategic goals of any organisation.
- Provides a structure for Preventative Action and Continuous Improvement which stimulates opportunities for improvement in products and services that are critical to customer satisfaction. Preventative Action and Continuous Improvement hones in on wasteful problems and inefficient processes thereby reducing ineffective operations.
- Provides tools such as Risk Based Thinking and Performance Evaluation to create and maintain a comprehensive framework in organisations encompassing quality, processes, customer requirements and supplier relationships.

Overall, ISO 9001:2015 offers several advantages beyond just financial gains. It helps organisations improve compliance, increase efficiency, manage risks, engage employees, streamline communication, comply with regulations, and foster a culture of continuous improvement.

2.2.2 The development of quality management systems

The ensuing section will discuss the evolution of quality management systems over the past four decades. The purpose of examining this literature is to draw attention to the development and expansion of the concept of quality and how it can possibly be used in the development of the IQEMS.

Fonseca and Domingues (2016) advise that in 1984, ISO published the first version of ISO QMS 9000. The original ISO 9000 standard was a generic standard that provided structure to

achieve efficient products and services by guiding simple management practices towards profitability. Over the years, ISO continued to update this management system. In 1994, the first revision of the standard was published to draw more attention to Preventative Action. The next revision (in 2000) was published to ensure that the system focused on Process Management (Process Approach) as opposed to reactive quality control procedures. In addition, emphasis was placed on Customer Satisfaction and Continuous Improvements. Jørgensena, Remmena and Mellado (2005) attest that in the updated ISO 9000:2000 version, the standard began an alignment with ISO14001:1996. This was to aid organisations which were running parallel management systems to consolidate their practice into one-integrated system. In 2008, the third revision was developed to begin the harmonisation of generic quality management systems and supporting technologies that were presented in TC 176 - Quality Management and Quality Assurance. The evolution of the ISO 9000 series highlights the evolution of quality from being a restrictive concept to be more encompassing.

Adversera (2019) adds that in 2015, ISO published an updated version of ISO 9001:2015. The updated version considered the exponential increase in the availability of new technology, new product requirements, as well as the complexity of the ever-changing global supply chain. It outlined a framework for improving quality and also provided and explained the vocabulary in order for an organisation to understand all the requirements of products, processes and services. In doing so this ensured that, all customer expectations were met and all other requirements fulfilled in an efficient manner. Consequently, if followed the organisation would be able to reduce manufacturing and labour costs, meet regulatory requirements and can expand into different markets.

According to Fonseca and Domingues (2016) and Galli (2019) one of the key changes from ISO 9001:2008 to ISO 9001:2015 was the substitution of Preventive Action with a Risk-Based Thinking approach. Isa and Rahman (2017) describe risk as an inherent and an integral part of any system that must be managed as a component in the development of a comprehensive quality management system. A Risk Based Thinking approach is a proactive measure to determine faults that may occur during any part of the process and takes into account any risk that may occur when designing and maintaining the organisation's QMS. By accounting for risk throughout the system, the probability of achieving an organisations' stated objectives, they moot, are improved. Moreover, adherence to Risk management establishes a proactive culture of improvement and improves the knowledge base of the system, which can be useful in identifying liabilities in the IQEMS.

Jankensgård (2019) suggests that in order for risks to be managed, they need to be identified, assessed, and categorised into two groups, for example: internal and external to the organisation. Internal risks are those that are associated with obstacles that can occur within an organisations operation, for instance quality control defects or health and safety accidents, to name a few. External risks refer to those that occur out of an organisations control such as political instability and environmental vulnerability, among others. Given this, internal risks, he advises are more likely to occur than external risks but if external risks do occur, they tend to have far more damaging and costly effects than internal risks. Internal risks such as

ensuring that robust procurement and supplier management processes are in place are vital to an organisations risk management process.

Martins, Sanches da Silva, Sampaio and Gabriel (2021) highlight that both internal and external factors are accommodated in ISO 9001:2015 and that it ensures that risks are systematically addressed, minimising their negative impact on quality. Given the nature of this study and findings from the statement of the problem, occurrences such as political instability and environmental vulnerability are likely to affect policy that may emerge from adherence to the IQEMS.

According to Heidari, Khanbabaei and Sabzehparvar (2018) and Zimon, Madzik and Sroufe (2020) a risk management approach in supply chain management has gained prominence in recent years. This has stemmed from organisations ensuring that their supply chain have the ability to meet evolving policy and production requirements of consumers to maintain business continuity. Furthermore, they report that ISO 9001:2015 provides avenues for streamlining of the supply chain and active development of risk based thinking. This will be useful in the development of the IQEMS.

Tang (2006), Hu-Chen, Long and Nan (2013) Cagnin, Oliveira, Simon, Helleno and Vendramini (2016) propose a conceptual model for selecting suppliers by categorising them according to risks. They consider risks as two different dimensions, namely: operational and supply interruption. The operational dimension deals with internal process uncertainties and procedures an organisation uses to respond to these uncertainties; for example, an organisations procedure concerning a sudden customer demand for large quantities of a product. The supply chain dimension is also associated with possible interruptions in the supply chain such as political instability and natural disasters. These finding are supported by Jankensgård (2019) and can be considered as a focal point for this study.

According to Fonseca, Domingues, Machado and Harder (2018) a significant change was made when the ISO 9001:2008 was updated in 2015. In the updated ISO 9001:2015 Standard, the concept of Management Responsibility that was present in ISO 9001:2008, was replaced with Leadership. This change implied that management now had to show their level of commitment in managing the quality management system. A considerable alignment can be drawn from [Tukiran (2016), Juanzon and Muhi (2017), Rybski (2017), Ahmudi, Purwanggon and Handayani (2018) and Ong, Purwanto, Supono, Hasna, Novitasari and Asbari (2020)] on the importance of involving Top Management in all process and procedures in an organisation. Consequently, it can be deduced that in order for the IQEMS to be successful, high levels of Management will have to be committed to the Policy and Objectives.

Chen, Anchecta, Lee and Dahlgaard (2016) report that the ISO 9001 Standard, is the most adopted quality management system in the world. Globally, there were over 1.3 million certificated organisations by the year 2016. Hence, it can be concluded from the wide use of this Standard internationally; that is suitable to use as a foundation or platform for developing a management system.

Friedly and Schneider (2016), Chen, Anchecta, Lee and Dahlgaard (2016), Anttila and Jussila (2017), Salazar, Tigre and Tubón-Núñez, Carrillo and Buele (2019) advise that ISO 9001:2015 is the foundation of any type of quality management system because it provides the framework for Policy Development. Clause 5, Policy, in ISO 9001:2015 provides the framework for a Policy Statement and Objectives of the organisation as well as the action plan for their measuring and monitoring. This resonates with research conducted by McLellan (2014) and UNEP (2018) – that the lack of policy development when South Africa tried to curb the consumption of SUP bags. Consequently, it is reasonable to assume that the use of ISO 9001:2015 can be favourable in the development of a new system.

2.3 Environmental Management

Environmental management focuses on the surrounding environment of the organisation; encompassing the interrelation of different elements such as air, water, fauna, and flora with an organisations processes and procedures. In order to support environmental management, ISO has developed environmental management systems such as 14001 to aid in providing structure for environmental management.

Environmental Management: ISO 14001 is an environmental management standard that shares a similar structure with ISO 9001. Organisations can combine the two standards to potentially create an Integrated Management System that could address both quality and environmental compliance. This opportunity has been used to develop the IEQMS system in this study.

2.3.1. Environmental management, environmental management systems and ISO 14001:2015

This subsection will introduce environmental management systems, specifically ISO 14001:2015. It will show the salient aspects of the Standard that will be used in the development of the IQEMS that will be proposed in this study.

Castro, Gregorio, Amores-Salvadó, and Navas-López (2016) and Dbouk, Wassim, Jin, Wang and Wan (2018) report that organisations in the past, used to have a perception that pursuing environmental goals was antithetical to sound business strategy. However, in recent years there is a growing market and demand for products that are produced from organisations that minimise their environmental impact. The calls for the responsible practice by organisations have featured prominently in reports from the G7, G20 and BRICS intergovernmental bodies. In order to keep up with the growing demand of products globally and increasing competition of similar products and services, environmental management has been widely encouraged, developed and is being widely used.

Boiral, Guillaumie, Heras-Saizarbitoria, Valery and Tene (2017), Wairon, Purwanggono and Handayani (2018), Deyassa (2019), Carrillo-Labell, Fort and Parras-Rosa (2020) and Ali, Belal, Roy, Rahman and Raihan (2022) assert that environmental management allows for organisations policies and procedures to be focused on minimising their negative environmental impact. An environmental management system, similar to a quality

management system, is the framework that an organisation uses to develop processes and procedures to meet goals and targets. This provides a systematic approach to the management of the organisations development and environmental goals. The management system does not prescribe predetermined performance levels but rather allows the organisation to set their own attainable environmental impact goals. Therefore, an organisation can determine metrics of how their goals are to be measured and monitored, this can be useful in the IQEMS. Similar sentiments are echoed by Friedly and Schneider (2016), Chen, Anchecta, Lee and Dahlgaard (2016), Anttila and Jussila (2017), Salazar, Tigre and Tubón-Núñez, Carrillo and Buele (2019) in the use of ISO 9001:2015.

Ciravegna and Fonseca (2015) and Laaraifi, Aouane, Saadoune, Chaouch and Echchelh (2017) state that ISO 14001:2015 is the most internationally recognised environmental management system. ISO 14001:2015 is used to measure the intensity of the environmental management system present in an organisation. Once this is ascertained, an organisation is then able to adjust its environmental system to an optimal level regarding their environmental impact. The British Standards Institution (2019) reports that at an optimal level of ISO 14001:2015 certification, fifty-seven per-cent of organisations reported a reduction of waste reduction, seventy-six per-cent reported on regulatory compliance, sixty per-cent outlined that they have seen significant increase in trust in their businesses and fifty-two per-cent disclosed that they experienced an increase in competitive edge among business offering similar services and products. In light of the information presented by Ciravegna and Fonseca (2015) and Laaraifi, Aouane, Saadoune, Chaouch and Echchelh (2017) it can be gleaned that ISO 14001:2015 can be used as a suitable standard in the development of a management system.

2.3.2 The development of environmental management systems

This part of the study will draw attention to the evolution of environmental management systems over the past three decades and will present potential advancements that can be used in the development of the IQEMS.

Psomas, Fotopoulos, Kafetzopoulos, Motives (2011), Schoenherr (2012) and Ciravegna and Fonseca (2015) express that environmental management began towards the end of the 1970's. It slowly began in organisations that desired to move in the direction of 'green manufacturing'. The overall goal of an environmental management system was to reduce an organisations impact on the environment while sustaining a profit margin in order to achieve sustainable success. In 1996, the first version of ISO 14000 was published. The standard was then updated in years 2004 and 2015. Balle (2007) reports that the updated ISO 14000 version that was published in 2004 only had minor changes throughout the standard. For instance, some of these changes entailed enhancing the need for following regulations and other environmental initiatives such as reducing carbon emissions. Another addition to the updated standard was that objectives and targets must be measurable. It can be inferred that this addition would allow the organisation to assess their current practice and compare it to their desired practice and thus be able to act accordingly to meet their goals.

Wairon, Purwanggono and Handayani (2018) added that the ISO 14001:2015 Standard, focused not just on prevention of pollution (ISO 14001:2004) but on the protection of the environment (ISO 14001:2015). Recognising this highlights the Standards evolution, which now includes a variety of environmental challenges such as climate change mitigation and sustainable use of resources. These distinguishing features further shows that ISO 14001:2015 could be beneficial in the development of the IQEMS as it addressees the current difficulties.

According to Ajidarma, Rahmadini, Trusaji and Irianto (2018) some of the new components in ISO 14001: 2015 are the addition of product life cycle analysis, increased management involvement and most prominently the implementation of the Plan, Do, Check, Act (PDCA) Cycle (depicted in figure 2.2) for the entire management system.

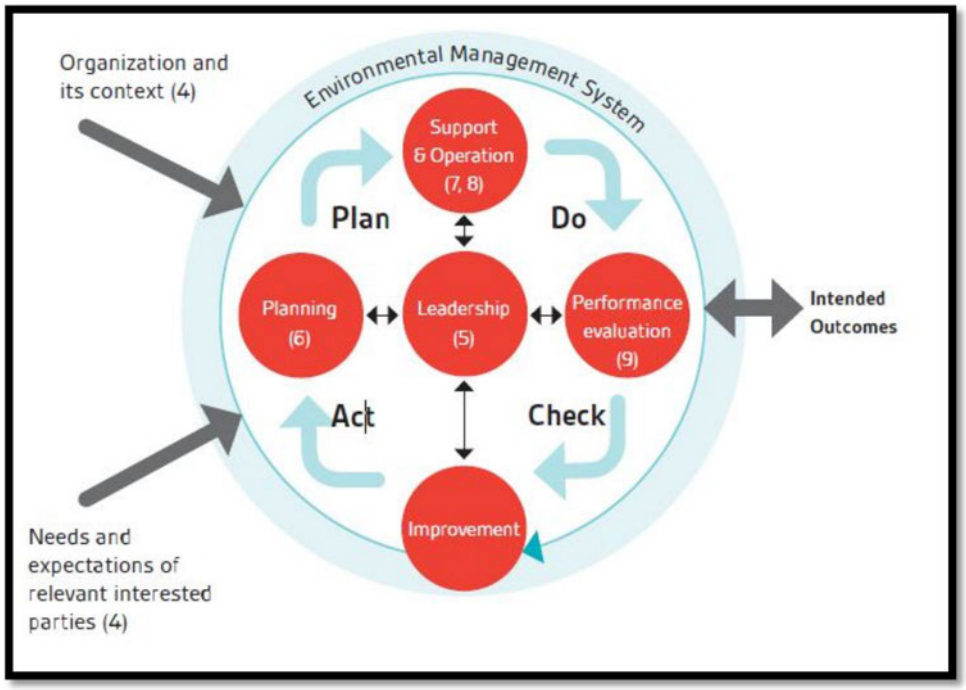

Figure 2.1: Model depicting the Plan, Do, Check, Act cycle
(Sources: SABS 14001:2015)

Moen and Norman (2015) express that Walter Shewhart first developed the concept of the Cycle for Continuous Improvement in 1939 and that in the 1950's Edward Deming worked off the Shewhart Cycle to develop the most commonly used version of the PDCA Cycle.

Ciravegna and Fonseca (2015) Boiral, Guillaumie, Heras-Saizarbitoria, Valery and Tene (2017), Budi, Karuniasa and Nurcahyo (2020) and Bravi, Santos, Pagano and Murmura (2020) discuss that the Plan, Do, Check, Act (PDCA) cycle in the ISO (2014) Standard is a model that provides a structure for Continuous Improvement in an organisation. The model covers all the clauses in the Environmental Standard, ISO 14001:2015. The "Plan", part of the cycle entails the development of the environmental policy; this includes goals, objectives, organisational commitments and regulatory frameworks. "Do" requires, the implementation and operation of the organisations Environmental Policy. This encompasses; assignment of

roles and responsibilities, developing documentation and processes, organising training and awareness as well as determining Emergency Preparedness. “Check”, is the monitoring and measuring of the Environmental Management System. This is to ensure that goals and target set out in the environmental policy are met. Finally, “Act”, is the Continuous Improvement part of the cycle. In this stage, the Management Review is generally completed. This aids in evaluating the organisations overall commitment to the environmental management system.

Drawing from Ciravegna and Fonseca (2015), Det Norske Veritas (2016), Mazzi, Tonio, Mason, Aguiari and Scipioni (2016), Boiral, Guillaumie, Heras-Saizarbitoria, Valery and Tene (2017), Budi, Karuniasa and Nurcahyo (2020) and Bravi, Santos, Pagano and Murmura (2020) the PDCA cycle is a fundamental concept used in both ISO 9001:2015 and ISO 14001:2015. While these standards are specific to different domains, as stated earlier, they share common elements in their approach to continual improvement. These common elements are: Continuous Improvement, System Approach, Risk-based thinking and Feedback-loops. For continuous improvement, the PDCA cycle provides a systematic framework to identify areas for improvement, implement changes, monitor their effectiveness, and make adjustments as necessary. This cycle helps organisations in both quality management and environmental management to evolve and enhance their performance over time.

The next common element is a systematic approach: Both ISO 9001:2015 and ISO 14001:2015 promote a systematic approach to management. The PDCA cycle provides a structured method to plan activities, execute them, evaluate the results, and take appropriate actions. This systematic approach ensures that processes are managed consistently and improvements are based on data-driven analysis.

Thirdly is the development of risk-based thinking: Both standards encourage organisations to adopt a proactive approach to identify and manage risks. The PDCA cycle helps in this regard by enabling organisations to plan for risk prevention or mitigation, implement measures to address identified risks, check the effectiveness of risk controls, and take corrective actions if necessary. By incorporating risk-based thinking into the PDCA cycle, organisations can identify and address quality and environmental risks to improve their overall performance.

Lastly, feedback loops, both ISO 9001:2015 and ISO 14001:2015 require organisations to monitor and measure their performance against established objectives, analyse the collected data, and use it to make informed decisions. The feedback loop in the PDCA cycle ensures that organisations learn from their experiences, adjust their strategies, and make improvements based on the feedback received. Based on preceding narrative, the PDCA cycle can be used as a tool in the development of the IQEMS.

Det Norske Veritas (2016), Mazzi, Tonio, Mason, Aguiari and Scipioni (2016) Wang, Lin , and Weber (2016) and El Hour, Aouane and Chaouch (2017) advise that the key aspect of an Environmental Management System is the development of an Environmental Policy. This is to ensure that the organisation’s goals are documented and that they have a direction to

achieve them. The Environmental Policy is meant to be a declaration of the organisations commitment to environmental sustainability and must include;

- Aims, objectives and targets of the organisation and how they will be achieved.
- Prevention of pollution commitments
- Commitments to Continuous improvement
- Adherence to legal requirements

Resonating with the aforementioned authors, it can be perceived that the development of the Environmental Policy for the IQEMS of this study could include aims, objectives and targets of how to control the consumption, use and pollution of SUP towards sustainability.

2.4 Integrated management systems

From the literature presented thus far, it is evident that each of the Management Systems discussed provides its own contribution to developing different types of frameworks and processes. Consequently, this presents an opportunity to develop a new integrated management system for controlling SUP that integrates existing structures of management systems.

ISO 9001 and ISO 14001 share a common structure and can be integrated into a single system, offering several benefits. This similarity allows organisations to streamline their processes, reduce duplication, and establish an integrated management system that addresses quality and environmental aspects simultaneously.

Thus, it can be reasoned that the integration of the codes of practice or management systems in this study provides a means to streamline the number of activities from different management systems to be consolidated into a single system for ease compliance for potential governance forthcoming.

2.4.1 Understanding integrated management systems

This subsection will briefly discuss an overview of integrated management systems and present its usefulness. Although ISO 9001:2015 is specifically tailored for quality management, many organisations have successfully integrated its principles into other management systems to improve overall performance and efficiency

The Charted Quality Institute, United Kingdom (2015) states that integration is a process in which different management systems converge into one coherent system that represents all the organisational requirements. Over the past decade, organisations have been driven by different requirements from customers, standards and regulations. To achieve these requirements, organisations have implemented quality, health and safety, environmental and risk management systems to name a few.

Čekanová (2015) suggests that the most commonly integrated management systems are Quality Management Systems – ISO 9001:2015, Environmental Management Systems – ISO

14001:2015 and Occupational Health and Safety Management Systems - ISO 45000:2018. The integration of these management systems can be accomplished because ISO 9001 and ISO 14001 are compatible and ISO 45000 is modelled on ISO 14001. In addition, all three management systems are based on the Process Approach Model and the PDCA Cycle. Additionally, Management Systems now purport that, Food Safety Management Systems – ISO 22000:2018, Automotive Quality Management Systems - ISO/TS 16949:2009 and Social Responsibility Management Systems – ISO 26000:2010.

A compelling argument is presented by Douglas and Glen (2000), Wright (2000), Simon, Karapetrovic, and Casadesus (2012), Moumen and El Aoufir (2017) and Muzaimi, Chew and Hamid (2017) that integrated management systems are attractive for an organisation to peruse because of several key advantages. Some include that: they allow for the development of simpler management systems (reduced amount of paperwork and the removal of duplicate processes and procedures), lower audit and management costs and provides simplified regulatory requirements. Figure 2.2 gives a visual representation of overlapping activities that occur from integrating management systems that result in streamlining processes that is easier to manage.

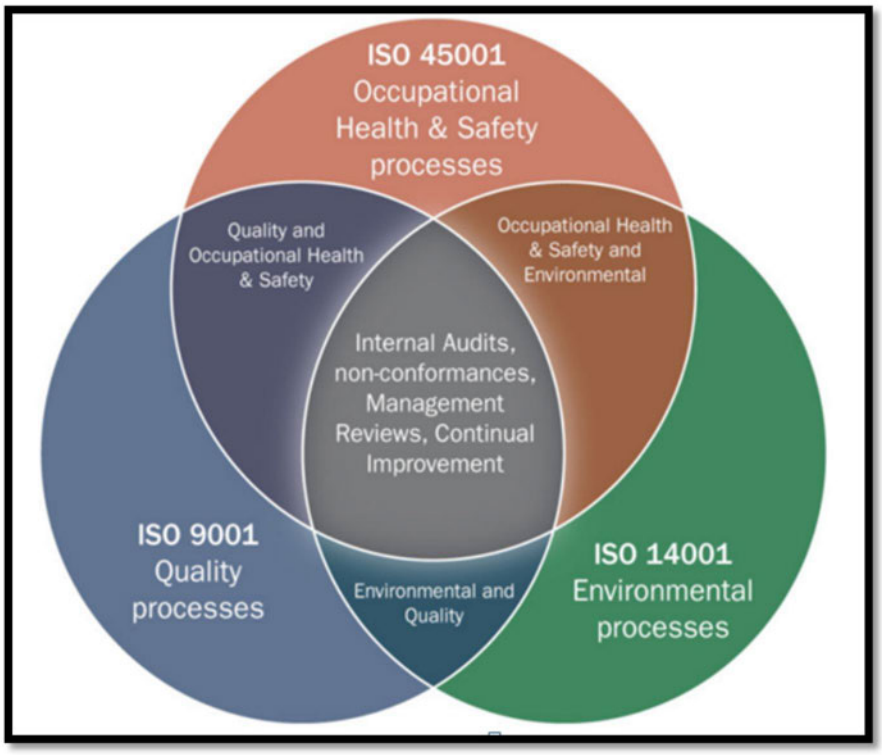

Figure 2.2: Figure depicting the integration of different management systems (Sources: QMS UK, 2022)

2.4.2 The development of integrated management systems

Wilkinson and Dale (1999) and Douglas and Glen (2000) report that Europe was the first to develop integrated management systems because organisations required certification to different Standards. This slowly became a trend that seeped into the international market and

began the need for certification with different Standards due to updated legislation in the European Union regarding the Environmental Protection Act, Health and Safety at Work Act and the Control of Substances Hazardous to Health Regulations.

When integrated management systems were first introduced, Jonker and Klaver (1998) proffered that either the quality management system or the environment management system could be developed first and then other management systems could be integrated. However, the following year, Wilkinson and Dale (1999) suggested four ordered steps for the integration of management systems. The first step was to achieve full certification in ISO 900. The next step was to highlight linkages between different management systems and begin by integrating requirements that are common to the standards. The third step was to combine quality management systems and environmental management systems with further management systems. The fourth step was having the integrated system audited to achieve a 'true' integrated management system. This method was later substantiated by Douglas and Glen (2000), Wright (2000), Fresner and Engelhardt (2004), Zutshi and Sohal (2005), Jørgensen, et al (2005) López-Fresno (2010), Simon, Bernardo, Karapetrovic, and Casadesus (2011), Simon, Karapetrovic, and Casadesus (2012) and Moumen and El Aoufir (2017). The method has a high degree of substantiation. Therefore, it can be concluded that this format is a suitable method for integrating management systems.

Jonker and Karapetrovic (2004), Jørgensen, *et al.,* (2005) and Rocha, Searcy and Karapetrovic (2007) assert that there are no specific constituents that are required for an integrated management system. However Tarí, Molina-Azorín and Heras (2012), Santos, Barros, Mendes and Lopes (2013), Kleinová and Szaryszová (2014) and Dahlin and Isaksson (2017) state that the most proficient way to begin integrating management systems is to highlight the common points that overlap between the different systems. Some of areas that overlap can include the Scope, Objectives, Customer Requirements, Process Approach and Policy Statements. International Organisation for Standardisation (2001) advises that when integrating different types of management systems and drafting the framework for their operation the Plan, Do, Check, Act cycle phases must be considered. Early possible overlapping areas in the development of the IQEMS are organisational responsibility, resource management, raw material acquisition and legal requirements.

Of particular interest, Asif, Fisscher, de Bruijn and Pagell (2010) developed different 'drivers' for corporate motivation concerning integrated management systems. They categorise them as the following drivers: operational, regulatory, financial, marketing, and social. Operational drivers refer to those areas that deal directly with the supply chain and process efficiency. These two areas emerged in section 2.2.2 as focal points for the IQEMS.

Regulatory drivers refer to legal requirements that have to be followed in an organisation in terms of environmental, health and safety, social and quality requirements. Financial drivers deal with financial gains that can result from an integrated management system. The fourth set of drivers are marketing drivers, which refers to customer and executive board requirements for integrated management systems. This discourse suggests it might be worth nothing that these drivers can be useful in the development of the IQEMS for this study.

The final set of drivers is social drivers. These drivers come from public pressure in the form of legal requirements prescribed by the Government. An example of this driver can be seen in Sudan, in an organisation called 'Talisman'; an oil organisation that had to leave the country due to public pressure because they were violating the environment and social rights of the inhabitants of the native land. This can be seen as a key motivational driver for prompting environmental change by organisations. In line with this Boer, Haleem and Farooq (2014) and Misopoulos, Michaelides, Salehuddin, Manthou and Michaelides (2018) advise that public pressure can play an essential role in expanding and developing legal requirements regarding the environment. Based on these findings social drivers can form an important component of Policy Development in this study.

Psomas, Fotopoulos, Kafetzopoulos and Motives (2011), Samy, Samy and Ammasaiappan (2015), Bernardo, Simón, Taríand Molina-Azorín (2015) and Martí-Ballester and Simon (2017) propose that, after investigating ISO 9001:2015 and ISO 14001:2015, there are several areas that are common to both Standards. In the context of this study, areas that arise from integrating ISO 9001:2015 and ISO 14001:2015 are: the foundational use of the PDCA cycle, Communication programmes, Goals, Scope, Policy Development, streamlining of supply chain management and assignment of responsibility to Top Management.

A concern raised by, Zeng, Tam, Khoa (2010) is that there are challenges that arise from the integration of management standards. An example of this is the misunderstanding of integration concepts and a lack of clear and concise guidelines. Methods to overcome these challenges will be investigated further in the chapter.

2.4.3 Strength, Weaknesses, Opportunities and Threat analysis for Integrated Management Systems

It is evident that integrated management systems have provided the means for streamlining of organisational processes and transformation. This subsection will delve into assessment tools on integrated management systems with the goal of determining the optimal feasibility of integrated management systems pertinent to this study.

Vaishampayan (2012) and Teece (2017) identify strengths, weaknesses, opportunities and threats (SWOT) analysis as an assessment tool used to organise information into the positives (strengths and opportunities) and negatives (weaknesses and threats) for any industry, organisation or model. Bonnici and Galea (2015) report that SWOT analysis, identifies the internal, strengths and weaknesses in an organisation and the external, opportunities and threats that may affect an organisation.

In the context of this research, strengths (S) will be the internal positive attributes of integrated management systems, weaknesses (W) will be the internal negative attributes of integrated management systems. Opportunities (O) will be external positives factors that the implementation of integrated management systems could bring and threats (T) will be external negative factors that may result from the implementation of integrated management systems.

Stables (2001) reports that the use of business improvement tools such as SWOT analysis, Scenario Analysis and Gap Analysis aids in the development of management systems and enhances the credibility of the system. This is accomplished by showing stakeholders the research and structural development that created the system. In order to determine the feasibility and practicality of developing an integrated management system, a SWOT analysis will be conducted on integrated management systems.

It was gleaned from literature that the first part of conducting the SWOT analysis would be to determine the internal strengths of implementing an integrated management system. Therefore, peer review articles on integrated management systems were sourced and reviewed then strengths were derived from them. The common strengths were allocated into groups and the authors presented. The results of the strengths are presented in the Table 2.1.

Table 2.1: The strengths of integrated management systems derived from literature.

Strengths	References
Simplified management systems	Douglas and Glen (2000), Wright (2000), Zutshi and Sohal (2005), Fresner and Engelhardt (2004), Jørgensen, *et al* (2005) López-Fresno (2010), Simon, Bernardo, Karapetrovic, and Casadesus (2011), Simon, Karapetrovic, and Casadesus (2012) Moumen and El Aoufir (2017) , Barbosa, Bueno da Silva, Fernandes de Souza and Morioka (2021) and Wang and Lui (2022).
Improved allocation of resources	Wright (2000), Jørgensen, *et al.,* (2005), Rocha, Searcy and Karapetrovic (2007), Zeng, Shi and Lou (2007), Salomone (2008) and Barbosa, Bueno da Silva, Morioka, Norte da Silva and Fernandes de Souza (2023)
Management and audit cost reduction	Wright (2000), López-Fresno (2010) and Simon, Bernardo, Karapetrovic, Casadesus (2011) and Barbosa, Bueno da Silva, Morioka, Norte da Silva and Fernandes de Souza (2023)
Increased level of communication between departments	Jørgensen, *et al.,* (2005), Salomone (2008), López-Fresno (2010) and Barbosa, Bueno da Silva, Fernandes de Souza and Morioka (2021).
Defined responsibility allocations	Jørgensen (2007), Salomone (2008) and Wang and Lui (2022).

Capitalising on the information provided in Table 2.1 there are several major strengths that can be derived from the implementation of integrated management systems. From the literature reviewed, there is consensus that the streamlining of management systems results in the simplification of management systems. This presents itself in the forms of minimised

bureaucracy, reduction of paperwork, and the removal of parallel policies, processes and procedures. Better allocation of resources is associated with optimisation of financial and human resources by minimising or merging costly and redundant processes. This allows financial and human resources to be freed creating the opportunity for more employees to be trained, increase marketing campaigns and expand product development capabilities. Another point worth mentioning is that, there can be significant financial savings from a reduction of the number of audits and the frequency at which they are undertaken.

Moreover, integrated management systems allowed for heightened and defined allocations of responsibility, thereby reducing repetitive roles in an organisation. The last strength from the literature reviewed was enhanced communication levels that existed between different departments due to the merging of systems, concomitantly different departments and procedures. United Arab Emirates, Ministry of Climate Change and Environment (2021) reported using integrated management system policies to help align the ministries' processes, principles and guidelines. This was done to ensure that resources were allocated efficiently and communication programmes were effective.

In the context of this study, Ansell, Sørensen and Torfing (2017) and Hudson, Hunter and Peckham (2018) provide supplementary information that one of the main failures of policy implementation at the legislative level is that there are too many common processes and procedures in departments and ministries. One of the main reasons for inefficiencies and hindrances in policy implementation is the duplication of roles and responsibilities in government. This suggests that the use of integrated management systems can be useful in this study.

Even though several advantages are associated with integrated management systems some weaknesses have emerged from the literature review. The succeeding table will portray them.

Table 2.2: The weaknesses of integrated management systems derived from literature.

Weaknesses	References
Lack of knowledge and information on how to integrate management systems	Wilkinson and Dale (2000), Zutshi and Sohal (2005) and Salomone (2008)
Cultural resistance to change	Wilkinson and Dale (2000), Jørgensen, *et al.,* (2005) and Zeng, *et al* (2007),
Lack of intellectual resources	Karapetrovic and Willborn (1998), Wassenaar and Grocott (1999), Matias and Coelho (2002) and Zutshi and Sohal (2005)

From the internal attributes that could affect an integrated management system some prime insights could be drawn from the table. For example, the main drawback for organisations when dealing with integrated management systems is that there is lack of understating on how to plan and implement an integrated management system. To overcome this problem, when the IQEMS is developed, there will be detailed guidelines on how to plan and then implement the system.

The next valuable insight that can be exacted from the table 2.2 is that there is an internal mind-set among the employees that is difficult to change. In conjunction to this insight, Bhat (2013) and Halawi and Haydar (2018) express that training is one of the most effective tools to overcome employee resistance. To supplement this finding, training is a main clause in ISO 9001:2015 and ISO 14001:2015. Masood, Mujtaba, Khan, and Ali (2014) studied organisations from different sectors in Pakistan that adopted integrated management systems. They found that that there was a lack of training and understanding when implementing integrated management systems. It can be surmised that, training will have to be a key component in the development of the IQEMS in this study.

The succeeding table will present the opportunities of implementing an integrated management system that were derived from literature.

Table 2.3: The opportunities of integrated management systems derived from literature.

Opportunities	References
Basis of sustainable development	Fresner and Engelhardt (2004), Rocha, *et al.,* (2007), Jørgensen (2007) and Muzaimi, Chew and Hamid (2017)
Defined responsibility allocations	Jørgensen (2007) and Salomone (2008)
Increased customer satisfaction	Douglas and Glen (2000), Zutshi and Sohal (2005), Fresner and Engelhardt (2004)
Simplified regulatory requirement	Douglas and Glen (2000), Wright (2000), Zutshi and Sohal (2005), Jørgensen, *et al.,* (2005), Fresner and Engelhardt (2004), López-Fresno (2010), Simon, Karapetrovic, and Casadesus (2012), Moumen and El Aoufir (2017) and Muzaimi, Chew and Hamid (2017)

The preceding table summarises those aspects that can provide external opportunities for an organisation when integrating management systems. The integration of management systems provides the basis of sustainability that manifests itself by merging processes and procedures concomitantly reducing waste and lowering an organisations carbon footprint. Another important note is that an organisation with a high sustainability rate can portray a strong

reputational image, spur investment and boost customer satisfaction. This finding is another key indicator that integrated management systems can be useful for this study.

Another opportunity is that regulatory requirements become simplified, this again results the availability of human resources and reduction in costs. A major theme that has emerged from investigating integrated management systems is that the removal of parallel policies, processes, procedures, roles and responsibilities have had a tremendous impact both internally (strengths) and externally(opportunities). Organisations such as Danish Crown (2008), Jaguar Plasticos (2020) and Santarli (2020) have reported increased customer satisfaction and simplified regulatory requirements arising from implementing integrated management systems.

Table 2.4: The threats of integrated management systems derived from literature.

Threats	References
Limited number of bodies licenced for certification	Karapetrovic (2002) and Simon, *et al.,* (2012)

A point of contention when implementing integrated management systems is that there is a limited number of certification bodies. Thus, mitigation, audits will have to be planned significantly in advance in order to ensure that the organisation is audited annually or within the prescribed time frames.

The SWOT analysis derived from the literature highlights significantly more strengths and opportunities than weaknesses and threats. Weaknesses and threats that were identified from the SWOT analysis and possible mitigation have been presented. Therefore, it is reasonable to conclude from the results of the SWOT analysis that integrated management systems are suitable and can be a feasible method to utilise the development of the integrated management system in this study. When reviewing different organisations and industries that have implemented integrated management systems, it was found that none of the organisations used integrated management systems concerning SUPs.

2.5 Digital quality systems

The emergence of digitalisation ushering the Fourth Industrial Revolution has also prompted a massive shift in practice. This shift has caused a disconnect among organisations, employees and technology. This section will explore the link of integrated management systems in a world of intelligent and automated systems, showing the evolution of Quality from inspection to discovery as it pertains to the development of the IQEMS.

During this study, the Researcher was heavily engaged in international events, namely the G7 and G20 Summits. At these events a deficiency was highlighted, from a South African context, concerning digital quality systems which have started to become the norm in the

Global North. In order to ensure that South Africa is not left behind in this regard, digital quality systems, has been included in this study as another avenue of exploration for continuous improvement. However, both digital and non-digital discourse is explored in this study.

2.5.1 Understanding digitalisation

Cohen and Rodrigues (2020), and Morakanyane, O'Reilly, McAvoy and Grace (2020) describe digitalisation as the convergence of digital information and digital technologies to produce organisational models that promote efficiencies and increase profit. By definition it has forced organisations in the direction of automation, cyber-physical systems and cloud computing. There is consensus that digitalisation has emerged as the most significant technological trend of the twenty first century [Parviainen, Tihinen, Kääriäinen and Teppola (2017), Gebayew, Hardini, Panjaitan and Kurniawan (2019), Reis, Amorim, Melao, Cohen and Rodrigues (2020), Morakanyane, O'Reilly, McAvoy and Grace (2020) and Urbinati, Chiaroni, Chiesa and Frattini (2020)]. Moreover, digitalisation has played a significant role in ushering in the Fourth Industrial Revolution (4IR). Ramos, Loures, Deschamps and Venancio (2019), Jeon, Yoon, Um, Suh (2020), Botlikova and Botlik (2020) and Yang and Gu (2021) advise that digitalisation has already had a tremendous impact on organisations.

Xu, David and Kim (2018), Mahmood and Mubarik (2020), Kimani, Adams, Attah-Boakye, Ullah, Frecknall-Hughes and Kim (2020) and Botlikova and Botlik (2020) - tout 4IR as the convergence of digitalisation with artificial intelligence, robotics, 3D printing, advanced wireless technologies, physical and biological innovations. 4IR extends beyond the Third Industrial Revolution by merging the digital world with the biological and physical world. Therefore, it can be perceived that, The Fourth Industrial Revolution (4IR) will cause systematic change that will tremendously influence and transform organisations across all sectors. Although significant developments have been made towards 4IR, it still requires substantial evolution and support from society and organisations when viewed as a nascent idea.

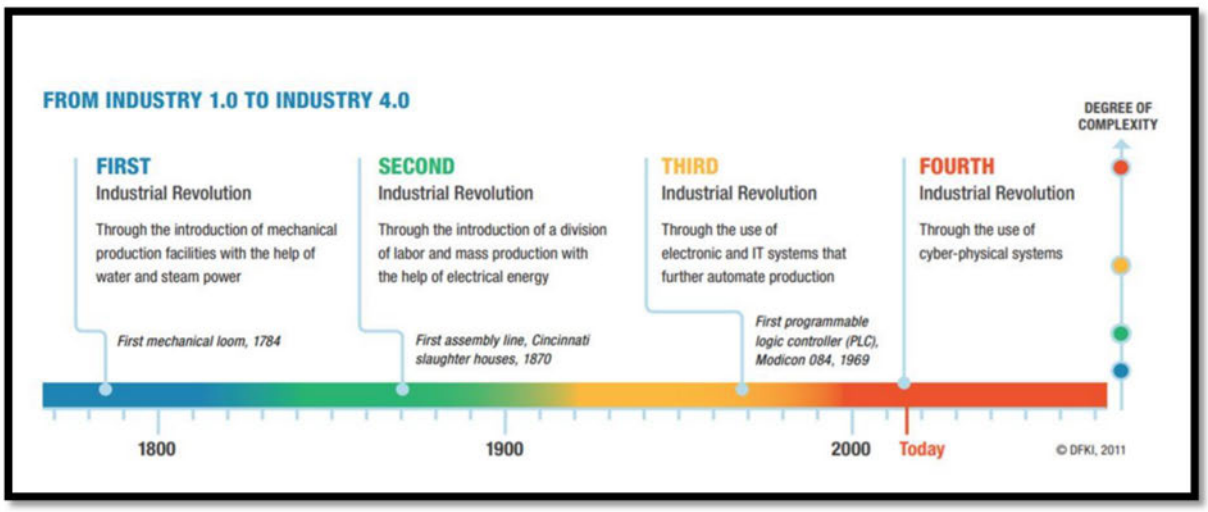

Figure 2.3: The four industrial revolutions with descriptions and time lines
(Source from: LSN Research, 2017)

Arsovski (2019), Zonnenshain and Kennet (2020) and Chiarini (2020) report that digital transformation has made a significant impact on Quality. Quality 4.0 is the term that has been coined to describe the digitalisation of Quality in 4IR. It might be useful to recognise how Quality is embedded throughout the industrial revolutions and to learn from its evolution to inform Quality in 4IR. Figure 2.3 depicts a summary from the First to the Fourth Industrial Revolutions on the evolution of industry and its necessity to explore 4IR. The American Society of Quality (2021) highlights some of these roles, for instance during the First Industrial Revolution, the concept of Quality first emerged as 'self-inspection' in production plants. In the course of the Second Industrial Revolution, there was a shift towards Quality control and inspection. Noteworthy, throughout the Third Industrial Revolution, Quality materialised as a simple system that required basic planning and documentation. Following this, there have been major advancements in the field of Quality, namely the development of the International Organisation for Standardisation and for example the introduction of organisational wide Quality control in Japan that was influenced by Quality gurus such as Edwards Deming and Joseph Juran. ISO later began developing different Quality standards that are used today. The evolution of Quality accentuates that it has adapted to technological changes and scientific advancements throughout the first three industrial revolutions. Therefore, it can be perceived that the advancements of Quality in 4IR are eminent and are vital for organisational success in the Industry 4.0 milieu.

Quality in the age of digitalisation presents promising opportunities such as the possibility to revolutionise traditional quality control and assurance systems and significantly expand the access to financial markets for organisations [Rowlands and Milligan (2021) and Park (2021)]. Of importance, Piccarozzi, Aquilani and Gatti (2018), Sader, Husti and Daróczi (2019), Lim (2019), Frank, Dalenogare and Ayala (2019) and Elg, Birch-Jensen, Gremyr, Martin, Melin (2020) express that Quality in the age of digitalisation is not just isolated to the technological advancements of 4IR but also to the ability of organisations to utilise that technology to reduce inefficiencies, improve access of information and increase profit.

2.5.2 The impact of digitalisation on Quality

Sader, Husti and Daróczi (2019) posit that digitalisation can be used in the implementation of the seven mandatory clauses in ISO 9001:2015. For example, digitalisation can be used in the Planning Clause by transferring data from processes onto digital systems and analysing the data thereby enabling predictive maintenance to occur. This can result in less downtime and reduce defects. Another example can be seen in the Leadership Clause, where they argue that Management are able to allocate resources more successfully due to the evaluation of digital information such as intelligent quality control systems and early prediction of failures. Lim (2019) proposed that another route towards Quality 4.0 from an engineering perspective, is by combining Information Technology and Operations Management enabling digital transformation to occur. This entails transferring Operations Management principles onto

digital platforms. For example, moving planning and scheduling into digital platforms ensures maximum availability of employees and efficient use of their time.

Another view from, Padhi and Illa (2019) is to introduce Quality 4.0 in the context of developing a 'smart factory'. They argue that Total Quality Management can be divided into four main components that will drive digitalisation. The first category is, "integrated system architecture", which entails that all Quality related data and daily checks needs to be integrated with an online system. The second category is "automated data processing"; where all Quality related data needs to be "automated". The penultimate category is increased levels of "autonomy", which entails that operations are not dependant on people to function after defects occur. The last category is "predictive analysis" which requires the ability of data to automatically pre-empt defects and non-conformances. Fernández-Caramés and Fraga-Lamas (2019) and Buchi, Cugno and Castagnoli (2020) had similar findings in their research.

Piccarozzi, Aquilani and Gatti (2018) and Frank, Dalenogare and Ayala (2019) posit the concept of Industry 4.0 or 'smart manufacturing' as the amalgamation of processes, systems and operations with digitalisation and automation. Wiktorsson, Noh, Bellgran and Hanson (2018) highlight an example of this in Sweden, where a large bus and truck manufacturing organisation with the philosophy of continuous digital improvement has created a special internal smart factory laboratory. The laboratory is designated to conduct trials on emerging digitalisation with production and logistics and ensures that production and processing capabilities are at its optimum. An encouraging lookout on initiatives similar to this is that organisations can create or develop new departments that can research and develop digitalised systems and processes.

Lee, Lee and Kim (2019) present an ideal example of the interrelation between Quality and the 4IR and report a case study on establishing predictive maintenance using the international organisation, namely Rolls-Royce. They report that the sequence for establishing predictive maintenance, first uploaded all the data and information onto an internal digital network for ease of access and analysis. This resulted in the "organisation" being able to generate new information and communication technologies based on data analysis. Thereafter, they were able to develop predictive maintenance and quality control techniques to detect errors and monitor processes continuously. The key technological advancement that they used to monitor processes was "nanobots' equipped with cameras and sensors. "Nanobots' are microscopic size robots with cameras and sensors that Quality Controllers insert into the engines and other parts of Rolls-Royce products, where they are able to monitor and access products and processes continuously.

A theme that has emerged from this section is that organisations must be encouraged to move their Quality systems online with the underlining aim of being able to eventually pre-empt operational defects and non-conformances. It can be deduced that once this is complete, organisations can then develop pre-determined preventative actions for different types of non-conformances that may occur, thus reducing downtime, waste and defects.

2.5.3 The link between digitalisation, sustainability and Quality

Mülle, Kiel and Voigt (2018), Bressanelli, Adrodegari, Perona and Saccani (2018), Parida, Sjödin and Reim (2019), Reza, Jayashree and Malarvizhi (2021) and Bag, Gupta and Kumar (2021) describe the link between sustainability and digitalisation. Sustainability through digitalisation can occur in the form of improving product and process design, thereby moving organisations towards zero waste. This can be achieved through predictive maintenance programmes and product/process tracking based on available digital data streams such as work rate, rejection rate and other Quality performance checks. This also allows organisations to lower their carbon footprint by reducing energy and minimising negative environmental impact by cutting down on waste.

Some positive attributes of digitalisation is that it encourages the use of different digital platforms to promote value-creating opportunities to provide new revenue streams. These findings present the various advantages digitalisation has for both the organisation and the environment. Additionally, the positive effects that digitalisation has on the environment can form a key component of ISO 14001:2015 which further highlights the possible use of digital integrated management systems.

2.5.4 The connection between integrated management systems and digitalisation

Zimon, Madzik and Sroufe (2020) are of the view that the integration of different management systems is important in order to maintain growth in the age of digitalisation. It can be viewed that the integration of management systems has become a necessity to achieve the optimum structure for different organisations. This is also corroborated with findings from Ramezani and Jassbi (2020).

It can be appreciated that not every organisation has the maturity to have a QMS that is digitalised, but conversations portrayed in this study can sensitise role-players into the importance and convenience of digitisation

Considering the evolution of Quality over the various industrial revolutions, integration and digitalisation of management systems and standards appears to be a natural progression and it can be argued that Quality can be adapted to keep up with the progression of 4IR activities, supporting the notion that integrated management systems a vital part of the digitalisation in organisations.

2.6 Corporate Social Responsibility

Corporate social responsibility refers to organisations that maintain a competitive advantage while remaining accountable to the community, shareholders, environment and employees. Many organisations in the private sector have voluntarily initiated recycling of SUP. This section will discuss a few innovative measures undertaken in selected organisations. It is envisaged that by reviewing these measures it will assist in the creation of Policy in the IQEMS in this study.

2.6.1 Clothing Manufactures

Several clothing brands are currently using recycled plastic waste in the manufacturing of their products. This subsection will highlight some organisations that have undertaken these measures. The viability of these measures will be explored and assessed to ascertain whether they can be used in the development of the IQEMS.

2.6.1.1 Timberland

Swarnapali (2017) advises that more organisations have shifted towards corporate responsibility and sustainability. This move involves a number of actions such as environmental consideration, green energy usage, conservation and recycling as part of an organisations daily activities and production.

Timberland (2018) an international clothing brand launched an 'Earthkeepers®' clothing collection in which recycled PET bottles are used to make different types of clothing items such as jackets, shirts and boots. For instance their Spring 2018 boot range was made up of fifty per-cent post-consumer recycled PET silhouette, a fifty per-cent recycled PET mesh lining for comfort and breathability, and an outsole made of fifteen per-cent recycled rubber. To enhance, their sustainability efforts and image, Timberland has collaborated with another organisation called Thread International that operates primarily in Honduras and Haiti. The operations of Thread International highlight interesting practices (Timberland, 2019) that could be useful if implemented in a South African context.

Figure 2.4: Boots from the Timberland Earthkeepers collection
(Source: Timberland, 2021)

Thread International (2019) have Material Health and Safety Certification by the Cradle-to-Cradle Institute (2019). This is a valuable building block in the development of producing products in a sustainable manner (raw materials and process inputs). The resulting partnership between Timberland and Thread International has created seventy-seven income opportunities for small business owners. Thread International employs small businesses who collect plastic bottles for recycling. The collaboration has removed 765,280 plastic bottles from the streets and water canals in Haiti. Furthermore, the organisations have saved 30,521,203 gallons of water compared to if they were using one hundred per-cent cotton in

the manufacturing process of products. Such initiatives are very important as it diverts these items from landfills of the ocean.

Reviewing this operation has highlighted several practices that can be applied to the South African context. For example: by identifying small business groups, which can be involved in plastic waste collection can possibly create a niche market for sustainable businesses. Ahmad, Draz, Su, Ozturk and Rauf (2018) echo these sentiments and add that small business groups can be identified in areas that have the highest unemployment rate and areas that are close to tourist destinations. These where highlighted in the problem statement that required addressing.

Ong, Purwanto, Supono, Hasna, Novitasari and Asbari (2020) conducted studies in Indonesisa on the impact of implementing the ISO 9001:2015 clauses in the tourism sector. Their empirical results showed a strong correlation with those tourist organisations that implemented ISO 9001:2015 and financial gain. Based on the literature highlighted so far, a possible pathway for small businesses concerning SUP in the IQEMS is beginning to emerge.

2.5.1.2 BATOKO

BATOKO (2020) is an organisation based in the United Kingdom, which manufactures swimwear solely out of one hundred per-cent, recycled plastic waste. They source material from two factories in China. To verify the efficacy of their sourced material, BATAKO conducts frequent audits on both the factories in China to ensure that they are receiving material made from one hundred per-cent recycled plastic waste. To date, they have used the equivalent weight of approximately three hundred thousand plastic bottles in their processes and turned it into swimwear. In addition, the factory based in the United Kingdom uses one hundred per-cent renewable energy. This is synonymous with Ciravegna and Fonseca (2015) and Wairon, Purwanggono and Handayani (2018) who suggest that environmental management systems have moved beyond just prevention of pollution but rather environmental protection as well.

It is noteworthy that organisations that do not have the financial capacity to convert recycled plastic waste into usable material on site can purchase material from other manufactures that have the infrastructure to do so. This can foster development of innovative initiatives from organisations that have the financial resources to build the infrastructure necessary to carry out these operations.

2.5.1.3 Gucci

Even luxury designer bands, such as Gucci (2022) have begun to use recycled plastic waste to manufacture their clothing items. Recently, Gucci starting using ECONYL®, a brand of nylon cotton that is made from one hundred per-cent recycled plastic fishing nets, plastic waste from landfills and cotton thread off cuts and waste. The ECONYL® (2020) brand collects plastic waste from the oceans and fabric cut-offs from landfills. The waste is then cleaned, dried and stored (until required) thereafter, it goes though the purification process

and is recycled back to nylon. The nylon is then generated into fabric and textile yarn to be used by the fashion and interior industries.

ECONYL® (2022) claims that for every ten thousand tons of raw material used, they are able to save the approximate equivalent of seventy thousand barrels of crude oil and fifty-seven thousand one hundred tonnes of Carbon Dioxide emissions. They also sell the recycled nylon yarn to many small clothing businesses as well as other major corporations such as Prada, Adidas and Tommy Hilfiger. Figures 2.6 and 2.7 show a snapshot of the ECONYL® manufacturing facility. These pictures were selected to illustrate that technology, machinery and equipment has tremendously evolved and is now available to process and manufacture plastic waste at mammoth volumes.

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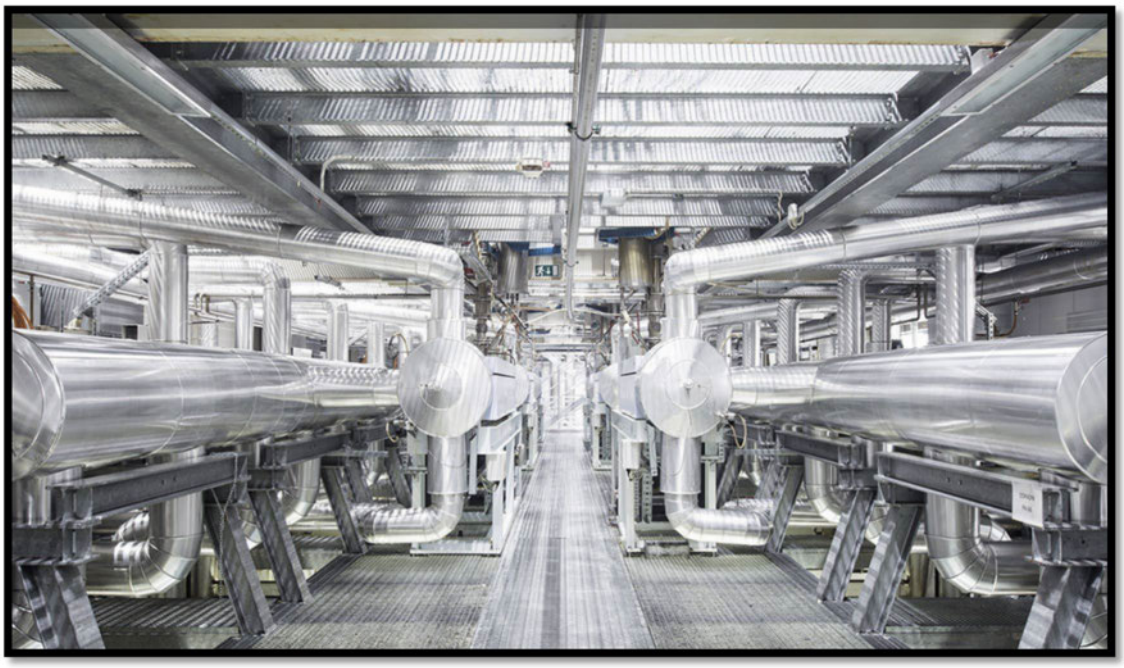

Figure 2.5: ECONYL® Factory with equipment and machinery to process plastic waste (Source: ECONYL®, 2022)

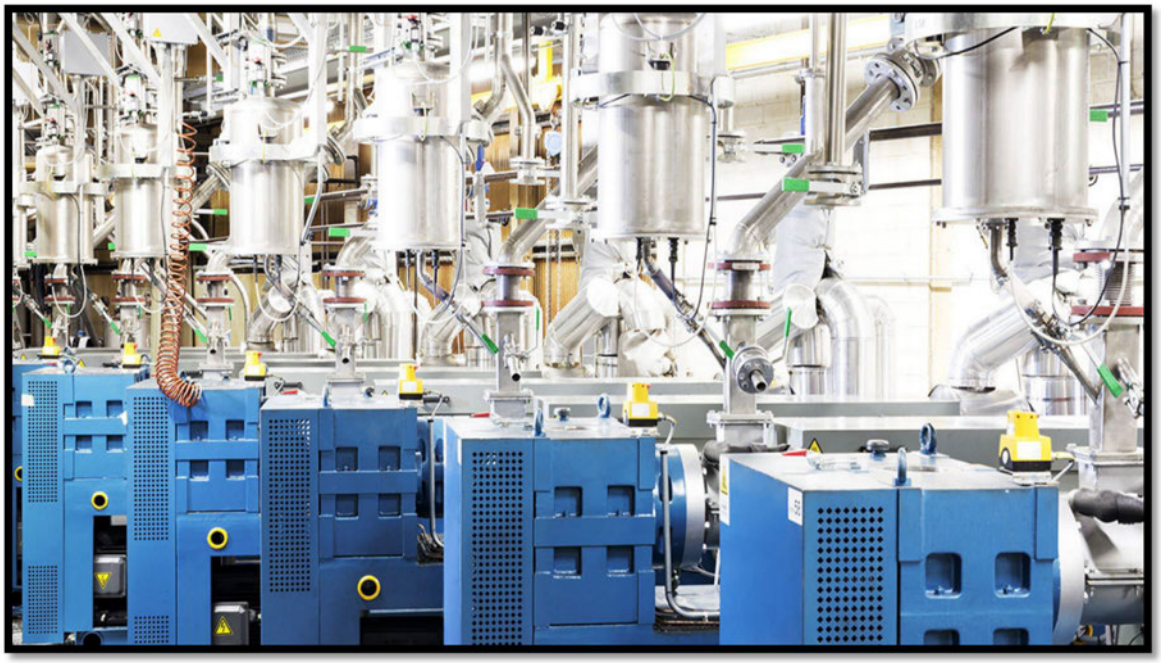

Figure 2.6: ECONYL® Factory with equipment and machinery to process plastic waste (Source: ECONYL®, 2022)

However, there is still reluctance and lack of motivation among organisations to move in a more sustainability direction. To mitigate this Mormann (2013), Curtin, McInerney and Johannsdottir (2018) and Dippenaar (2018) report that when organisations are offered tax incentives they are encouraged to consider undertaking 'green initiatives'. These finding were further fortified by; Schulz and Heitger (2014), Ruminaa, Balandinaa and Bannovab (2015), Harrision (2015) and Redond, de Sarralde, Hallerberg, Johnson, Melamud, Rozemberg, Schwab and von Haldenwang (2019). Given this information, it can be inferred that the role of the Government can be to provide tax incentives for organisations to encourage them to use recycled single use plastic waste in their manufacturing capacity.

The aim of this initiative is to divert the amount of single use plastic waste that will end up in landfills or in the environment. Additionally another outcome of this will be to create a waste collection market, which can support small and medium sized businesses. For example: malls, beaches and restaurants can contribute by allocating bins for collecting single use plastic waste such as; plastic bottles, plastic bags and styrofoam cups. Waste collection services can then collect waste from these designated points and can transport them to different manufactures and recyclers. Consequently, a possible tax incentive framework will be pitched within the IQEMS.

2.5.2 Furniture manufactured from plastic waste

Another trend that has emerged from the private sector is the use of recycled plastic waste to manufacture furniture. Several organisations in South Africa manufacture furniture out of recycled plastic waste. For example, Envirotimbers is an organisation based in Kwa-Zulu Natal, South Africa. They submit that they first collect plastic waste such as plastics bottles

and packets from landfills, street collectors and schools. Next, the plastic waste is washed and the crushed into flakes, later the flakes are extruded into planks, which makes furniture. The organisation manufactures chairs, tables, benches and pallets (figure 2.3). An interesting claim that they make is that their two-setter bench is made up of approximately one thousand two hundred plastic bottles (Envirotimbers, 2020). This is a novel and innovative way of dealing with plastic waste and it can be applied in different sectors across South Africa. Other organisations in South Africa that are offering similar types of services are Polywood Plastic and Green Furniture, which shows that these types of trends are growing [Polywood Plastic (2020) and Green Furniture (2020)].

Figure 2.7: The process of developing furniture from single use plastic waste
(Source: Envirotimbers, 2020)

A strong appeal by Mormann (2013), Schulz and Heitger (2014), Ruminaa, Balandinaa and Bannovab (2015), Harrision (2015), Johannsdottir (2018) and Dippenaar (2018) and Redond a, de Sarralde, Hallerberg, Johnson, Melamud, Rozemberg, Schwab and von Haldenwang (2019) was to use tax incentives to leverage organisations to shift into a more sustainable direction. It can be inferred that to foster research and development in the field of sustainability it is recommended that organisations that undertake such initiatives form part of the tax incentive framework.

2.5.3 Further economic potential

To further emphasise the possible economic potential that could result from controlling the consumption, use and pollution of SUP. This subsection will review related literature.

Of importance, The Waste Economy Market Intelligence Report (2017) attests that, historically the focus of waste management in South Africa was primarily on end-of-pipe technologies such as landfilling and incineration. Current estimates by Godfrey and Oelofse (2017) show that the informal sector is currently responsible for the approximate retrieval of between eighty per-cent to ninety per-cent of paper and plastic packaging that is recovered for recycling. There has been very little integration by governmental agencies of these

informal sector programmes into waste management services. Herein lays further opportunity for the development of policies in the IQEMS.

Moreover, the Waste Economy Market Intelligence Report (2017) postulates that the Waste Economy has a market value of approximately R 3.6 Billion throughout South Africa with the potential of creating seven thousand eight hundred and sixty jobs. Further studies of the economic stimulation and job activity in South Africa are currently lacking. However: Maia, Giordano, Kelder, Bardien, Bodibe, Du Plooy, Jafta, Jarvis, Kruger-Cloete, Kuhn, Lepelle and Makaulule (2011), Borel-Saladin and Turok (2012), Global Alliance for Incinerator Alternatives (2013) and Jacob, Quitzow and Baer (2015) echo that moving South Africa towards a green economy will result in major economic stimulation.

It can be argued that though Governmental legislative initiatives, South Africa can a unlock social, economic and environmental opportunities. These opportunities can come from diverting, recycling, reusing SUP and provide the potential to create significant opportunities.

2.6 Eco-construction

Eco-construction refers to the practise of building houses, roads and buildings in a sustainable and 'green' manner for example using plastic waste in construction, minimising the amount of water used and decreasing the overall impact of the environment. This section will address the concept and feasibility of eco-construction in South Africa.

2.6.1 Housing

Pandey, Gotmare and Wankhade (2017) assert that the increasing costs and availability of conventional building materials has become a hindrance in low cost housing development. They further advise that an alternative solution needs that will address both the financial and environmental impacts of housing needs to be investigated.

Haque and Islam (2021) and Mihai, Gündoğdu, Markley, Olivelli,. Khan, Gwinnett, Gutberlet, Reyna-Bensusan, Llanquileo-Melgarejo, Meidiana, Elagroudy, Ishchenko, Penney, Lenkiewicz, and Molinos-Senante (2022) highlight that in recent years the concept of using recyclable plastic waste in the development of low cost housing has gained prominence. The concept was first trialled in Honduras in the early 2000's and has since spread to other developing countries. Wells, Bardake, Cepe, Cramer, Delaney and Landman (2007) coined the term 'eco housing' or 'green building.' They further explain that eco-houses are houses made from, plastic bricks. To further explain, plastic bottles are filled with sand and then stacked together using mortar to bind them together. Thereafter, cement, sand and water are used to seal the bricks in and plaster the wall. This facilitates a reduced amount of production and logistics that will go into making clay and cement bricks; even less cement, sand and water are used in the sealing phase of building because the moisture absorption rate is lower than when using the plastic bricks.

Mokhtar, Sahat, Hamid, Kaamin, Kesot, Wen, Xin, Ling and Lei (2016) conducted subsequent research in Indonesia, where they built a house made of plastic bottle bricks and

another house built with normal cement and clay bricks as a reference point. The first set of tests that were conducted were compression tests in order to determine the maximum stress of the 'eco bricks' compared to the ordinary clay bricks. Compression tests determine what the load carrying capacity of bricks under compression will be. The maximum stress results were as follows: the 250ml 'eco bricks' were 38.34 N/mm². Comparatively, the maximum stress test of a clay brick is 58 N/mm². According to Indonesian Law, the minimum compressive strength for clay bricks per 1000 bricks must be above 5.2N/mm². For reference, according to SABS (2012) in South Africa, the minimum compressive strength for clay bricks is above 17N/mm² per 1000 bricks. The compressive strength of clay bricks is much higher than 'eco bricks', but the compressive strength of 'eco bricks' are above legal regulations in South Africa. Therefore, the 'eco bricks' can be a suitable substitute in place of clay bricks.

The next set of tests that were conducted concerned the thermal characteristics and properties of the 'eco bricks'. The indoor temperatures in the house constructed from 'eco bricks' ranged from 29.7°C to 31.0°C between the hours of 8:00 am and 9:00 pm while for the house constructed with clay bricks, the temperatures ranged from 28.6°C to 31.6°C between the hours of 8:00 am and 9:00 pm. The next test performed was indoor humidity. The percentages for the house made of 'eco bricks' was between 72.50% at 8:00am and 70.50% at 9:00pm, while, with the house made with clay bricks the indoor humidity percentages were between 71.60% at 8:00am and 69.10% at 9:00pm. The study notes that the higher temperatures from the house made of eco bricks was because the house was constructed with limited ventilation and that will be reviewed going forward.

Finally, Pandey, Gotmare and Wankhade (2017) conducted a project in India for a low-cost house made of 'eco bricks'. From their final assessment of the project, they ascertained that the house made from 'eco bricks' was forty-five per-cent cheaper compared to producing a low cost house from cement bricks. Additionally, they report that houses made from 'eco bricks' absorb abrupt shock loads at a higher rate than a house made from clay bricks. This finding is consistent with reports by Mokhtar, *et al.,* (2017). Another finding from their experiment was that the compressed filling materials of the 'eco bricks' aided in making the structure of the house 'bulletproof'. Their conclusions reiterated that the use of the 'eco bricks' will result in less production of cement which consequently results in reduced carbon dioxide emissions from the production and transportation of cement.

Another area of sustainable single plastic use and plastic waste was using plastic bottles in the construction industry can possibly play a vital role in job creation and low-cost housing development. According to Rule-Groenewald (2015) South Africa has an estimated homeless population of approximately 200 000 people. The use of 'eco construction' as a cheaper alternative in the low-cost housing sector can aid in improving and/or combating homelessness. This area of construction can provide jobs in two different avenues. The first avenue is the plastic waste collection sector and the second from those who are physically involved in the construction industry. Moreover, this can also serve as an alternative approach offering employment opportunities for homeless people in these industries.

2.6.2 Roads

Another innovative research initiative conducted by Yadav and Chandrakar (2017) and Manju, Sathya and Sheema (2017) used plastic waste in the construction of roads. They detailed that the process began with the shedding and crushing of plastic waste (primarily plastic bottles, plastic packets and styrofoam takeaway containers) into plastic powder. The plastic powder was then added to bitumen and then the combination is used to coat aggregates (construction material made out of sand, rumble and stones). This process allowed for increasing the bonding and contact between plastic polymers and the aggregates. The new combined mixture was higher than that of the melting point of the ordinary bitumen mixture. This provided an advantage in overcoming brittleness in road structures and assisted in roads lasting a longer period in cold temperatures. This can be useful in central rural areas throughout South Africa.

Further advantages of using plastic waste in the construction of roads are that the plastic waste being added into the mixture helps prevent oxidation and moisture absorption of the road material. This results in creating roads that last for longer periods and roads with reduced potholes. Adverda (2019) reports a private construction organisation in South Africa built the first road made out of plastic waste in Kwa-Zulu Natal.

Another area of sustainable single plastic use plastic waste was portrayed in this section. This is another avenue that plastic waste could be used in. These findings echoed the role of single use plastic waste in low cost housing, clothing manufacturing and furniture manufacturing. A possible pathway has formed for Policy concerning sustainability and the creation of employment.

2.8 International bodies regarding SUP

This section will dissect different intergovernmental bodies and the role that they play regarding SUP. Following the researcher attending events at different International bodies, the role that these bodies play in Policy Development was highlighted.

2.8.1 Brazil, Russia, India, China and South Africa

This subsection will detail the formation, outcomes and a critique of BRICS. The proximity of the researcher to the BRICS Summit provided a unique perspective on the neutral role that South Africa plays in this body. Additionally a key take way was that there must be compliance and alignment with outcomes from this body to ensure that effective Policy is developed.

2.8.1.1 Formation of Brazil, Russia, India, China and South Africa

Mihika and Ikuno (2022) and Duggan, Hooijmaaijers, Rewizorski and Arapova (2022) detail the process of establishment of BRICS. The initial concept emerged from an economist at Goldman Sachs (American multinational investment bank), in a paper titled, ‘Building Better Global Economic BRICs’. At the time of publication, South Africa was not a part of the

concept. The paper outlined four strong emerging market economies at the time Brazil, Russia, India and China. The paper proposed that these four countries would outperform other developing countries and cause major disruptions to the international political economy. It was argued that these economies would be strong investment destinations for capital flow and infrastructure development. Five years after the paper was published, there was a meeting among the foreign ministers of these four countries in New York City, USA and in the year 2009, the first official diplomatic meeting took place with the leaders of these countries in Yekaterinburg, Russia.

2.8.1.2 Outcomes of Brazil, Russia, India, China and South Africa

Duggan, Ladines and Marek (2021) state that there were two key outcomes from the first official diplomatic meeting of the BRIC countries. The first being that there the BRIC countries need to have a strong joint voice in world affairs and the second being the need for a new global currency. Following the first meeting, South Africa began formal engagements with BRIC and submitted a request to join BRIC and towards the end of the year 2010; China had formally invited South Africa to the collaboration. Consequently, BRIC had now changed to BRICS to include South Africa and the country joined the 2011 BRICS Summit in Sanya, China. With the inclusion of South Africa, BRICS covers a diverse range of approximately forty-one and a half per-cent of the global population.

In the succeeding years, each of these countries have gone through dynamic structural changes ranging from financial crises, wars and changes in political ideology. One of the biggest achievements that the BRICS countries outline is the formation of the New Development Bank, a multilateral bank with a primary focus on infrastructure development and expansion. The bank was primarily developed with an attempt to challenge the hegemony of Western countries and their financial institutions.

2.8.1.3 Critique of Brazil, Russia, India, China and South Africa

Basile and Cecchi (2019) and Li (2021) highlight that there is a high degree of uncertainty amongst BRICS countries regarding sustainable development policy. They argue that there is ambiguity in policy regarding recycling, pollution, energy, ocean protection and agricultural resources.

Camioto and Pulita (2022) describe three pillars that should drive sustainability in the BRICS countries, namely: economic, social and environmental. They suggest that by these metrics, BRICS countries have fallen behind the G7 countries in achieving sustainability targets. Furthermore, they add that China, India and Brazil are achieving more in sustainable developmental goals compared to South Africa and China. It is noted that G7 countries have greater financial and legislative capacity compared to BRICS countries. However, strong economic policy coupled with sustainable development could help drive economic growth and alleviate unemployment. Detailed and implementable policy proposals are suggested by these authors to drive sustainable development.

For BRICS countries and particularly South Africa to be taken as leaders in the aspect of sustainable development, there needs to be a multilateral approach in the sustainable policy concerning recycling, pollution and ocean protection.

2.9 South African and international legislation regarding SUP

The literature review will now present legislative changes taken by South Africa and selected international countries.

2.9.1 South Africa legislation

On the legislative level, a report by the United Nations Environmental Programme (2018) asserts that South Africa has only one major Law concerning the mitigation of SUP. Accordingly, the South African Department of Environmental Affairs and Tourism (2003) amended the Environmental Conservation Act (No. 73 of 1989) to introduce regulations on the use of plastic carrier bags, as a levy-tax. According to McLellan (2014), the impetus for the use of this levy-tax was to create an organisation called 'Buyisa-e-Bag', under the auspicious of The Department of Environmental Affairs and Tourism, to create employment opportunities for lower income households to encourage the recycling and waste management. McLellan (2014) and Vipin, Vivekanandhan and Mohanty (2014), concur that although South Africa introduced the levy on plastic shopping bags in 2003 it has shown minuscule results in alleviating the negative impact or curbed the use of single use plastic bags. They assigned the predominant reasons for the diminutive results as the lack of awareness and education regarding the levy-tax as well as the failure of Government to discuss implementation and regulatory plans with all different stakeholders such as the clothing industry, among others, prior to implementation of the levy-tax. Almost a decade later, The Buyisa-e-Bag (2011) minutes of meetings concluded that the Organisation failed to meet its objectives and has been dissolved while the levy-tax is still being charged to consumers.

2.9.2 Table describing international legislation

Table 2.5 will investigate different countries and the root causes of why they made legislative changes. Subsequently, learning opportunities of the successes of these measures will be reviewed in order to determine whether they can be applicable to the South African context

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Table 2.5: A summarised collection of countries and their economic measures and initiatives regarding SUP

Country	Economic measures and initiatives	Cause/s	Success and learning opportunities
Bangladesh	• The first country in the world to ban single use plastic bags. • The ban was first passed in the Capital city and then later spread to the remaining provinces in the country.	• Major flooding resulting in the loss of life as a result of single use plastic items clogging waterways and drains.	• Governmental agencies report that the ban was successful throughout the country because the ban was eased into the country, province by province.
Republic of Northern Ireland	• Legislation passed for a levy-tax on all single use plastic bags in 2003.	• Littering was the main reason for the introduction of the levy tax. • Reducing the amount of single use plastic bags per person was also an objective.	• There was a ninety per-cent reduction in the purchasing of single use plastic carrier bags over a 10-year period. • The amount of single use plastic bags per person was reduced significantly, from 328 bags per year to 21 bags per year over a 10-year period. • There was extensive collaboration between stakeholders and citizens in Northern Ireland. • All funds received from the levy tax were transferred to an environmental fund. • The Fund was actively used in Environmental protection and awareness programmes.

Table 2.5: A summarised collection of countries and their economic measures and initiatives regarding SUP

Country	Economic measures and initiatives	Cause/s	Success and learning opportunities
Kenya	• Strict laws on the single use plastic bag passed in the year 2017.	• Plastic bags were blocking waterways, clogging drains and causing flooding as a result. • Moreover, plastic bags were found in cattle at alarming rates.	• The Government expressed that the ban is a success so far. • There have been negative responses from rural communities and lower class households. • Cheap and easy alternatives not provided for poorer communities.
Canada	• Regulations passed to ban the manufacture and sale of micro-plastics in cosmetics • Ban on Single-Use-Plastic cutlery, ring carriers and stirrers.	• Due to the concern over the amount of micro plastics entering the oceans and rivers.	• Ban has been successfully implemented. • The people of Canada prompted the ban. • International organisations began changing their product composition.
Zimbabwe	• Enacted a bill banning Styrofoam food containers.	• Cancerous and carcinogenic effects from the burning of Styrofoam caused distress in local communities.	• In-depth and provisional assessments have not being conducted to date. • According to opposition parties not enough time was given to manufactures and vendors to find cheaper alternatives.
Honduras – Bay Islands	• Government implemented a ban on single use plastic bags.	• The main contributor to ban was the amount of plastic waste in the ocean	• The ban has been successfully implemented with ease among the

		affect tourism.	populace. • Awareness programmes were initiated and promoted throughout the Islands prior to implementation.

Table 2.5: A summarised collection of countries and their economic measures and initiatives regarding SUP

Country	Economic measures and initiatives	Cause/s	Success and learning opportunities
United Kingdom	• Laws passed to ban the manufacture and sale of micro plastics in cosmetic products	• Due to concern for the destruction of marine life and aquatic water sources	• Ban has been successfully implemented. • The success of the ban has prompted additional legislation regarding SUP.

(Source: Adapted from Canadian Environmental Law Association, 2015; Summit Foundation, 2017; Zwinoira, 2017; Mollina, 2017; Ryan, 2017; Ecospearbd, 2017; Moola, 2018; United Nations, 2018; United Nations Environmental Programme, 2018; Hardin, 2018; Watts, 2018; Kenya's National Environmental Management Authority, 2018; United Kingdom Department for Environment, Food and Rural Affairs, 2018, Tamura, 2018, United Nations, 2021 and Canadian Environmental Law Association, 2022)

2.9.2 Opportunities and potential implementation plans regarding legislation.

This subsection will detail key points from these different countries that could be applied in a South African context.

The United Nations (2018) asserts that when the levy-tax was first introduced in South Africa, clothing retailers and other stakeholders were left out of the negotiation process prior to its introduction. The lack of consultation resulted in large gaps in the legislation. Given that there was little consultation with the private sector, it can be deduced that any new or amendments to legislation, needs to have extensive collaboration with CEO's, Stakeholders as well as directors of major franchises and distribution chains, in South Africa, for example the Shoprite Holdings Group, Woolworths Holdings Limited, Spar and Pick n Pay. Additionally there needs to be joint effort and alliance with clothing retailers such as the Foschini Group, Truworths Group and Edgars. With key players, being involved from the start, those organisations and manufactures will have time to formulate alternatives and change their business model. For example, in the Western Cape, Spar retailers offered brown paper bags free to customers on International Plastic Day (03 July 2018). An encouraging outcome from key initiatives similar to this can help ease the country towards a plastic free future with minimised resistance.

Zohny (2009), Molina (2017) and The Summit Foundation (2017) present a compelling learning opportunity concerning legislation that took place in Honduras and Egypt. They attest that these countries began substantial awareness and outreach programmes prior to their ban on SUP bags. These countries followed a different protocol prior to the ban of SUP bags. Firstly, municipal and governmental agencies went door to door to explain to people the need for the new law by providing them with information on pamphlets. Secondly, these agencies provided each household they visited with two reusable fabric bags. These steps helped assimilate people to the changes in laws that were going to occur. Moreover, resistance from people usually comes about when they have not been provided with sufficient information, time to adjust and make sense of new or improved laws. It can be inferred that Governmental awareness platforms will need to be brought to the forefront of any legislative or Policy recommendations.

Aljaradin, Persson and Hossam (2011) have also conducted research in Jordan on the impact of awareness programmes in recycling and reusing initiatives. They found that people need to be consulted on legislation relating to SUP and be involved in the decision-making process concerning SUP. Tiew, Watanabe, Basri, Zain and Basri (2013), Rabiatu, Halima and Rami (2018) and Aksan and Çelikler (2019) echo the importance of awareness programmes for recycling and reusing initiatives. They express that without significant awareness programmes any recycling initiative will fail. Drawing on the processes of the extensive awareness programmes in developing nations such as Honduras, Egypt and Jordan, a possible Policy recommendation for the South African context could be developed.

The initial step in South Africa would be phasing in the awareness programmes slowly, starting with those in rural areas and poor communities by providing them with reusable

fabric bags. In South Africa there is an entire African niche that hand sews reusable fabric bags. Majority of the people who come from this niche market are people from rural and impoverished communities. Following such a Policy could result in investment into these communities and aid in economic development. This could also spawn positive public relations, which could translate to easier acceptance of the Policy throughout other economic groups in South Africa and possibly encourage international investment into South Africa. Moreover, this can provide a transition sector for those working in the SUP industry by providing an opportunity for alternative employment.

An interesting argument by Ryan (2017) and The United Nations Environmental Programme (2018) is that the key to success in Ireland was the rate at which the plastic levy was set at. The levy was set six times more than what the population expected and resulted in ninety per-cent decrease in the use of single use plastic bags. However, an important note is that Ireland is a fully developed country. The population was able to adapt to the levy-tax with minimal resistance, and the majority were able to use fabric or paper bags. Zwinoira (2017), Watts (2018) and Dante (2018) attest that in the South African context the livelihoods of the working class need be accounted for when developing regulations and legislation and cheap or cost effective alternatives need to be provided for them.

An argument can be made that, extreme taxes must be avoided for two prime reasons. Firstly, people living in rural communities and the working class will not be able to afford extreme taxes. Those who live in rural communities and the working class need access to plastic bags to transport groceries and clothing due to the long distance they travel and not having access to private transport. Secondly, echoing the learning opportunities from Kenya and Bangladesh, having the support of the working class is vital to the success for any legislation or regulations regarding SUP. Therefore, setting high taxes could result in resistance from people and often as a consequence a black-market would be developed, for SUP.

An important argument is presented by The Canadian Environmental Law Association (2015), Ecospearbd (2017), United Kingdom Department for Environment, Food and Rural Affairs (2018), Tamura (2018), UNEP (2018) and National Environmental Management Authority (2018) that when proposing new legislation, it takes a long period of time, in certain cases as seen in Bangladesh (up to seven years) and Canada (up to a decade). This shows that the process of implementing and amending laws can take a considerable amount of time. Reddy and Subbaiah (2014), Jambeck and Johnson (2015), Sebille, Spathi and Gilbert (2016), Crawford and Quinn (2017), Alimi, Budarz, Hernandez and Tufenkji (2018), Botha (2018), Forrest, Giacovazzi, Dunlop, Reisser, Tickler, Jamieson and Meeuwig (2019), Alabi, Ologbonjaye, Awosolu and Alalade (2019) and Verster and Bouwman (2021) report that urgent action needs to be taken concerning SUP. Consequently, the options to mitigate SUP must take the fastest course possible. Bases on the aforementioned narrative, it can be concluded that when developing Policy for the IQEMS, no new laws or amendments will be considered because of the duration the legislative process takes coupled with the urgency required in dealing with SUP.

Drawing from the information presented in this section, the recommendation for legislation is to reintroduce and revive the levy-tax with proper implementation, awareness programmes and clean guidelines.

Chapter 3

The preceding chapters reviewed the introduction of the study and were followed by a critique and insights into the literature review that outlined the gap of knowledge. According to Pandey and Mishra (2015), the essence of research is to provide a framework for the retrieval of maximum information by collection of the required data as well as execution of the research project. Therefore, the objective of this chapter is to illustrate the design of research with the methodology and the research techniques that were adopted by the study. In addition, this chapter will also focus on preliminary work.

3.1 Research Design

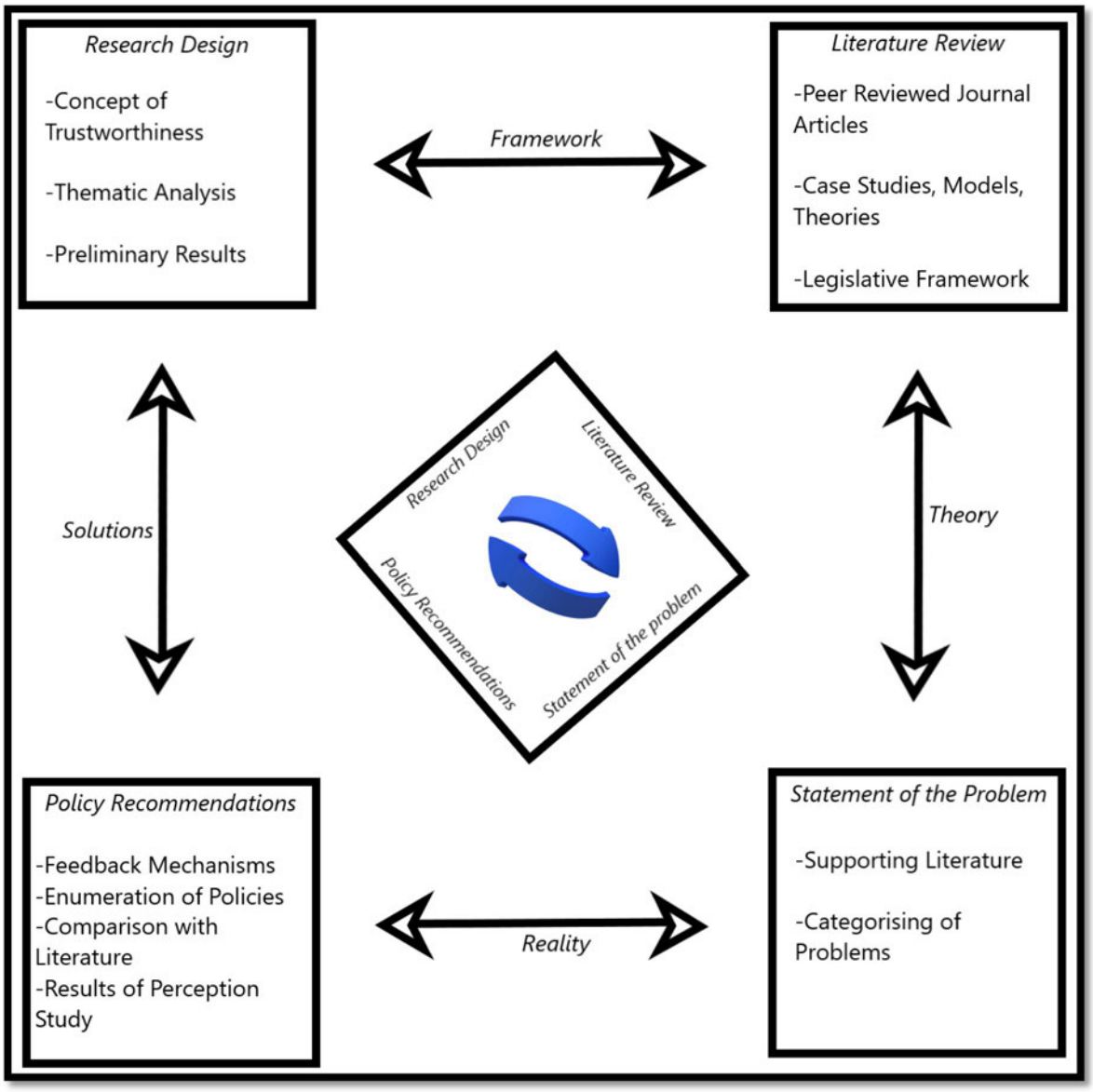

Figure 3.1 Flow diagram depicting the research design of this study
(Source: Developed by the researcher, 2022)

Figure 3.1 illustrates the design of the research, which this study is based on for the development of the IQEMS.

3.1.1 Research Methodology

Rajasekar, Philominathan and Chinnathambi (2013) are of the view that research design provides a coherent and systematic look into a study and facilitates the extraction of the subject matter desired. They further add that research can be described as information collected through literature, people and nature in order to develop social, political and economic change.

Bryant and Charmaz (2017) advocate that research is stimulated by topics that falls into three headings that are deductive logic, inductive reasoning and abductive reasoning. Deductive logic starts with a general statement arising from an assumption or truth. That leads to a hypothesis, followed by an examination of data in order to reach a logical conclusion. Inductive reasoning starts with an observation from which statements can be made. Data on the observation is drawn from literature and conclusions are made on that basis. Abductive reasoning begins with incomplete observations that lead to the most likely explanation. This type of reasoning is used typically when there is very little data available.

This research is stimulated by deductive logic specifically the truth that was derived from literature and media, that South Africa has a challenge with the control of SUP and the assumption that there are countries that have implemented systems to control the SUP.

Rahi (2017) and Kivunja and Kuyini (2017) proposes that there are different paradigms that can guide assumptions and enquires into specific research. They state that the main paradigms are positivist and interpretivist. A positivist paradigm generally uses the scientific method to examine research and produce knowledge. Positivism is adopted from empirical science and generally follows the line of quantitative research. They further posit that an interpretive paradigm adopts a theoretical strategy. This paradigm, he states supports deep explanation and research into world and develops subjective meanings towards research findings and conclusions. Therefore, this research adopts an interpretive paradigm.

Alvesson and Sköldberg (2018) and Matta (2022) describe philosophical concepts such as epistemology, ontology, and axiology as support structures for qualitative research. In qualitative research, epistemology recognises that knowledge is subjective, context-dependent, and socially constructed. This was taken into consideration during the interview phase of this research as participants responses were based on their perspectives and experiences. Ontology, provides a frame of reference that reality is multifaceted and complex and resultantly, a diverse understanding of different realties and multiple perspectives were considered when the interviewee responses were examined. Finally, axiology in qualitative research refers to the participants autonomy and confidentiality while the interviews took place. These three concepts will serve as a foundation to how research is conducted in this study.

Secondary data from books, journals and interviews will be used to evaluate different types of management systems and how they can be applied in developing a quality management system for controlling SUP. Additional literature will also be assessed to determine successes or failures in strategies from other countries concerning legislation and/or methods in place to control the use of plastics. Additionally, initiatives from the private sector to mitigate the impact of single use plastic pollution will also be assessed.

3.2 Data collection

Various methods of data collection are stipulated by Sileyew (2018) and Tobi and Campen (2018). Some of the most prominent methods they include are literature reviews, interviews, questionnaires and surveys. Data collection tools are used to make valid conclusions from investigations that have been conducted. Data is obtained though primary and secondary sources. Primary sources refer to first-hand information that a research collects that has not been analysed yet, whereas secondary information is obtained by examining existing data and literature. This study will make use of both primary and secondary sources of information.

Gopaldas (2016), Levitt, Motulsky, Wertz, Morrow, Ponterotto (2017) and Mohajan (2018) establish that interviews are a crucial method in qualitative research due to their unique advantages in gathering in-depth and rich data.The use of interviews allows the researcher to develop a high level of detail from respondents. Additionally, interviews facilitate the establishment of rapport and trust between the researcher and the participant, encouraging open and candid responses. DeJonckheere and Vaughn (2019) express that qualitative interview questions are used to examine the real-life expectations or consequences of a study. Accordingly, due to the nature of this research this study will use interviews as a method of data collection.

Gopaldas (2016), Levitt, Motulsky, Wertz, Morrow, Ponterotto (2017) and Mohajan (2018) add that there are two ways in which interviews can be conducted; the first being structured interviews, which have a predetermined set of questions that the interviewer will ask the interviewee without moving off the topic. The second way is through unstructured interviews, where the interviewer moves in the direction of the interviewees responses. This study will use structured interview questions to gauge direct responses from the interviewees. The interviews were conducted telephonically through Zoom or Microsoft Teams and handwritten notes were taken throughout the interview session. Interviews were conducted with key role players from Non- Governmental organisations such as the Environmental Monitoring Group of South Africa and Wildlife and Environment Society of South Africa. These organisations were selected from the United Nations Environmental Programme accredited environmental group listing. An online search of possible candidate biographies from these organisations was conducted and then these participants were emailed for an appointment once the IQEMS was completed, towards the close of the study. No candidates were excluded based on age, gender, sexuality, race or ethnicity.

The email contained the letter of consent, gate-keepers letter and letter of information. This is to ensure that all the participants could make an informed decision concerning their

participation in the interviews. Participants, who consented to being interviewed, completed the letter of consent and then only did the interview take place. No personal details of the interviewees were included in the study and all records of interviews were stored in a locked cupboard and will be kept for five years; thereafter they will be shredded and discarded. The interviews formed a feasibility study that served as a point of departure for this study. Appendix I has the interview questions listed. The rationale as to why specific questions were asked will be discussed in Chapter 4 along with the results of the feasibility study.

3.3 Qualitative versus quantitative research methods

Punch (2014) introduces two prime techniques for conducting research these are qualitative and quantitative. Quantitative research follows a positivist philosophy that is based on a scientific approach to research. In this technique, the researcher observes objectively with an attempt to either prove or disprove their hypothesis. This is accomplished through the collection of data that can be measured. With qualitative research, this technique uses an exploratory method that allows for an in-depth enquiry into the theoretical subject matter. This technique uses words and images rather than numbers to help aid a deeper analysis of the subject matter. This study followed a qualitative research technique.

According to Matta (2019), Aspers and Corte (2019) and Busetto, Wick and Gumbinger (2020), under the banners of qualitative and quantitative research techniques, there are several methods of data collection. They detail some examples of Quantitative research methods such as, observation, which is a research concept that examines behavioural patterns, and changes that are observed systematically then detailed. Another method is correlation where the researcher investigates the statistical relationship between two variables. A survey is a research method that extracts data from a population regarding characteristics and frequency of incidents.

The aforementioned authors review some examples of qualitative research methods. For example, Grounded Theory, which is a research concept that gathers data and examines it until core theoretical concepts are identified. Thereafter, there is development of interrelationships between the data and core concepts. An additional method is Ethnography that is rooted in anthropology. It involves mainly the investigation of cultural groups in their natural setting. Phenomenology is another method that investigates the participants view and perception of a certain cultural and social reality. Thematic Analysis is a research method where data and literature are coded for easier classification and identification. Those codes are then used to find patterns and themes that relate to the research question.

This study used Thematic Analysis as a research method to ascertain core themes that can be used in the development of the IQEMS.

3.4 Sampling

Etikhan and Bala (2017) state that when conducting research there are two groups of sampling techniques: Probability and Non-probability. They further add that under the banner

of Probability sampling, there is an additional technique called the Random technique, where all members of the sample group have an equal chance of been selected. Etikan, Musa and Alkassim (2015) add that under the banner of Non-probability sampling there are two types of sampling techniques referred to as Convenience sampling and Purposive sampling. Convenience sampling is a type of sampling technique where members of a particular target population meet certain criteria and generalisations cannot be made about this population. A Purposeful sampling technique is a deliberate choice to identify and select literature or subjects with a specific plan. Drawing from Palinkas, Horwitz, Green, Wisdom, Duan, Hoagwood (2015) this study undertook a non-probability, due to its suitability for capturing the diverse and subjective perspectives of participants in this study. In qualitative research, the focus is on understanding complex social phenomena in-depth in the context of this study. Non-probability sampling methods, such as purposive sampling, allowed the researcher to deliberately select individuals or groups with specific characteristics or experiences relevant to the research objectives. This targeted approach ensured that participants possessed the necessary knowledge and insights to provide valuable information for the study.

Isman, Ekéus, and Berggren (2013) posit that a minimum of six interviews were required when using open-ended questions. Saunders, Sim, Kingstone, Baker, Waterfield, Bartlam, Burroughs and Jinks (2018) advocate that once new themes stop emerging, theoretical saturation is reached and the interview process should cease. For this study, eleven people were interviewed for saturation to be reached.

3.5 Thematic Analysis

Boyatzis (1998) first introduced the concept of Thematic Analysis and he stated that hematic analysis falls under the category of Qualitative research.

Accordingly, King (2004) and Braun and Clark (2006) observe that the main feature of conducting a Thematic Analysis is to a pathway to have a well-structured organising system when dealing with large and complex sets of data. This aided in the development of the IQEMS and ensures that the data and literature is represented in an organised and systematic manner.

Braun and Clark (2006) express that a theme must represent an aspect of work with association to the research question being asked. Boyatzis (1998) posits that themes can be classified as either Semantic or Latent. With a Semantic approach, themes are identified at face value. This approach is seen as a one-dimensional approach to classify data and literature, as the analysis does not look for anything deeper behind what has been identified. With a Latent approach, the analysis looks at the underlying issues and begins to develop different patterns and themes that are based on ideologies and interpretations. He advises that when working systematically though the stages of conducting a Thematic Analysisthe researcher is able to give equal attention and emphasis to each set of literature presented. This study followed a Latent approach.

Braun and Clark (2006) propose five stages that must be carried out when conducting a thematic analysis. The first stage is 'familiarisation with the literature or data'. It is recommended during this step that notes be taken to help gauge early emerging themes and patterns. For this study, this stage entailed reviewing all formats of qualitative data; interviews, quality standards, journal articles and policies. Stage two is 'generating initial codes'. During this stage, it is recommended that the researcher begin to assigning codes literature and data. In conducting this activity, repeatability was established because the researcher has to continuously go back and forth to the literature and data to assign initial codes and then group similar codes. Maguire and Delahunt (2017) state that codes are assigned to important sections of literature.

Stage three is categorised as 'searching for themes'. At this stage data, triangulation begins to occur. During this part of the process, detailed notes are taken for the development of themes and concepts. Fundamentally, at this stage, codes are analysed to construct themes. According to Aronson (1994), theme development occurs when splinters of literature and data are brought together which may not always be apparent when viewed in isolation. The penultimate stage is 'reviewing the themes'. Throughout this stage, the researcher begins to refine the themes that have resulted from stage three. The goal of this stage is to remove themes that do not have enough data or literature to support them and consolidate those that do. In concluding this stage, the researcher will be able to gauge how the themes fit together to aid in answering the research question.

The final stage is 'producing the report' and the final consolidation of all data and literature. As a result, of this stage saturation will be shown. This will fall in line with the concept of transferability. Additionally description of an audit trail will be an outcome of this stage, and forms part of confirmability. King (2004) reports that after the data, literature has been classified resulting in patterns, and themes emerging, researchers can begin to theorise the significance of the data in relation to the research question.

3.6 Trustworthiness

Irene and Albine (2018) advocate that the criterion for the evaluation of qualitative research cannot be easily imported from criteria that are generally adopted during quantitative research. The development of parallels to reliability and validity criteria of trustworthiness was then proposed by Guba (1981) as aligned qualitative criteria with that of internal validity, external validity and reliability which is primarily used for Quantitative work. Several years later, Guba and Lincoln (1989) added several concepts to the trustworthiness criteria: credibility, transferability, confirmability and dependability.

- Credibility – According to Nowell, Norris, White and Moules (2018) this concept relates to the accuracy of a study being conducted. It gathers intelligence on whether a study has reached saturation. Saturation is described as the point where new emerging theories and concepts cannot be found when variation in literature ceases and triangulation can occur. Yin (2003) states that triangulation is a method used to strengthen a study. There are four types of triangulation: data triangulation,

investigator triangulation, theory triangulation and methodological triangulation. This study adopted a theoretical triangulation method, which was established by reviewing different processes, models, literature, interviews, and discussions were analysed for consideration in the development of the IQEMS.

- Transferability – Irene and Albine (2018) express that this concept refers to the degree to which the research can be applied to other settings or areas. For the development of the IQEMS, the researcher conducted an in-depth analysis of the research material from literature. For the purposes of this study, transferability was enhanced though purposeful sampling and once saturation had been reached.

- Dependability – Nowell, Norris, White and Moules (2018) explain that Dependability refers to whether the data produced is stable and if the results yielded can be examined by another researcher to gauge similar results. To fortify the dependability of this study a detailed research and methodological process was presented.

- Confirmability – Irene and Albine (2018) add that this concept refers to the ability of the research being conducted to be confirmed or collaborated by other researchers. Confirmability deals with the bias of the researcher. This study reinforced confirmability by conducting an audit trail into the data and their sources. This showed that the research can be confirmed and corroborated by other researchers.

3.7 Systematic Analysis

Peters, Godfrey, Khalil, McInerney, Parker and Soares (2015), Dewey and Drahota (2016) and Xiao and Watson (2017) suggest that following a Systematic Review process is an effective method to search, select and critically evaluate literature. They add that it is one of the most constructive and functional methods for reviewing literature. Hence, this study selected a systematic review process as a reliable data collection tool.

In the first phase of this study, databases that contained peer reviewed journal articles were explored using a key word search. The databases used were: Pubmed, Web of Science, Emerald, Scopus and Taylor and Francis. The Keywords that were used to search the databases were “SUP”, “ISO 9001”, “ISO 14001” “Industry 4.0”, “Digitalisation of Quality”, “Risk Management”, “Plastic Pollution”, “Bioplastics” “Integrated Management Systems” and “SUP regulation”.

Thereafter, the contents of these research articles were explored and scrutinised for information pertinent to this study. Two-hundred and twenty-three articles from different mediums were used in this study. The ensuing section will present different graphics of data extracted from the literature reviewed. Moreover, the purpose of presenting this information is to highlight the concept of Confirmability by showing the detail of all literature reviewed.

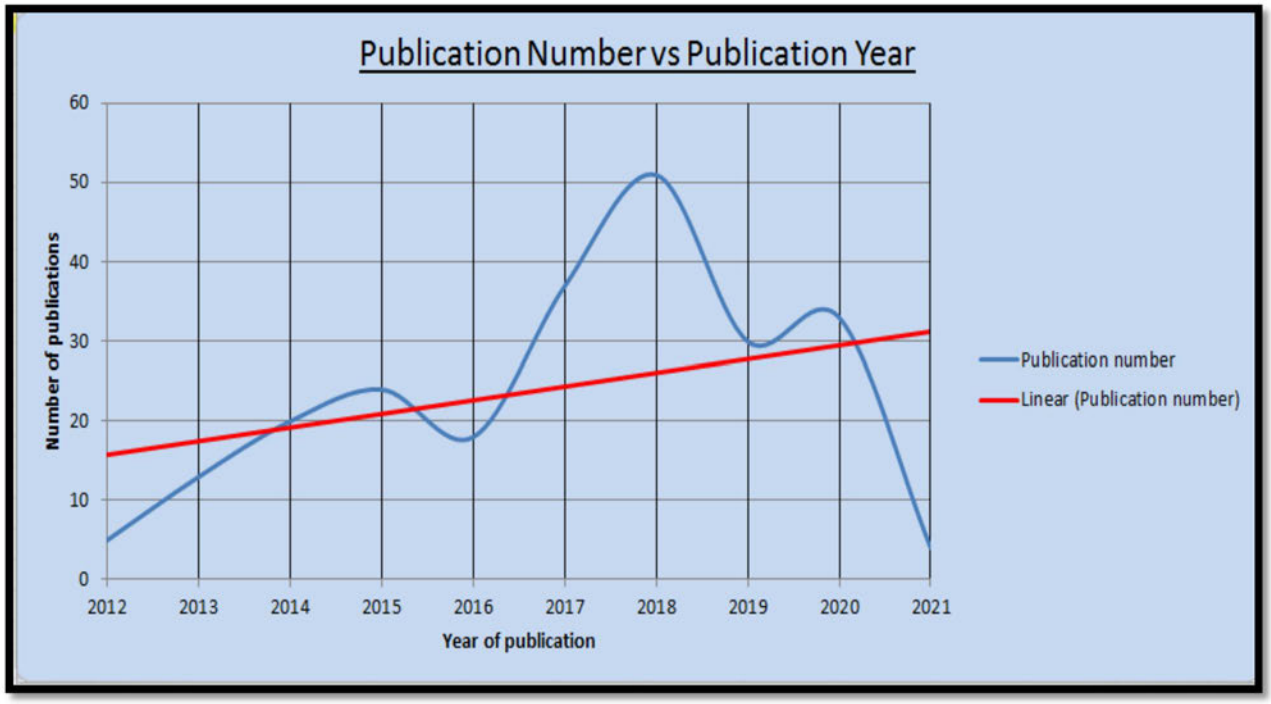

Figure 3.2: The number of publications versus the publication year

Figure 3.2 illustrates that over the past ten years there has been an overall increase in the number of publications concerning SUP, ISO standards, digitalisation, pollution and environmental degradation. Based on the results of the linear trend analysis, it can be perceived that in the coming years there will be an increase in publications concerning SUP and international standards as they continue to permeate society and organisations. This shows the inclination that relevance of this study will continue in the coming years. Saturation was reached when no new themes emerged from the number of publications evaluated; this is indicated by the drop in publication numbers reviewed. This presents the criteria of Credibility and Transferability.

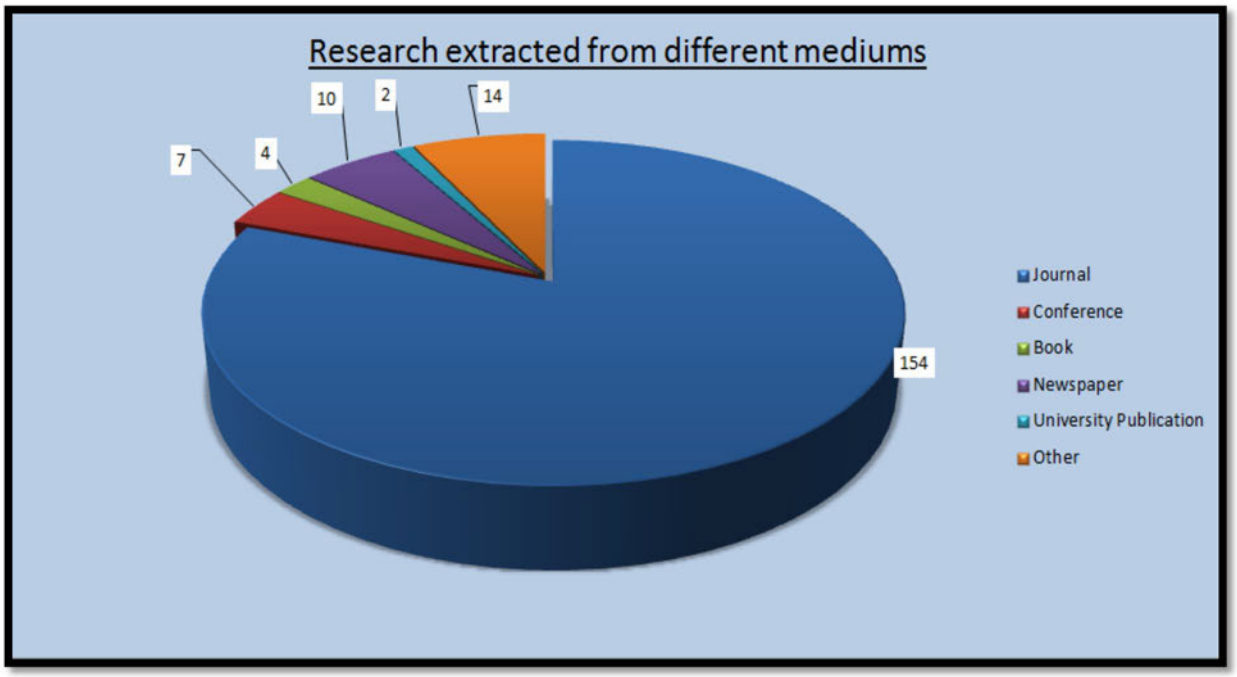

Figure 3.3: The different media used during the review of literature

The information in Figure 3.3 introduces the Confirmability of this study along with the theoretical triangulation by showing an audit trail of where research was extracted. This is illustrated by the number of peer-reviewed journals extracted for this study, which highlights that the research can be confirmed and corroborated by other researchers. Supplementary literature was also extracted from conference publications, books, newspapers, university publications, international standards (other), Government gazettes (other) and statistical models (other).

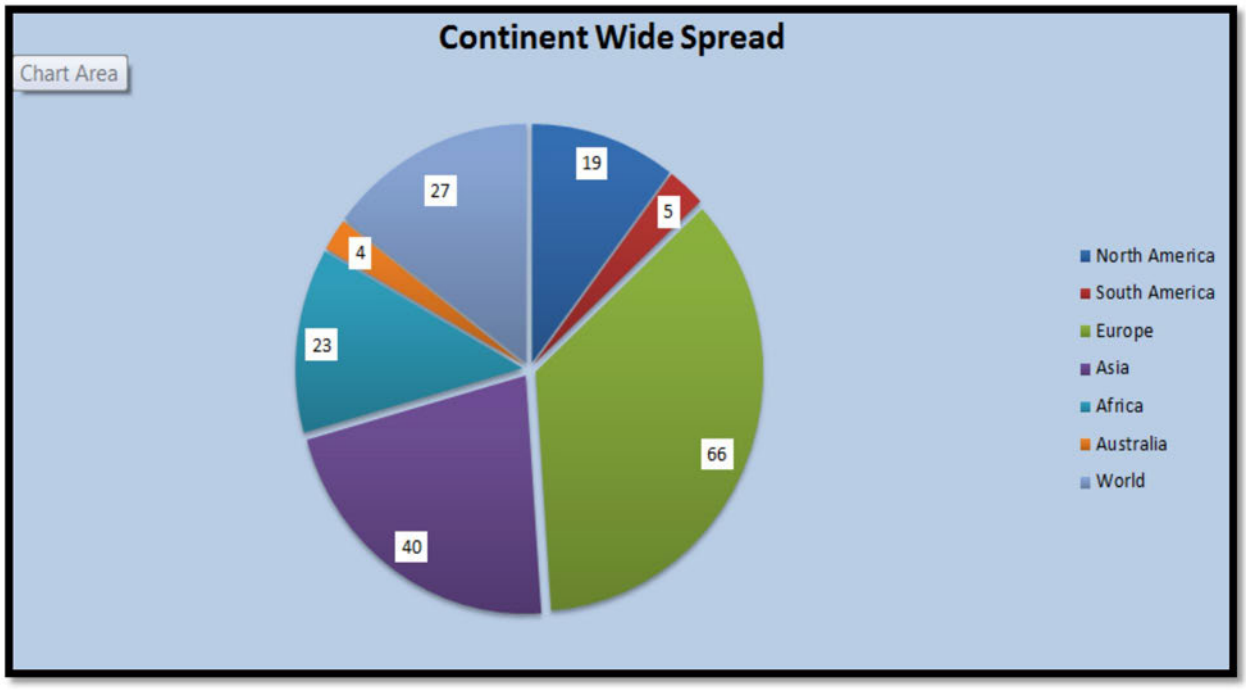

Figure 3.4: Continent wide spread of research review

Figure 3.4 underscores that the vast majority of research used in this study was conducted in Europe and publications from Africa coming in at fourth place. It can be deduced that due to the minimal research published from Africa, compared to other continents, this study can be useful to assist in the African context.

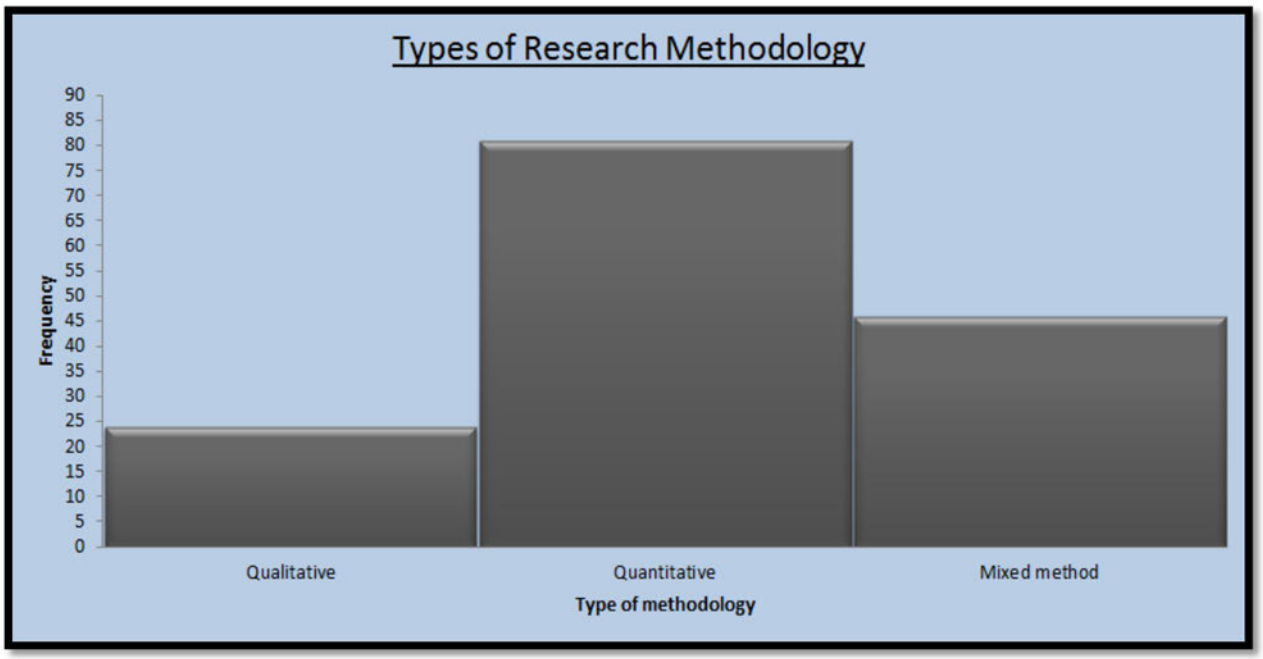

Figure 3.5: Types of research approaches used in the literature reviewed

Figure 3.5 highlights the data analysis of the different literature that were used in this study. Majority of the articles that were examined followed a Qualitative research analysis.

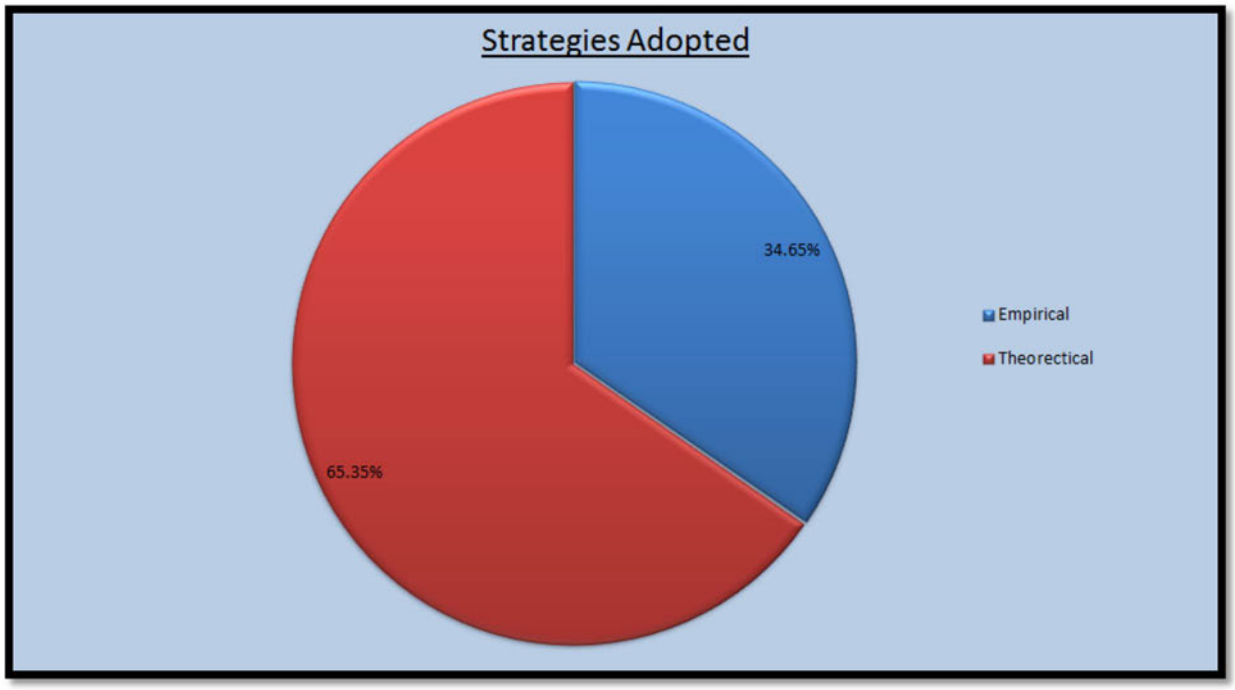

Figure 3.6: Strategies adopted from literature reviewed

The pie chart shown in Figure 3.6 gives a percentage breakdown of the different strategies that were adopted from literature reviewed in this study. Sixty-five, thirty-five per-cent of literature selected followed a theoretical strategy. This aids with contributing to the Transferability by highlighting purposeful sampling of this study because it also followed a theoretical strategy.

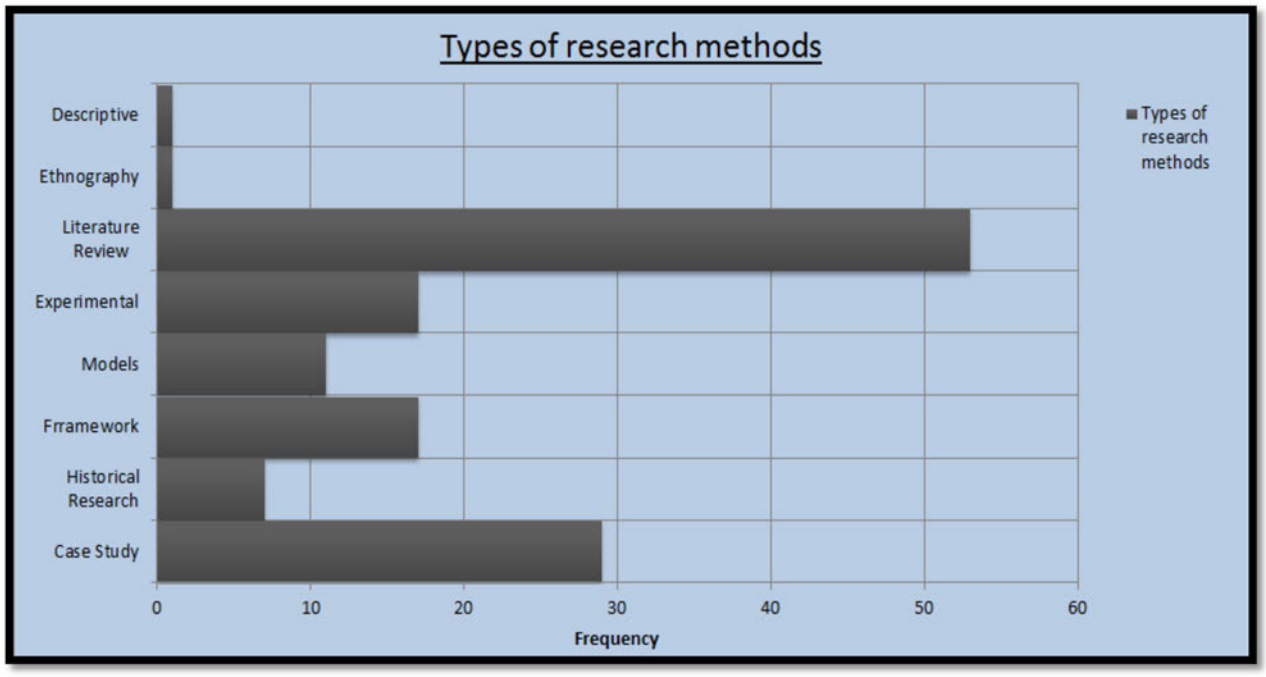

Figure 3.7: Graph depicting different types of research methods

The last graph presents the different types of research methodologies that the literature followed. Literature review and case study accounted for the majority of research methods that were used by other researchers. This type of method was primarily selected due to the nature of this study. Furthermore, frameworks, models and experimental methods of the literature were also purposefully selected to aid in guiding this study. This also shows the Credibility of the study along with the theoretical triangulation. These were established by reviewing models, literature, interviews and case studies relevant to this study until saturation was reached.

3.8 Reliability

According to Heale and Twycross (2015) when dealing with a qualitative study, it is important that best practices be used to ascertain results. Given the interpretive nature of qualitative data, they emphasise that the framework of Trustworthiness must be followed to ensure accurate reporting. Reliability is when there is consistency with a measuring instrument that can then yield a certain result without any changes within that entity. Leung (2015), Cypress (2017), McDonald, Schoenebeck and Andrea (2019) and Hayashi, Abib and Hoppen (2019) report that there are four types of reliability: inter-rator reliability, internal consistency reliability, equivalent forms of reliability and test-retest reliability.

- Inter-rator reliability - Is the extent to which two or more can individuals evaluate the same results and give identical judgements
- Internal consistency reliability - Is the extent to which all of the items within a single instrument yields similar results
- Equivalent forms of reliability – Is the extent to which two different versions of the same instruments yields similar results
- Test-retest reliability – Is the extent to which a single instrument yields the same results for the same people on two different occasions

For determining reliability with qualitative interviews, inter-rator reliability will be used. Braun and Clark (2006) assert that Cohens Kappa formulae must be calculated in order to determine the Reliability value. They express that a value above 80% is sufficient to prove reliability. The formula to determine this is;

$$\text{Reliability} = \frac{number\ of\ agreements}{number\ of\ agreements + number\ of\ disagreements} \text{ x } 100$$

Equation 1: Cohens Kappa formulae
(Reference: Braun and Clark, 2006)

3.9 Preliminary Research

The preliminary research covers salient factors that emerged from the systematic literature review. It will highlight the fundamental considerations that should be included in managing SUPs. Estihono, Festiyed and Bentri (2019) advocate that preliminary research, addresses the feasibility of a study. Moreover, it provides an in-depth knowledge of the current position of the research area and aids in the design of theoretical framework. The preliminary research in this study investigated from literature the extent of the environmental impact of SUP. This was undertaken in order to ascertain the depth that the IQEMS will have to cover in order to compose comprehensive mitigation measures.

The subsections below will address the, "sustainable management of chemicals and waste and possible options to reduce pollution overflow into developing countries," that arose out of the statement problem that will form part of the Policy developed.

3.9.1 Micro plastics

Plastic pollution, improper waste disposal and inadequate landfill storage eventually leads litter and plastic waste into streams and rivers. The authors elaborate that between 1.15 and 2.41 million tonnes of plastic waste enters the oceans through the global ravine system each year. The runoff of plastic waste generally occurs when there is excess rainfall that is higher than that of the soils infiltration rate. This results in catchment areas collecting plastic waste, which then travels with water into rivers and streams and finally into oceans. Nizetto, Bussin, Futte, Butterfield, Whitehead (2017) adds that due to turbulence, the plastic waste in the rivers ultimately flows with the waste into the oceans. This highlights how easily it is for plastic waste to travel, primarily due to the low density of SUP that allows them to be washed away easily. A concerning relationship is highlighted by Yonkos, Friedel, Perez-Reyes, Ghosal, Arthur (2014) where the human population densities and surface plastic waste concentration levels are directly proportional. This further fortifies the need for the IQEMS, which can aid in mitigating the impact of SUP.

Of concern, Lebreton, Slat, Ferrari, Sainte-Rose, Aitken, Marthouse, Hajbane, Cunsolo, Schwarz, Levivier, Noble, Debeljak, Maral, Schoeneich-Argent, Brambini, Reisse (2018) determined that there are several spots in the ocean where there is an extreme conglomeration of plastic waste. They report five plastic waste 'hot spots' in North Atlantic Gyre, South Atlantic Gyre, North Pacific Gyre, South Pacific and the Indian Ocean Gyre. Majority of the time the plastic waste accumulates in one of the five aforementioned spots due to the abiotic nature of ocean currents. The Great Pacific Garbage Patch has the largest collection of plastic waste that covers approximately one and a half million square kilometres. This is almost twice the size of the United States of America. The Patch contains approximately one and a half trillion pieces of plastic waste that is estimated to weigh around seventy-nine metric tons. Researchers used eighteen water vessels and collected hundreds of water samples to estimate an approximation of the magnitude of the impact of plastic waste in the Patch. They also report that plastic fishing nets contribute a large portion of the plastic waste that has accumulated in the Patch. While plastic fishing nets are not classified as SUP, they still pose

a great threat to marine life and the oceans. Additional research in managing this area of impact is required in the future.

3.9.2 Macro plastics

Posing just as much a danger to aquatic and terrestrial life as micro plastics, are macro SUP such as; plastic bottles, ear buds, plastic bags, polystyrene cups and plastic straws. These enter the oceans and landfills at an extremely alarming rate. The Velzeboer, Kwadijk, Koelmans (2014) and Gewert, Plassmann, MacLeod (2015) concern themselves with the lifecycle of SUP in the ocean, they express that once plastics enter the ocean, they begin to breakdown into Nano-plastics. These plastics are polymers with the carbon backbone, usually in the form of Polyvinyl Chloride (PVC), Polypropylene (PP), Polyethylene Terephthalate (PET) and/or Polystyrene (PS). Photo degradation occurs when ultra-violet (UV) light (from sunlight) converts plastics into smaller units of plastics over time, which results in new chemical groups, which form atoms of Carbon Dioxide and inorganic chemicals. Gewert (2018) found that these chemicals are toxic for marine life, more predominantly PVC and PP leachates. The ocean temperature coupled with saline conditions and UV radiation results in slow degradation of plastics. Irrespective of the slow of the process when the leachates begin to leak out, they become poisonous to the marine life in those surroundings.

Ioakeimidis, Fotopoulou, Karapanagioti, Geraga, Zeri, Papathanassiou (2016) also studied the effects of plastic pollution on the ocean. They showed that microorganisms and marine life colonise on these floating pieces of plastic debris, which hinders degradation by UV light but resultantly affects the buoyancy of the plastic debris. The effected buoyancy of the plastic debris causes it to sink below the sea level. The United Nations Environmental Programme (2016) states that the more microorganisms and marine life that gather together, the more density of these floating pieces of debris increases and resultantly the plastic debris begins to sink to the ocean floor. This primarily occurs in the colder regions of the ocean. They report that this occurs primarily in the colder regions of the ocean is because the density of water is a lot higher in these areas. The plastic debris starts to break down and due to the change in density, it begins sink. National Geographic (2019) discovered microscopic dissection and analysis that the plankton on the ocean floor with plastic in their biological systems. This may affect their ability to capture Carbon Dioxide. These phenomena draw major attention to the issue of single use plastic pollution and the extent to which a crisis has developed.

Furthermore, during these processes Sebille, Spathi, Gilbert (2016) reported that ocean birds and aquatic life ingest pieces of plastic debris. According to UNEP (2016) majority of the time, aquatic life mistake plastic bags for jellyfish. Jambeck and Johnson (2015) stated that fifteen per-cent of species that are endangered are affected by the ingestion and entanglement from marine litter. Additionally, Sebille, *et al.,* (2016) elude that because of insufficient wastewater treatment, micro beads from cosmetic products and clothing fibres are a major source of micro plastic pollution. As reported by Derraik (2013) reported that fish can confuse these plastic pellets for plankton. The bioaccumulation of plastic debris in aquatic life and even terrestrial life, cause marine and terrestrial animals' digestive tracts to become blocked. As a result, they starve and then die. This abnormality is then transferred to different

food webs, causing a disruption to ecosystems at an enormous scale. Sebille, *et al.,* (2016) and UNEP (2015) reported that the main sources of marine litter come from inadequate waste management systems, costal littering and discharge from storm water pipes. These major issues create the opportunities for research to aid in alleviating the damage caused by these problems.

Chanaky and Ramachandra (2014) highlight that when solid waste such as plastic bags, plastic bottles and plastic wrappers come into contact with drains and sewers they cause blockages which can lead to flooding during rain falls and natural disasters. These plastics accumulate in low flow rate areas at first, and then when it begins to rain, they move downstream and can cause blockages in sewers, water streams, rivers and floodgates. This can cause overflowing and result in flooding. The primary challenge with single use plastic waste is that, the waste not recycled ends up in a landfill. At this point, waste just accumulates and takes centuries to decompose. Godfrey, Oelofse (2017) asserted that almost ninety per-cent of waste in South Africa ends up in a landfill. The institute of Waste Management for Southern Africa (2017) reported that, finding appropriate sites for landfills are becoming increasingly difficult especially in urban areas. Consequently, the reliance on landfilling needs to be addressed and mitigated.

According to Koushal, *et al.,* (2014) several toxic chemicals are by-products of plastic production. These by-products are carcinogens, neurotoxins and hormone disruptive chemicals that leech their way into the biosphere. Schuler (2015) reports that during the production of polyvinylchloride products, by-products such as dioxins and phthalates are released. Polystyrene production releases by products such as benzene, which is a compound that affects the nervous, reproductive, and respiratory systems. Bisphenol-A or most commonly known as BPA is used to produce majority of plastic bottles. The compound can leak toxins when improperly discarded manufactured and disposed. According to Mileva, Baker, Konkle, Bielajew, (2014) these toxins can be easily deposited into the fatty tissue of humans. Mileva, *et al.,* (2014) cites preliminary work conducted by Soto, Brisken, Schaeberle, Sonnenschein (2013) that BPA toxins can play a role in the development of testicular cancer and male reproductive dysfunction. Additionally, Acevedo, Davis, Schaeberle, Sonnenschein, Soto (2013) advocate that BPA toxins can have estrogenic side effects in females. It can have effects on human placenta tissue resulting in premature growth retardation and stillbirth.

3.9.3 Bioaccumulation of micro-plastics in human, marine and terrestrial life

Smith, Love, Rochman and Neff (2016), Anderson, Park and Palace (2016) and Catarino, Macchia, Sanderson, Thompson and Henr (2018) moot that micro-plastics found in water systems, marine life and salt bio-accumulates within the human body. Due to micro-plastics being so compact they add that there are concerns with micro-plastics being inhaled in environments that are heavy polluted such as industrial areas. These studies suggest that the cumulative effect of ingesting micro-plastics will be toxic over the long-term period. Furthermore, they suggest that when micro plastics are consumed by human life, they are often consumed with toxic chemicals such as persistent pollutants. Even though they will only be consumed in trace amounts, the accumulation of these toxic chemicals over-time in

the body will cause long-term immune system damage. Write and Kelly (2017) review that the ingestion of micro plastics affects the gut in the long-term period. The studies iterate that the full long-term side effects of ingesting micro plastics are not fully known and that appropriate studies are being carried out to determine the full effect of the bioaccumulation of micro-plastics within the body.

Fisheries of the United States (2015) and Steer, Cole, Thompson and Lindeque (2017) argue that the intake of micro-plastics begins at the bottom of the food chain with marine organism such as plankton and lower-level larvae in ocean sediment. Bioaccumulation of micro plastics occurs higher up the tropic levels in marine eco systems. This situation concerning micro-plastics has resulted in copious amounts of micro plastics in the biota. Baulch and Perry (2014) and Doughty and Eriksen (2014) review that there is major cause for concern with micro plastics bioaccumulation through the tropic levels of food webs. Several studies have conducted quantitative analysis on the quantity of micro plastics present in marine and terrestrial life. Woodall, Sanchez-Vidal, Canals, Paterson, Coppock, Sleight, Calafat, Rogers, Narayanaswamy and Thompson (2014) conducted water and sediment sampling in the deep-sea areas in the Indian and Atlantic Oceans at a depth of three thousand five hundred meters. The average quantity of micro plastics that they found was 13.4 pieces/50 mL of sediment. At such extreme depths, this could indicate that in the deep sea a possible sink for micro plastics has begun to form. This information further exasperates the urgency that is required to deal with SUP.

Food and Agricultural Organisation (2018) reports that due to the prevalence of micro plastics in aquatic ecosystems discussed in this study, the capacity for fish and other marine life forms to consume micro plastics are very high. Thompson, Gall (2015) confirmed that organisms are ingesting micro plastic waste and it is being transferred throughout the tropic levels. Cauwenberghe and Janssen (2014) and Rochman, Tahir, Williams, Baxa, Lam, Miller, Teh and Werorilangi (2015) review that the excessive amount of plastic waste in the oceans has resulted in them being consumed by the majority of marine life. The plastic waste follows the internal pathways of marine life through the digestive tract however; they are not egested from the body. They are often persistent in the body and translocate from the intestinal tract then travel through the circulatory system and become logged in the surrounding tissue. The accumulation poses a major health risk as times go by notwithstanding that more micro-plastic accumulates in the body.

In the context of micro plastics, as corroborated by Smith, Love, Rochman and Neff (2016), Anderson, Park and Palace (2016), Lebreton, *et al*., (2018) and Catarino, Macchia, Sanderson, Thompson and Henr (2018) caution that there is an immediate danger posed by micro plastic to human life. The main areas of greatest concern are the bioaccumulation of plastic waste in the body and food security. The primary effects will be people consuming micro plastic waste and developing health issues related to the plastic waste in future decades. The secondary effects will be the impact that the bioaccumulation of plastic waste has on marine life. From the experiments conducted on aquatic life, the bioaccumulation of plastic waste results in lower fertility. It can be deduced that, these issues will heavy impact the food web and food security. From a historical perspective, the food security issue will be one of the prime issues

that will affect those that are poverty-stricken and those who work blue-collar jobs. The secondary effects will be the impact that the bioaccumulation of plastic waste has on marine life.

Several deficiencies have been highlighted from the preliminary study. Table 3.1 will identify each deficiency, suggest a potential source and possible mitigation strategy.

Table 3.1 Table depicting summary of the preliminary results
(Source: Developed by the researcher, 2022)

Deficiencies identified	Source of the deficiency	Possible mitigation
The effects of micro plastics on the ocean.	Liquid discharge from manufacturing industries as well as cosmetic and pharmaceutical products	Transforming industries to manufacture products using sustainably sourced alternative material or banning the use of micro plastics in the production of cosmetics and pharmaceutical products.
Conglomeration of SUP at different 'hot spots' on the ocean.	Pollution and littering	Recycling and awareness programmes on pollution and littering. Developing new industries that collect and recycle plastic waste. Developing new industries that turn plastic waste into raw materials and alternative products.
Bleaching of chemical polymers into the ocean.	Pollution and littering	Ensuring alternatives to SUP that are not manufactured with toxic chemicals.
Bioaccumulation of micro plastic waste in terrestrial and quality life as well as humans.	Liquid discharge from manufacturing industries as well as cosmetic and pharmaceutical products. Ingestion of seafood and birds that have ingested plastic waste.	Transforming industries to manufacture products using sustainably sourced alternative material or banning the use of micro plastics in the production of cosmetics and pharmaceutical products.
The effects of macro plastics on landfills and the ocean.	Pollution and littering	Recycling and awareness programmes on pollution and littering. Developing new industries that collect and recycle plastic waste. Developing new industries that turn plastic waste into raw materials and alternative products.

The possible mitigation strategy [Schuler (2015),The Waste Economy Market Intelligence Report (2017), Summit Foundation (2017), Zwinoira (2017), United Kingdom Department for Environment, Food and Rural Affairs (2018), Tamura (2018), Thread International (2019), Cradle Institute (2019), Polywood Plastic (2020), Green Furniture (2020), Envirotimbers (2020), Haque and Islam (2021), Mihai, Gündoğdu, Markley, Olivelli, Khan, Gwinnett, Gutberlet, Reyna-Bensusan, Llanquileo-Melgarejo, Meidiana, Elagroudy, Ishchenko, Penney, Lenkiewicz, and Molinos-Senante (2022) and ECONYL® (2022)] has been consolidated from literature, evaluated and assigned to address appropriate deficiencies.

Mitigation strategies play a crucial role in sustainability by addressing and minimising the negative environmental and social impacts associated with various activities. Mitigation strategies are essential for achieving the UNSDGs. The strategies highlighted will from part of the IQEMS and Policy Development.

3.10 Results of Thematic Analysis

The table below will identify the different themes that emerged in the study. It will identify the themes, provide a description of each theme, present the source of the themes, the frequency of the feature and its saliency as support for developing the thematic analysis.

The Thematic Analysis will facilitate the exploration and interpretation of underlying themes and resultantly provide valuable insights in respective avenues.

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Table 3.2: Table presenting results of the Thematic Analysis

Themes	Description	Author/s	Frequency	Saliency
1. Legislation delays	The first theme that emerged was legislative impediments when Governmental houses tried to pass laws concerning limiting the use of SUP. This was common in Canada, The United Kingdom and Bangladesh.	Canadian Environmental Law Association (2015), Ecospearbd (2017), United Kingdom Department for Environment, Food and Rural Affairs (2018), Tamura (2018), UNEP (2018), United Nations (2018) and National Environmental Management Authority (2018)	7	High
2. Support from the working class	The lack of support from the working class is detrimental to any Laws and regulations passed regarding the controlling of SUP.	Barca (2012), Zwinoira (2017), Watts (2018), Molina (2017), United Nations Environmental Programme (2018), Dante (2018) International Labour Organisation (2018) and Bell (2020)	8	High
3. Awareness programmes	Development and promulgation of awareness programmes regarding SUP prior to legislative amendments and/or additions are vital to success.	Zohny (2009), Aljaradin, Persson and Hossam (2011), Tiew, Watanabe, Basri, Zain and Basri (2013), Molina (2017), Summit Foundation (2017), United Nations Environmental Programme me (2018), Rabiatu, Halima and Rami (2018) and Aksan and Çelikler (2019)	8	High

Table 3.2: Table presenting results of the Thematic Analysis

Themes	Description	Author/s	Frequency	Saliency
4. Tax incentives	Providing tax incentives to private businesses to mitigate their impact of SUP has emerged as a predominant theme.	Mormann (2013), Schulz and Heitger (2014), Ruminaa, Balandinaa and Bannovab (2015), Harrision (2015) Dippenaar (2018), Curtin, McInerney and Johannsdottir (2018) and Redonda, de Sarralde, Hallerberg, Johnson, Melamud, Rozemberg, Schwab and von Haldenwang (2019)	7	High
5. Impact on the food chain as a result of SUP	The impact of SUP is causing detrimental effects thought out all tropic levels in food chains.	Baulch and Perry (2014) and Doughty and Eriksen (2014), Fisheries of the United States (2015), Smith, Love, Rochman and Neff (2016), Anderson, Park and Palace (2016), Write and Kelly (2017), Steer, Cole, Thompson and Lindeque (2017) Catarino, Macchia, Sanderson, Thompson and Henr (2018) Gewert (2018)	9	High
6. Job creation	Controlling SUP towards sustainability has the opportunity to create a significant amount of jobs both in the public and private sector.	Maia, Giordano, Kelder, Bardien, Bodibe, Du Plooy, Jafta, Jarvis, Kruger-Cloete, Kuhn, Lepelle and Makaulule (2011), Borel-Saladin and Turok (2012), Global Alliance for Incinerator Alternatives (2013), Jacob, Quitzow and Baer (2015), Packaging Report (2016), The Waste Economy	7	High

Themes	Description	Author/s	Frequency	Saliency
		Market Intelligence Report (2017) and Godfrey and Oelofse (2017)		

The thematic analysis helped uncover underlying meanings, trends, and perspectives, providing insights into possible avenues of development for the IQEMS. It generated valuable knowledge that can inform decision-making and Policy Development.

3.11 Summary

This study was qualitative and used thematic analysis to identify key-themes to explore the use, control and pollution of SUPs. The steps to show the methodological soundness of the study was also presented in this chapter. The systematic analysis was presented using graphs and diagrams to illustrate different aspects of the literature gathered. The next chapter will present the IQEMS and the results of the perception study.

Chapter 4

This chapter will be divided into two parts. The first part will illustrate the development of the IQEMS and present the IQEMS. The second part of the chapter undertake a perception study post the development of the IQEMS and present the feedback obtained on the potential usefulness of this system.

4.1. Informing the IQEMS

The next two subsections will highlight the influence of the themes that arose out of the thematic analysis and how it will inform the IQEMS and Policy development going forward. It will also express the influence of literature on the selection of management systems for the integration process.

4.1.1 The influence of themes on the IQEMS

Six themes emerged out of the Thematic Analysis, each of these themes will be used directly or indirectly in the IQEMS and/or Policy development. These themes are as follows: Theme number one: Legislation delays, Theme number two: awareness programmes and Theme number three: Support from the working class will form part of the development at the legislative level.

Theme number four: Tax incentives, Theme number five: The impact on the food chain as a result of SUP and Theme number six: Job creation, will be indirectly achieved in the development of the IQEMS as part of the activities and requirements of the system.

The layout below is specific to integrating codes of practice as suggested in this study. The details of each requirement must be written and adhered to, as stipulated in the standalone management systems; ISO 9001:2015 and ISO 14001:2015.

4.2 Development of an integrated quality and environmental management system

The proceeding discourse will specifically relay clause numbers and requirements of the IQEMS. Each clause will show the integration of ISO 9001:2015 and ISO 14001:2015 in the context of this study. The appendices (A, B, C, D, E, F, G and H) will address the actual requirements of ISO 9001:2015 and ISO 14001:2015 that arose out of the literature review. The flow diagrams will illustrate the specific integrated clauses related the IQEMS.

The first three clauses of ISO 9001:2015 and ISO 14001:2015 are the Scope of the Standard, References and Terms and Definitions. These are generic requirements that are applicable to any organisation therefore; the IQEMS will be presented and discussed from Clause 4.

Cognisance of the current practice and the dominance of the number of integrated management systems with Quality Management Systems based on ISO 9001 and Environmental Management Systems based on ISO 14001 is acknowledged. Therefore, the integration considerations in this study will address only those aspects that are applicable to integration based on the use of SUPs.

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4.2.1 Clause four: Context of the organisation

Figure 4.1 provides an overview of the IQEMS requirements pertaining to Clause four.

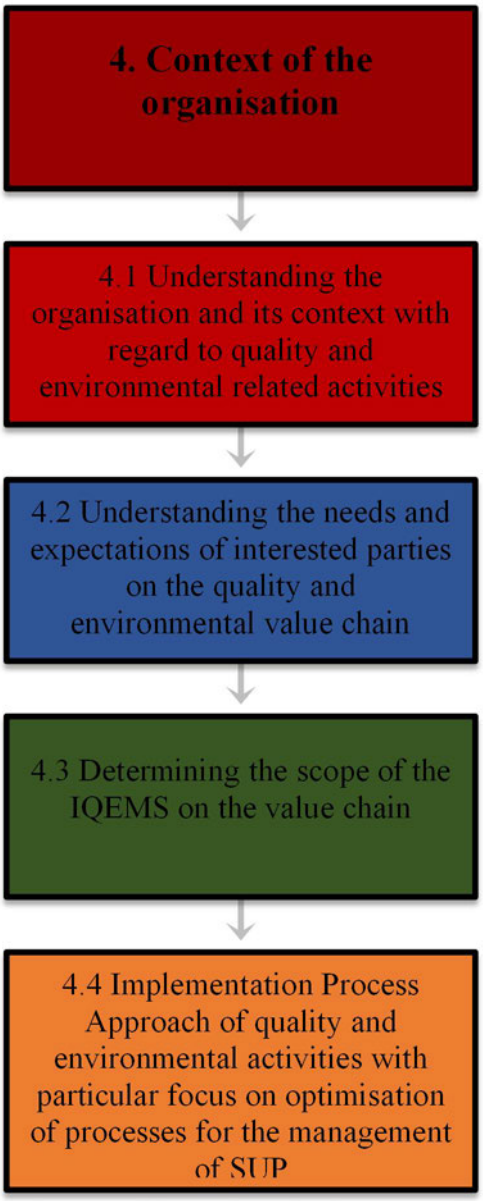

Figure 4.1: Flow diagram illustrating the integrated clauses pertaining to section four (Reference: Developed by the researcher)

Figure 4.1 provides an overview of the IQEMS requirements pertaining to Clause four. The first component, *4.1 Understanding the organisation and its context with regard to quality and environmental related activities*, pertains to the organisation determining the external and internal problems of the organisation, the holistic direction that the organisation will take and the intended results of the IQEMS.

Arising from the SWOT analysis and in-keeping with the requirement on internal and external problems, risks emerged as a salient point from the literature review. A key argument that emerged from the literature was to consider corporate "drivers' to inform integration. It was found that

Operational, Regulatory, Financial, Marketing, and Social considerations should be regarded as key drivers to support a strong foundation for the integration process in this study.

- Operational – refers to supply chain management and process efficiency. This also falls in line with a risk-based thinking approach of operational efficiency and supply-chain management that will be discussed in Clause six and eight.
- Regulatory – deals with the legal requirements that organisations will have to fulfil from the Departments of Health, Labour and Environment Affairs.
- Financial – covers the investment requirements that the organisation will have to make relating to research and development into the use of alternatives materials, processes and products for controlling SUP as well as new technologies, machinery and equipment.
- Marketing – reviews the customer requirements relating to controlling SUP.
- Social – examines public expectations and requirements for the organisation. Public protests, especially NGOs and social media pressure relating to reducing and controlling SUP is rife, therefore it is sensible for organisations to consider this as a part of its direction.

These requirements will have to be accounted for at the start of implementing the IQEMS.

4.2 Understanding the needs and expectations of interested parties. A key aspect here is ensuring that all role players and stakeholders are involved and their contributions and concerns are made transparent from the start of establishing the IQEMS. It must be remembered that key role players and stakeholders will include the community to ensure that the organisational processes and products have accounted for public concern and do not negatively affect their environment and that their expectations. Other interested parties would include regulatory bodies, sustainably sourced suppliers and potential finance partners.

4.3 Determining the scope of the IQEMS. This follows Clause 4.1 and 4.2 it sets out the requirements and expectations of the organisation. Thereafter, the scope can determine the extent to which the organisations processes, procedures and departments will be incorporated into the IQEMS.

4.4 Implementation Process Approach of quality and environmental activities with particular focus on optimisation of processes for the management of SUP. This Clause concerns the processes that are required to ensure that the IQEMS is followed and maintained by the organisation. This sub-clause also requires that regular improvements be made to the system based on results from organisational processes. Within Clause 4.4 there are eight sub-clauses (a to h) were each have their own functionality. Sub-clause (g) and (h) has not been included in this integration as it does not apply to SUP

- a – refers to the inputs required and the outputs that would be expected from the processes. Some examples are: the sustainably sourced raw materials that would be required for production such as cotton made from recycled plastic waste for clothing, planks made from recycled waste for furniture and ‘ecobricks’ used in the construction of houses. Some organisations would be making the material for others to process. Those facilities would have to have a sufficient stock of SUP waste collected before beginning their processes.
- b – represents the sequence, interaction, criteria and methods of these processes. The organisation needs to develop Standard Operating Procedures (SOPs) for each of the processes

that account for sensitivity of the new raw materials, their interactions with each other, criteria to monitor them and the methods to control them along the value-chain.

- c – deals with resources required for the organisational processes. This will involve Top Management to ensure that financial, human, equipment and machinery resources are provided. The shift towards the IQEMS will require substantial investment be made into the organisation.
- d – assigns responsibilities to all employees. This will entail a detailed integrated job description to ensure that all employees are aware of their responsibilities.
- e – ensures that risks are addressed and opportunities are followed through. This will be discussed further in Clause 6.1.
- f – concerns the evaluation and improvement of processes. This will require the organisation to have the capability to measure and monitor the results and be able to adjust based on the results. For example, if there are toxic by products such as PVC, PP, PET and PS. There must be processes in place to stop the production line, isolate the stock and revalue the process.

Four of these eight clauses [(b) and (c)] and [(e) and (f)] have similar functions relating to SUP and were thus integrated with each other during the development of the IQEMS.

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4.2.2Clause five: Leadership

Figure 4.2 provides an overview of the IQEMS requirements pertaining to Clause five.

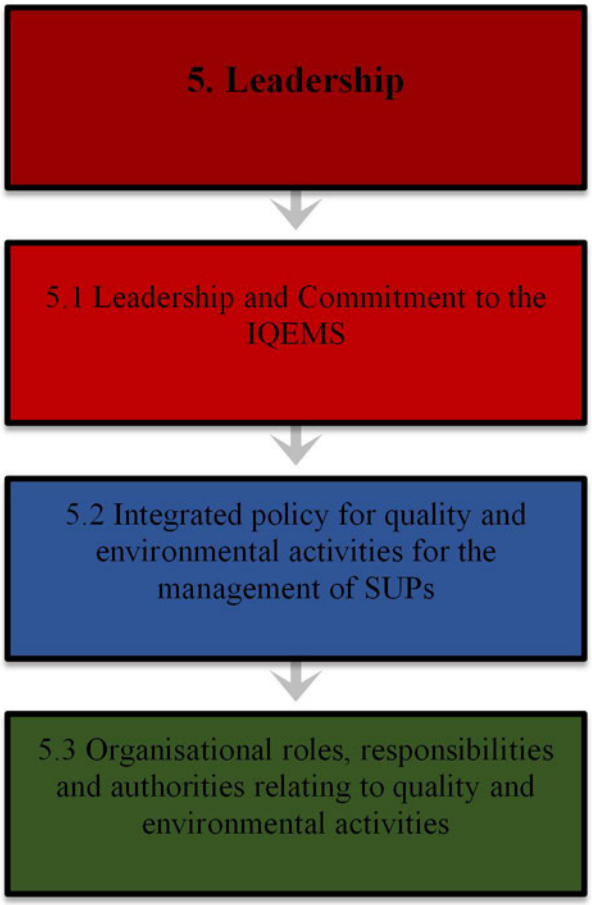

Figure 4.2: Flow diagram illustrating the integrated clauses pertaining to section five
(Reference: Developed by the researcher)

5.1 Leadership and Commitment to the IQEM. Is a significant aspect of IQEMS because it deals with the justification of resource requirements to management. The Leadership must commit to control the consumption and use of SUP in the organisation by addressing the needs and expectations of stakeholders. Both leadership and commitment are essential to the IQEMS, to ensure that management will provide the financial and personnel requirements at the inception of its development and implementation.

5.2 Integrated policy for quality and environmental activities for the management of SUPs. Requires that the organisation develop a framework to achieve their objectives and requirements. It must also include their commitment to the prevention of SUP usage and declarations of environmental protection. The Policy must also declare training and legal commitments.

5.3 Organisational roles, responsibilities and authorities, this sub-clause dictates the importance of roles and responsibilities as well as job descriptions within the IQEMS. Dual or overlapping roles that have two departments or people doing the same activity needs to be merged to ensure efficiency as well as that additional financial and human resources are freed up. The Human Resources department at an

organisation along with the relevant management will have to develop detailed integrated job descriptions to ensure that the IQEMS is implemented successfully.

4.2.3 Clause six:

Figure 4.3 provides an overview of the IQEMS requirements pertaining to Clause six.

Figure 4.3: Flow diagram illustrating the integrated clauses pertaining to section six
(Reference: Developed by the researcher)

6.1 Actions to address risks and opportunities. A risk-based thinking approach also emerged as a crucial component to building any system from the literature review. Sub-clause *6.1.1,* calls for external factors such as political instability, industry trends, environmental vulnerability and wars, that generally have little consideration in management systems must be accounted when determining risks that will affect the organisation. Internal risks such as ensuring the correct product specifications are followed, acceptation and rejection criteria are in place and robust procurement processes are in place.

6.1.2 Supply chain management. A risk-based approach to consider suppliers according to two dimensions, namely: operational and supply interruption. In light of the literature review, the operational dimension refers to all the internal processes and procedures that may cause uncertainties, such as, there being a lack of technical skills at site, maintenance upgrades to equipment and machinery, and that lack of cash flow in the organisation.

The supply interruption dimension requires all possible external risks be considered against each supplier for example, the organisations procedure if the sustainable sourced raw material supplier is not able to deliver the quantities required due to a natural disaster such as flooding. Considerations in the forms of contingency plans for: alternative supplier/s, reassignment of staff during manufacturing downtime, customer relations management because of delays should be established.

Suppliers should be divided into three-risk levels: namely high, moderate and low. Suppliers that are high-risk would have a critical impact on the organisations processes and products. Due to the present scarcity of sustainably sourced raw materials relating to SUP, the majority of supplies would have to be imported from other continents. Therefore, it is plausible that strategic planning would account for the lead-time required, sudden demand in products and delays in shipping. The carbon emissions from excess shipping and delivery will also have to be considered.

Moderate and low risk suppliers would be those that have a minimal and negligible impact on processes and products. Such suppliers are local or within the country and have raw materials available on hand, for example "ecobricks' and planks made from plastic waste are readily available.

6.1.3 Legal and regulatory requirements. Deals with detailed planning to achieve the requirements of the Departments of Health, Labour and Environmental Affairs.

6.2 Integrated objectives for the management of SUP. The integrated objectives of the organisation need to be congruent with the Integrated Policy to ensure that it is achievable. The objectives need to be monitored, communicated and updated appropriately.

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4.2.4 Clause seven:

Figure 4.4 provides an overview of the IQEMS requirements pertaining to Clause seven.

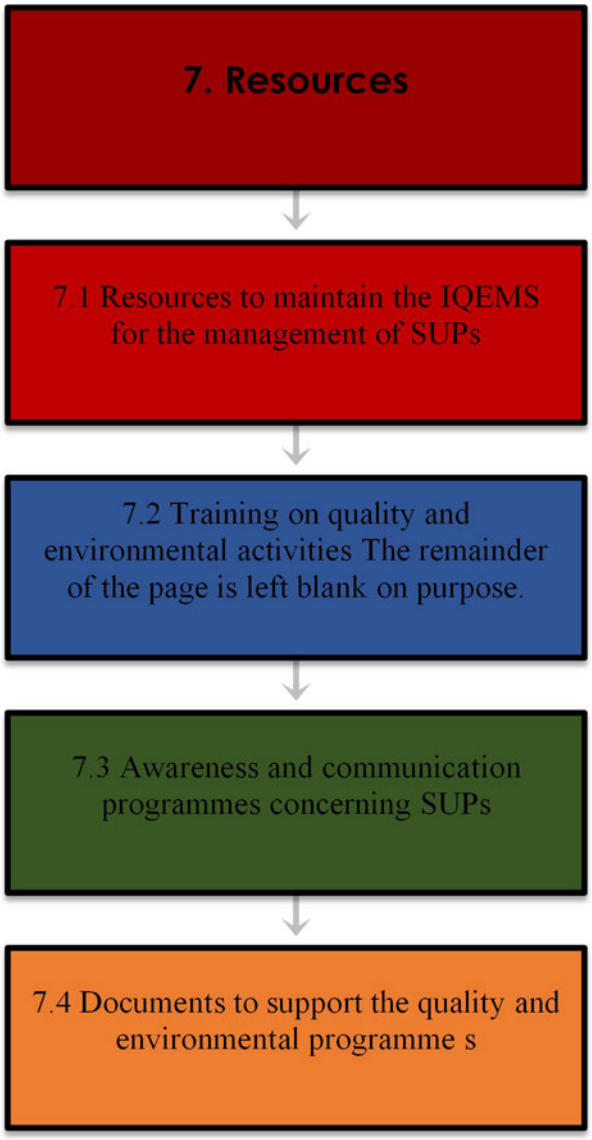

Figure 4.4: Flow diagram illustrating the integrated clauses pertaining to section seven (Reference: Developed by the researcher)

Clause seven, details the individual resource requirements and commitment that the organisation makes in Clause four. Clause *7.1 Resources to maintain the IQEMS,* will detail the individual financial, human, equipment and machinery resources that the organisation will have to make available.

7.2 Training on quality and environmental activities for the management of SUPs. The organisation will have to make significant financial provisions to ensure that employees are trained in line with new technologies and processes. It is recommended that Top Management go for the training prior to implementation to ensure all the provisions and requirements are understood.

7.3 Awareness and communication programmes concerning SUPs. Everyone in the organisation should be aware of the organisations integrated policies and goals and what actions must be taken to achieve

them. Given that the Policy and processes would be new to the organisation, there should be effective and practical awareness and communication programmes to ensure that employees are assimilated to the new system.

7.4 Documents to support the quality and environmental programmes. This sub-clause must detail the documentation requirements of the IQEMS. In alignment with calls for digitalised documentation organisations must develop a solid foundation of the IQEMS. It is first recommended that, all documents, policies and information concerning the IQEMS be digitally uploaded onto an internet storage database or a server.

4.2.5 Clause 8:

Figure 4.5 provides an overview of the IQEMS requirements pertaining to Clause eight.

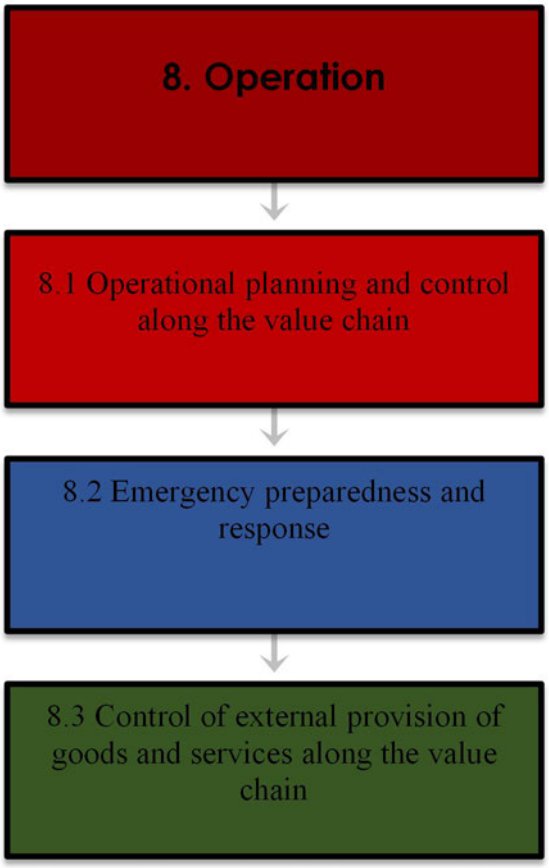

Figure 4.5: Flow diagram illustrating the integrated clauses pertaining to section eight
(Reference: Developed by the researcher)

Clause eight details the Operational requirements for the organisation. *8.1 Operational planning and control along the value chain.* The processes of quality and environmental checks and inspections must first be digitalised. Initially if the checks and inspections are conducted manually, the data must be inserted into a digital programme immediately. This can occur in two ways for example, computers stationed at quality and environmental checkpoints or quality and environmental controllers being assigned digital tablets.

8.2 Emergency preparedness and response. Aside from making provisions for potential risks to the supply-chain, the organisation must also develop SOPs on risks identified in Clause six (political instability, industry trends, environmental vulnerability and wars).

8.3 Control of external provision of goods and services along the value chain. The organisation must be able to provide checks on external raw material, products and service providers. For example, there must random chemical analysis of raw materials to ensure that they made from recycled plastic waste. There must also be testing to ensure that raw materials and products used verified and are not toxic, an example of the tests would include, Chemical Trace Analysis and Polymer Chemical Testing.

Water that is discharged from an organisations facility must also be tested to ensure that the community and environment are not being negatively affected; some of the tests that could be performed are specific conductivity and Total Dissolved Solids (TDS) ratio.

4.2.6 Clause nine:

Figure 4.6 provides an overview of the IQEMS requirements pertaining to Clause nine.

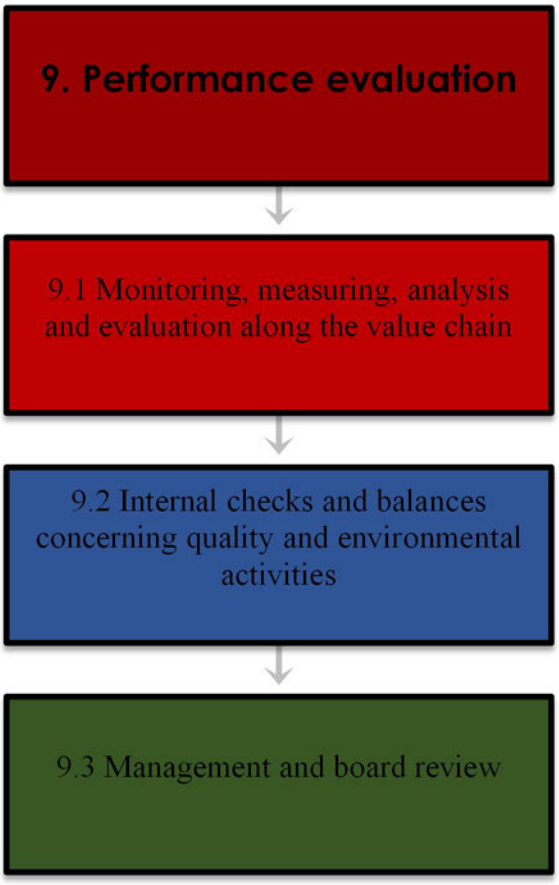

Figure 4.6: Flow diagram illustrating the integrated clauses pertaining to section nine
(Reference: Developed by the researcher)

9.1 Monitoring, measuring, analysis and evaluation along the value chain. Once, quality and environmental control data is digitalised then, organisations can use computer-based algorithms to develop statistical control charts for each process with predetermined control limits. Organisations can

begin incorporating advanced sensors into their processes for example using sensors with intelligent algorithms to detect products that have deviated from specifications.

9.2 Internal checks and balances concerning quality and environmental activities. The organisation must conduct random chemical and microbial testing on their final products to ensure that they are non-toxic and fall within the product specification.

9.3 Management and board review. Moving beyond just Management Review, the Board of an organisation should also be part of reviewing the organisations processes and performance especially when dealing with large scale investments.

4.2.7 Clause ten:

Figure 4.7 provides an overview of the IQEMS requirements pertaining to Clause ten.

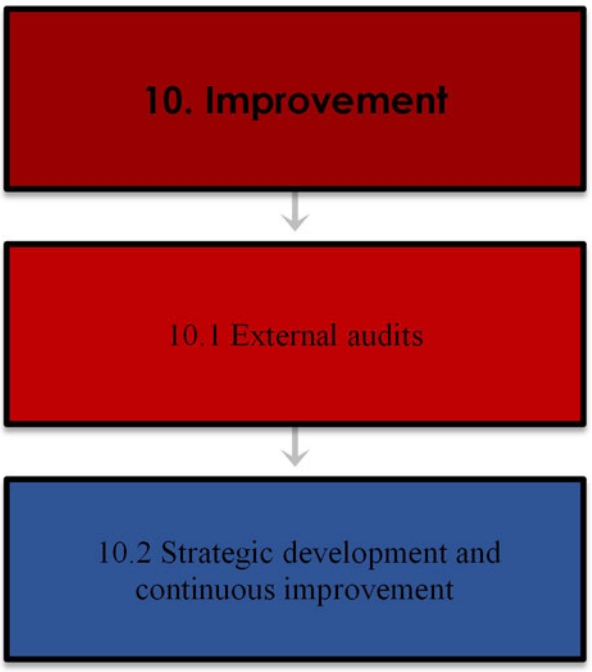

Figure 4.7: Flow diagram illustrating the integrated clauses pertaining to section ten
(Reference: Developed by the researcher)

10.1 External audit. Once the IQEMS is implemented, it will have to be audited independently annually by a third party body.

10.2 Strategic development and continuous improvement. The IQEMS will have to be reviewed annually to ensure that it keeps up with technological and industry advancements.

4.3 Perception Study

This section will present the results and discussion of the perception study with their reliability calculations.

4.3.1 Consultation with key role players

Interviews were conducted with key role players from selected non-governmental organisations to ascertain their perception on the IQEMS that had been developed. The participants were all from the sustainability sector and had extensive work and organisational experience in developing sustainable programmes in communities and the industry. These organisations were selected due to their proximity to sustainable and community development. Some of their work concerned SUP, carbon foot-printing technologies, costal immersion, agricultural development, youth and pre-teen initiatives.

The nature of the IQEMS covers a variety of aspects that include water consumption, landfill usage, clean energy generation and employment programmes. These factors make the selection of these organisations ideal because of their extensive experience in SUP management, sustainable and community development and their ability to provide holistic responses to the interview questions.

4.3.2 Results of the interviews

This subsection will highlight the interview questions, the rationale behind asking the questions and the responses form the participants.

Question 1

1.1 ***What is your view of the suitability of the Integrated Quality and Environmental Management System framework in reference to the South African Market and Biosphere****?*

Rationale:

In developing the questions for the Interviews, specific target words were used to ensure accurate responses from the participants. The key word in this question was “suitability”, this question was asked to determine what the participants thought about the IQEMS presented and if it can aid in controlling SUP towards sustainability in South Africa.

Response from participant:

The majority of respondents described the IQEMS as a pragmatic approach to dealing with SUP using the South African Market as a frame of reference. An academic in the field of Sustainable Development and one other participant questioned whether too much of emphasis is placed on suggested regulations given that government has failed to implement the current legislations that do exist. They further stated that they do not believe that the Government will participate fully in this system or any programmes relating to sustainable development.

Discourse addressing the participants response:

With regard to these comments, there is a significant portion of the IQEMS that focuses on private sector development and methods in which the Government can incentivise the private sector. It is a notable concern that Government inaction is something that needs to be accounted for in the IQEMS. However, regulations by their nature can only be passed by the Government through the Parliamentary

system. Specific examples of these types of businesses were discussed at length in the Literature Review.

The IQEMS has taken lessons from the Governments initiative and their outcomes with the single use plastic bag tax and the "Buyisa-i-bag" initiative to ensure that the all the responsibility of carrying out different actions does not rely solely on the Government but that responsibility is distributed among NGOs, the private sector and the general public.

The results of the reliability of this question will be calculated using Cohens Kappa formulae.

Question	Reliability %
1. What is your view of the suitability of the Integrated Quality and Environmental Management System framework in reference to the South African Market and Biosphere?	84,62%

Table 4.1: Results of the reliability for question one

According to Rossman and Rallis (2012) a result of above 80% is sufficient enough to prove reliability. There it can be concluded that responses for question one pertaining to the suitability of the IQEMS are reliable.

1.2 Would you describe the Integrated Quality and Environmental Management System as feasible?

Rationale:

The question was posed to the participants to ascertain what their thoughts were regarding whether the IQEMS is financially feasible and manageable at the legislative level.

Response from the participant:

All the participants agreed that the IQEMS was feasible. Notable comments were that the participants thought that the lack of fiscal commitments needed by the Government was something that they appreciated and applauded. These comments further highlight that there is a significant distrust among people when it concerns the Governments participation in programmes and systems.

These concerns reiterate that the Government cannot be the sole custodian of the implementing the IQEMS and that there needs to be participation from all sectors throughout South Africa with great emphasis placed on the private sector.

Question	Reliability %
2. Would you describe the Integrated Quality and Environmental Management System as feasible?	100%

Table 4.2: Results of the reliability for question two

Discourse addressing the participants response:

There was consensus among the participants regarding the feasibility of the IQEMS therefore, the reliability score is 100%. Therefore, it can be concluded that the participants think that the IQEMS can be useful at the legislative level.

1.3 What is your view on the adaptability of this Integrated Quality and Environmental Management System?

Rationale:

Adaptability in the context of this question refers to whether participants think that the IQEMS presented will be able to be used in other developing countries.

Response from the participant:

All of the participants state that they believed that South Africa and other developing countries have similar problems regarding SUP and recycling initiatives. They presumed that several aspects of the IQEMS can be applicable in other developing countries. However, four of the participants caution that a key driver for change will have to come from a legislative level in order for the IQEMS to be successful. This due to legislative prescripts being significantly unique from country to country due to vastly different procedures and processes, that will have to be accounted for. Therefore, the participants concluded that basic aspects can be applicable as the IQEMS stands but there will have to be notable changes to consider ensuring that legislative prescripts are accounted for.

Discourse addressing the participants response:

Concerning these remarks, although, it is factual that there are vast differences in legislative requirements between countries. One of the foundational elements of the IQEMS is that it requires significant participation from the private sector and key industries. The IQEMS does not rely on the Government to act on its own. Rather it requires the Government to play a role in incentivising organisations and industries.

This is one of the key reasons why in Chapter two, creating new laws and regulations were ruled out of the IQEMS due to the time constraints and bureaucracy. This finding was motivated by The Canadian Environmental Law Association (2015), Ecospearbd (2017), United Kingdom Department for Environment, Food and Rural Affairs (2018), Tamura (2018), UNEP (2018).

Question	Reliability %
3. What is your view on the adaptability of this Integrated Quality and Environmental Management System?	69.23%

Table 4.3: Results of the reliability for question three

The reliability score of this question fell below the 80% result that is required to prove sufficient reliability concerning the adaptability of the IQEMS. This is because of 4 participants having a negative opinion on the adaptability of the IQEMS in other developing countries. However, responses to those opinions are highlighted above.

1.4 Do you believe that this Integrated Quality and Environmental Management System will be useful to the Quality fraternity?

Rationale:

The final question was asked to participants to determine their thoughts around whether the IQEMS can slot into the current Quality Fraternity.

Response from the participants:

There was concurrence with all the participants that Quality has evolved from the traditional aspect of 'quality control' and 'quality assurance' and that Quality should now include environmental and sustainability requirements. The participants further added that the integration of these different components and standards could aid in organisations in improving efficiencies and competitive edge.

Discourse addressing the participants response:

Eight of the participants expressed the view that Quality had to evolve in order to survive the rapid changes that industries are facing. These rapid changes call for streamlining and integration of different systems to achieve the demands of fluctuating as well as crucial customer and market demands. They accentuate the different features of the IQEMS could play a significant role in ensuring that organizational quality systems can evolve to meet the challenges of world.

Question	Reliability %
4. Do you believe that this Integrated Quality and Environmental Management System will be useful to the Quality fraternity?	100%

Table 4.4: Results of the reliability for question four

Regarding whether the IQEMS can fit into the Quality fraternity, there was a Cohens Kappa reliability score of 100%. It can be presumed that IQEMS could conform to the Quality fraternity.

The interviews helped identify common themes, patterns, and variations in perceptions, shedding light on the complexity and nuances of people's perspectives. By analysing these insights it informed decision-making, Policy Development and possible program implementation, allowing for more targeted and effective strategies.

4.4 Summary

The first part of this chapter proposed the IQEMS using the integrated clauses from ISO 9001:2015 and ISO 14001:2015. It took into consideration the different sources of literature explored throughout chapter two. The next part of the chapter discussed the results of the interviews. The participants' responses allowed for a diverse view of the IQEMS that included some negative responses to the system proposed. The next chapter will discuss the next steps forward for the IQEMS and give the concluding remarks for the entire study.

Chapter 5: Conclusions and Recommendations

5.1 Concluding remarks

This chapter will discuss conclusions and recommendations under the two main sections of the study, the literature review and the presentation of the IQEMS. Thereafter, it will present opportunities for future research.

The aim of this study was to develop an Integrated Quality and Environmental Management System (IQEMS) to control the consumption, use and pollution of SUP in the South African context. This system was presented in the preceding chapter along with a perception study on the work conducted. The United Nations Sustainable Development Goal (UNSDGs), number twelve - Responsible consumption and production was one of the key drivers for the developing the IQEMS. However as the IQEMS was being developed, several other UNSGDs were identified that could be achieved if the IQEMS is implemented. At least five of the UNSGDs overlap with policies and requirements of the IQEMS. Some of the goals that overpay are;

- Goal six, Clean water and sanitation - Sustainable sourcing and production of clothing lines from plastic waste and alternative material. Organisations such as Thread International and the Graddle Institute have saved approximately 30,521,203 gallons of water. This significant quantity could be exponentially larger if multiple organisations across different sectors where to undertake such initiatives.
- Goal eight, Decent work and economic growth - A major portion of the IQEMS was on stimulating the local economy and developing niche markets with a particular focus on rural development.
- Goal nine, Industry, innovation and infrastructure - Another key element that came out of the IQEMS was the need to for Organisations and Industry to rapid change to adapt to the needs of a changing world.
- Goal fourteen, Life below water – A large portion of the preliminary results showed the serious and devastating impact that SUP has on the ocean and marine life and the food cycle that is affected as a result.
- Goal fifteen, Life on land – The IQEMS also covered the tremendous problem around landfill usage and potential damage to human health because of SUP.

Due to the urgency required to deal with SUP along with the need to achieve the UNSDGs by the year 2030, it is recommended that the IQEMS is implemented across all different sectors and at the Government follow the suggested Policy.

5.2 Where South Africa currently stands

The current stance that has been adopted in South Africa has been a levy-tax on single use plastic bags. From the literature reviewed: The Buyisa-e-Bag (2011) minutes, McLellan (2014) and The United Nation (2021), this has provided minuscule and underwhelming results. Mr T J Brauteseth v Minister of Finance (2014) states that the levy-tax has collected R 1 127 563 000. The National Revenue Fund has absorbed this money. The letter also states that just over R 216 million in funds have been

appropriated from the National Revenue Fund for the Buyisa-e-Bag organisation. This money was meant for staffing and recycling programmes. However, according to the Buyisa-e-Bag (2011) minutes these programmes never came to fruition and this money remains unaccounted. Since then there is no further updates or new legislation concerning SUP.

5.3 Recommended Policy and managerial implications

This sub section will detail the Policy recommendations and managerial implications that arose out of the thematic analysis. These recommendations arise out of the themes that emerged from the literature review.

1. The Ministry of Finance gazette tax reduction incentives for both small business owners and large corporations that contribute to the reduction of SUP as result of these initiatives plastic waste will be diverted from landfilling and incineration. Examples of organisations that could quality for these tax reductions are;
    a) Organisations that offer waste collection services.
    b) Organisations that convert, purify and process plastic waste into reusable nylon, mesh, plastic planks and plastic bricks.
    c) Organisations that use recycled plastic waste in the production of their clothing items, shows, apparel and furniture.
    d) Organisations that are involved in Eco-construction, for example: using plastic waste in roads and housing.
2. The Ministry of Finance present financial indicators and documentation that organisations should submit in order to qualify for tax reduction benefits.
3. All submission requirements concerning the tax incentives should be digitally available. This is to ensure accessibility, ease of access and make applying for these incentives, attractive.
4. Encourage through educational awareness programmes the formalisation of waste collection services. By formalising the waste collection services, a niche waste market can be created. These services can now have the opportunity to increase their profit margin and find new customers.
5. A focused approach on community participation though training and education at the municipal level.
    a) Collaboration between Government and the private sector to procure reusable bags made from fabric with the primary focus on small business owners thus creating employment.
    b) Municipalities are to provide production targets for the fabric bags to private businesses and coordinate delivery with them.
    c) Ensure, multiple drop off points within a municipality to ensure that small business owners in rural areas are accounted for.
    d) Municipal officials to undergo structured training before door-to-door awareness campaigning begins.
    e) After training are complete, municipal officers to be deployed into areas to begin awareness programmes.

5.4 Recommended oversight programme

Given that the magnitude of negative effects that are accompanied with SUP, many different governmental ministries are affected. The proposed integrated policy framework overlaps several different ministries. The main Ministers that are affected in the South African context are: Environment, Forest and Fisheries, Employment and Labour, Human Settlements, Water and Sanitation, Public Service and Administration, Tourism, Small Business Development, Social Development and Trade and Industry. Therefore, the IQEMS calls for the development of an overall Advisory and Oversight Committee (AOC) that will discharge policy, procedures and conduct oversight.

It is recommended that the AOC be a body that could act unilaterally over the various departments that will be involved in the IQEMS. This will also aid in creating competition among different departments that will inevitably drive efficiency and effectiveness. The AOC handling monitoring and measuring will also support efforts to curb corruption by ensuring that the requirements are adhered to and each department cannot act independently in procurement processes. Figure 5.1 is an illustration of where the AOC will be positioned in Government.

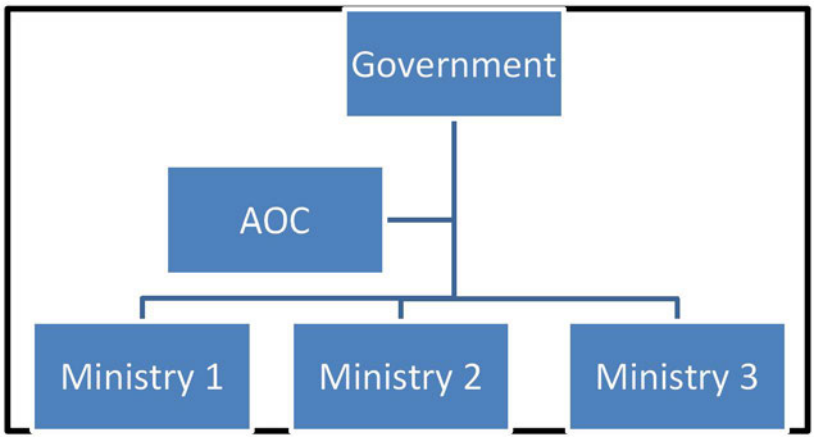

Figure 5.1: Diagram depicting proposed structure for Governmental departments
(Source: Developed by the researcher, 2022)

5.6 Future Research

Lennan and Morgera (2022) and Harris (2022) highlight urgent calls from Conference of the Parties 26 (Cop 26) on transforming the entire manufacturing process to include a life cycle product analysis all manufacturing and services. They add that this analysis must account for all waste, by-products and emissions released as a result of any processes. Tamasiga, Miri, Onyeaka, Hart (2022), Mahmoud (2022) and Sá, Oliveira-Silva, Cunha, Gonçalves, Diez, Méndez-Tovar and Izquierdo (2022) report an emerging trend coming from European Nations is the development of a circular economy. They add that a circular economy is an alternative to a traditional linear economy (make, use and dispose). In a circular economy, products are designed from the start with their end of life disposal and recycling effects.

Through improved waste management systems, widespread recycling practices, and increased awareness among consumers and businesses, the circular economy will strive to eliminate the detrimental environmental impact of single-use plastics, creating a more resilient and eco-friendly future. It is believed that incorporating the proposed IQEMS framework into the development of a circular economy is a potential way forward in order to achieve consistent sustainability in South Africa and beyond.

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Appendices

Appendix A:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Reference
4. Context of the organisation	4. Context of the organisation	4. Context of the organisation	
4.1 Understanding the organisation and its context	4.1 Understanding the organisation and its context	4.1 Understanding the organisation and its context with regard to quality and environmental related activities	Tang (2006), Asif, Fisscher, de Bruijn and Pagell (2010), Hu-Chen, Long and Nan (2013) Cagnin, Oliveira, Simon, Helleno, Vendramini (2016) and Jankensgård (2019)
4.2 Understanding the needs and expectations of interested parties	4.2 Understanding the needs and expectations of interested parties	4.2 Understanding the needs and expectations of interested parties on the quality and environmental value chain	Heidari, Khanbabaei and Sabzehparvar (2018) and Zimon, Madzik and Sroufe (2020)
4.3 Determining the scope of the quality	4.3 Determining the scope of the	4.3 Determining the scope of the	Tukiran (2016), Rybski (2017),

management system	environmental management system	IQEMS on the value chain	Ahmudi, Purwanggon and Handayani (2018), Galli (2019), Domingues, Reis, Fonseca, Avila and Putnik (2019), Purwanto, Asbari and Santoso (2020), Demir, Budur, Omer and Heshmati (2021) and Ain and Wahid (2022)
4.4 Quality management system	4.4 Environmental management system	4.4 Implementation Process Approach of quality and environmental activities with particular focus on optimisation of processes for the management of SUP	Jankensgård (2019)
4.4.1 General			
4.4.2 Process approach			

Appendix B:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Justification of the requirement
5. Leadership	5. Leadership	5. Leadership	
5.1 Leadership and Commitment	5.1 Leadership and Commitment	5.1 Leadership and Commitment to the IQEMS	Tukiran (2016), Juanzon and Muhi (2017), Rybski (2017), Ahmudi, Purwanggon and Handayani (2018) and Ong, Purwanto, Supono, Hasna, Novitasari and Asbari (2020)
5.1.1 General			
5.1.2 Customer Focus			
5.2 Quality Policy	5.2 Environmental Policy	5.2 Integrated Policy for quality	Friedly and Schneider (2016), Chen,

		and environmental activities	Anchecta, Lee and Dahlgaard (2016), Det Norske Veritas (2016), Mazzi, Tonio, Mason, Aguiari and Scipioni (2016) Wang, Lin , and Weber (2016), El Hour, Aouane and Chaouch (2017), Anttila and Jussila (2017), Salazar, Tigre and Tubón-Núñez, Carrillo and Buele (2019)
5.3 Organisational roles, responsibilities and authorities	5.3 Organisational roles, responsibilities and authorities	5.3 Organisational roles, responsibilities and authorities relating to quality and environmental activities	Jørgensen (2007) , Salomone (2008) Ansell, Sørensen and Torfing (2017) and Hudson, Hunter and Peckham (2018)

Appendix C:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Justification of the requirement
6. Planning	6. Planning	6. Planning	
6.1 Actions to address risks and opportunities	6.1 Actions to address risks and opportunities	6.1 Risk based thinking approach for the management of SUP	Fonseca and Domingues (2016), Isa and Rahman (2017), and Galli (2019) Jankensgård (2019)
	6.1.1 General	6.1.1 Internal and external risks	
	6.1.2 Environmental aspects	6.1.2 Supply chain management	
	6.1.3 Legal requirements and voluntary obligations	6.1.3 Legal and regulatory requirements	
6.2 Quality objectives and planning to achieve them	6.2 Environmental objectives and planning to achieve them	6.2 Integrated objectives for the management of SUP	Fonseca and Domingues (2016)
	6.2.1 Environmental		

	objectives		
	6.2.2 Environmental improvement programmes		
6.3 Planning of changes			

Appendix D:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Justification of the requirement
7. Support	7. Support	7. Resources	
7.1 Resources	7.1 Resources	7.1 Resources to maintain the IQEMS for the management of SUPs	Galli (2019), Domingues, Reis, Fonseca, Avila and Putnik (2019), Purwanto, Asbari and Santoso (2020), Demir, Budur, Omer and Heshmati (2021) and Ain and Wahid (2022)
7.1.1 General			
7.1.2 Infrastructure			
7.1.3 Process environment			
7.1.4 Monitoring and measuring devices			
7.1.5 Knowledge			
7.2 Competence	7.2 Competence	7.2 Training on quality and environmental	Purwanto, Asbari and Santoso (2020), Demir, Budur, Omer

		activities for the management of SUPs	and Heshmati (2021) and Ain and Wahid (2022)
7.3 Awareness	7.3 Awareness	7.3 Awareness and communication programmes	Zohny (2009), Aljaradin, Persson and Hossam (2011), Tiew, Watanabe, Basri, Zain and Basri (2013), Molina (2017), Summit Foundation (2017), United Nations Environmental Programme (2018), Rabiatu, Halima and Rami (2018) and Aksan and Çelikler (2019)
7.4 Communication	7.4 Communication	7.4 Documents to support the quality and environmental programmes	Wilkinson and Dale (2000), Jørgensen, *et al.,* (2005) and Zeng, *et al.,* (2007),
	7.4.1 General		
	7.4.2 Internal communication		
	7.4.3 External communication and reporting		
7.5 Documented information	7.5 Documented information		Zeng, Tam, Khoa (2010)
7.5.1 General	7.5.1 General		
7.5.2 Creating and updating	7.5.2 Creating and updating		
7.5.3 Control of documented information	7.5.3 Control of documented information		

Appendix E:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Justification of the requirement
8. Operation	8. Operation	8. Operation	
8.1 Operational planning and control	8.1 Operational planning and control	8.1 Operational planning and	Domingues, Reis, Fonseca, Avila and

		control along the value chain	Putnik (2019) and Purwanto, Asbari and Santoso (2020)
8.2 Determination of market needs and interactions with customer	8.2 Value chain planning and control	8.2 Emergency preparedness and response	Douglas and Glen (2000), Wright (2000), Zutshi and Sohal (2005), Jørgensen, *et al.,* (2005), Fresner and Engelhardt (2004), López-Fresno (2010), Simon, Karapetrovic, and Casadesus (2012), Moumen and El Aoufir (2017) and Muzaimi, Chew and Hamid (2017)
8.2.1 General			
8.2.2 Determination of requirements related to the goods and services			
8.2.3 Review of requirements related to the goods and services			
8.2.4 Customer communication			
8.3 Operational planning process	8.3 Emergency preparedness and response	8.3 Control of external provision of goods and services along the value chain	Asif, Fisscher, de Bruijn and Pagell (2010), Fonseca and Domingues (2016) and Galli (2019)
8.4 Control of external provision of goods and services			Moumen and El Aoufir (2017) and Muzaimi, Chew and Hamid (2017)
8.4.1 General			
8.4.2 Type and extent of control of external provision			
8.4.3 Documented information for external providers			

Appendix F:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Justification of the requirement
9. Performance evaluation	9. Performance evaluation	9. Performance evaluation	
9.1 Monitoring, measuring, analysis and evaluation	9.1 Monitoring, measuring, analysis and evaluation	9.1 Monitoring, measuring, analysis and evaluation along the value chain	Friedly and Schneider (2016), Chen, Anchecta, Lee and Dahlgaard (2016), Anttila and Jussila (2017), Salazar, Tigre , Tubón-Núñez, Carrillo and Buele (2019), Carrillo-Labell, Fort and Parras-Rosa (2020) and Ali, Belal, Roy, Rahman and Raihan (2022)
9.1.1 General	9.1.1 General		
9.1.2 Customer satisfaction	9.1.2 Evaluation of compliance		
9.1.3 Analysis and evaluation of data			
9.2 Internal audit	9.2 Internal audit	9.2 Internal checks and balances concerning quality and environmental activities	Friedly and Schneider (2016), Chen, Anchecta, Lee and Dahlgaard (2016), Anttila and Jussila (2017), Salazar, Tigre , Tubón-Núñez, Carrillo and Buele (2019)
9.3 Management review	9.3 Management review	9.3 Management and board review	Friedly and Schneider (2016), Chen, Anchecta, Lee and Dahlgaard (2016), Anttila and Jussila (2017), Salazar, Tigre , Tubón-Núñez, Carrillo and Buele (2019), Carrillo-Labell, Fort and Parras-Rosa (2020) and Ali, Belal, Roy, Rahman and Raihan (2022)

Appendix G:

ISO 9001:1015 Requirement	ISO 14001:2015 Requirement	IQEMS Requirement	Justification of the requirement
10. Improvement	10. Improvement	10. Improvement	
10.1 General	10.1 General	10.1 External audits	Karapetrovic (2002) and Simon, *et al.,* (2012)
10.2 Nonconformity and corrective action	10.2 Nonconformity and corrective action	10.2 Strategic development and continuous improvement	Karapetrovic (2002) and Simon, *et al.,* (2012)
10.3 Improvement	10.3 Improvement		

Appendix H:

The importance of ISO 9001:2015 as a Quality Management System was highlighted by [Fonseca and Domingues (2016), Tukiran (2016), Juanzon and Muhi (2017), Rybski (2017), Isa and Rahman (2017), Ahmudi, Purwanggon and Handayani (2018), Fonseca, Domingues, Machado and Harder (2018), Galli (2019), Jankensgård (2019), Domingues, Reis, Fonseca, Avila and Putnik (2019), Purwanto, Asbari and Santoso (2020), Ong, Purwanto, Supono, Hasna, Novitasari and Asbari (2020), Demir, Budur, Omer and Heshmati (2021) and Ain and Wahid (2022)].
By reviewing works of [Ciravegna and Fonseca (2015), Det Norske Veritas (2016), Mazzi, Tonio, Mason, Aguiari and Scipioni (2016), Boiral, Guillaumie, Heras-Saizarbitoria, Valery and Tene (2017), Wairon, Purwanggono and Handayani (2018), Ajidarma, Rahmadini, Trusaji and Irianto (2018), Deyassa (2019), Carrillo-Labell, Fort and Parras-Rosa (2020), Budi, Karuniasa and Nurcahyo (2020) , Bravi, Santos, Pagano and Murmura (2020) and Ali, Belal, Roy, Rahman and Raihan (2022)] it provided the insight required to select environmental management for integration.

The need for the integration of management systems was influenced by the work of [Douglas and Glen (2000), Wright (2000), Zutshi and Sohal (2005), Fresner and Engelhardt (2004), Rocha, Searcy and Karapetrovic (2007), Zeng, Shi and Lou (2007), Jørgensen (2007) and Salomone (2008), Jørgensen, *et al*., (2005) López-Fresno (2010), Simon, Bernardo, Karapetrovic, and Casadesus (2011), Simon, Karapetrovic, and Casadesus (2012), Simon, Karapetrovic, and Casadesus (2012), Georgiev and Georgiev (2015), Gianni and Gotzamani (2015), Moumen and El Aoufir (2017), Muzaimi, Chew and Hamid (2017), Moumen and El Aoufir (2017) and Purwanto, Putri, Ahmad, Asbari, Bernarto, Santoso and Sihite (2020)].

Appendix I

Letter of Information

Title of the Research Study: Developing an integrative Quality Management System for Single Use Plastics

Principal Investigator/s/researcher: Oshea Roopnarian, B Tech:Quality

Co-Investigator/s/supervisor/s: Professor Shalini Singh, D Tech: Quality

Brief Introduction and Purpose of the Study:

Greeting: Good morning/Good Day/Good afternoon. Are you keeping well. Thank you for this opportunity

Introduce yourself to the participant: I am a Masters student at the Durban University of Technology in Quality.

Invitation to the potential participant: I would like to invite you to participate in the research.

What is Research

The purpose of this study is to develop a quality management system to control single use plastics in South Africa that can be presented to government. This is to assist in controlling the use of single use plastics towards sustainability in South Africa.

Outline of the Procedures: Participants will be required to undergo an interview. The questions will be based on the developed Quality Management System. Participants will be required to answer questions relating to the effectiveness and viability of the Management System.

Risks or Discomforts to the Participant: There will be no risks to the participants. If participants are uncomfortable at any time, they can leave the interview. No further questions will be asked.

Explain to the participant the reasons he/she may be withdraw from the Study: If there are any adverse reaction to the questions being asked, participants can withdraw at any time without any adverse consequences.

Benefits: Study may result in publications

Remuneration: No remuneration will be provided to participants.

Costs of the Study: Participants will not be required to provide any costs for the study.

Confidentiality and storage: Participants answers to the interview questions will be locked in a cupboard for 5 years and thereafter will be destroyed by shredding.

Results: Will be available once the study has completed.

Research-related Injury: Not applicable.

Storage of all electronic and hard copies including tape recordings

Persons to contact in the Event of Any Problems or Queries: Oshea Roopnarian(Researcher) – 065 850 3661 or Professor Shalini Singh(Supervisor) – 082 975 7772 or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the Director: Research and Postgraduate Support Dr L Linganiso on 031 373 2577 or researchdirector@dut.ac.za.

_____ _____

Signature **Date**

Appendix J

Faculty of Management Sciences

Department of Public Management & Economics

Date: 10/08/2021

Oshea Roopnarian - Developing an Integrative Quality Management System for Single Use Plastics

Dear Participant:

The purpose of this study is to develop a quality management system to control single use plastics in South Africa that can be presented to government. This is to assist in controlling the use of single use plastics towards sustainability in South Africa. What you will be presented with is a Quality Management System that will assist to controlling single use plastics towards sustainability in South Africa. Once you have completed reading the proposed Quality Management System you will be requires to undergo an interview

The questions will be based on the developed Quality Management System. You will be required to answer questions relating to the effectiveness and viability of the Quality Management System. There will be no risks to you. If you are uncomfortable at any time, you can leave the interview. No further questions will be asked of you. There will be no remuneration provided to you for answering this question. Answers to the interview questions will be locked in a cupboard for 5 years and thereafter will be destroyed by shredding.

All personal information such as name, surname, qualifications etc. will be confidential. No personal information will be available to the public.

Thank you for your cooperation.

____Oshea Roopnarian_____

Student

065 850 3661

Contact Details

_____Professor Shalini Singh_____

Supervisor / Promoter

082 975 7772

Contact Details

Interview Questions:

1. What is your view of the suitability of the Quality Management System presented to you in reference to the South African Market and Biosphere?
2. Would you describe the Quality Management System presented as feasible?
3. What is your view on the adaptability of this Quality Management System in other third world countries?
4. Do you believe that this Quality Management System will be useful to the Quality fraternity?

Appendix K

Gatekeepers letter

Faculty of Management Sciences

Department of Public Management & Economics

41/43 ML Sultan Road
Durban
4001

Date: 10/08/2021

To:

100 Brand Road,
Durban 4
001

Gatekeepers letter:

Dear [Gatekeeper Name]

My name is Oshea Roopnarian and I am currently a Masters student at the Durban University of Technology. Subject to approval by Research Ethics Committee this research concerning the interview questions.

I am writing to ask your permission to be allowed access to your facility to seek research participants for interview questions. This should take approximately 30 minutes and can be conducted at a convenient time and date to be arranged. All answers and results from the research are kept strictly confidential and the results will be reported

If this is possible please could you e-mail me at oshea.r.r@gmail.com to confirm that you are willing to allow access to your facility and its members/students providing they agree and are happy to take part.

Thank you for your time.

Yours sincerely/faithfully
Oshea Roopnarian

Appendix L

turnitin

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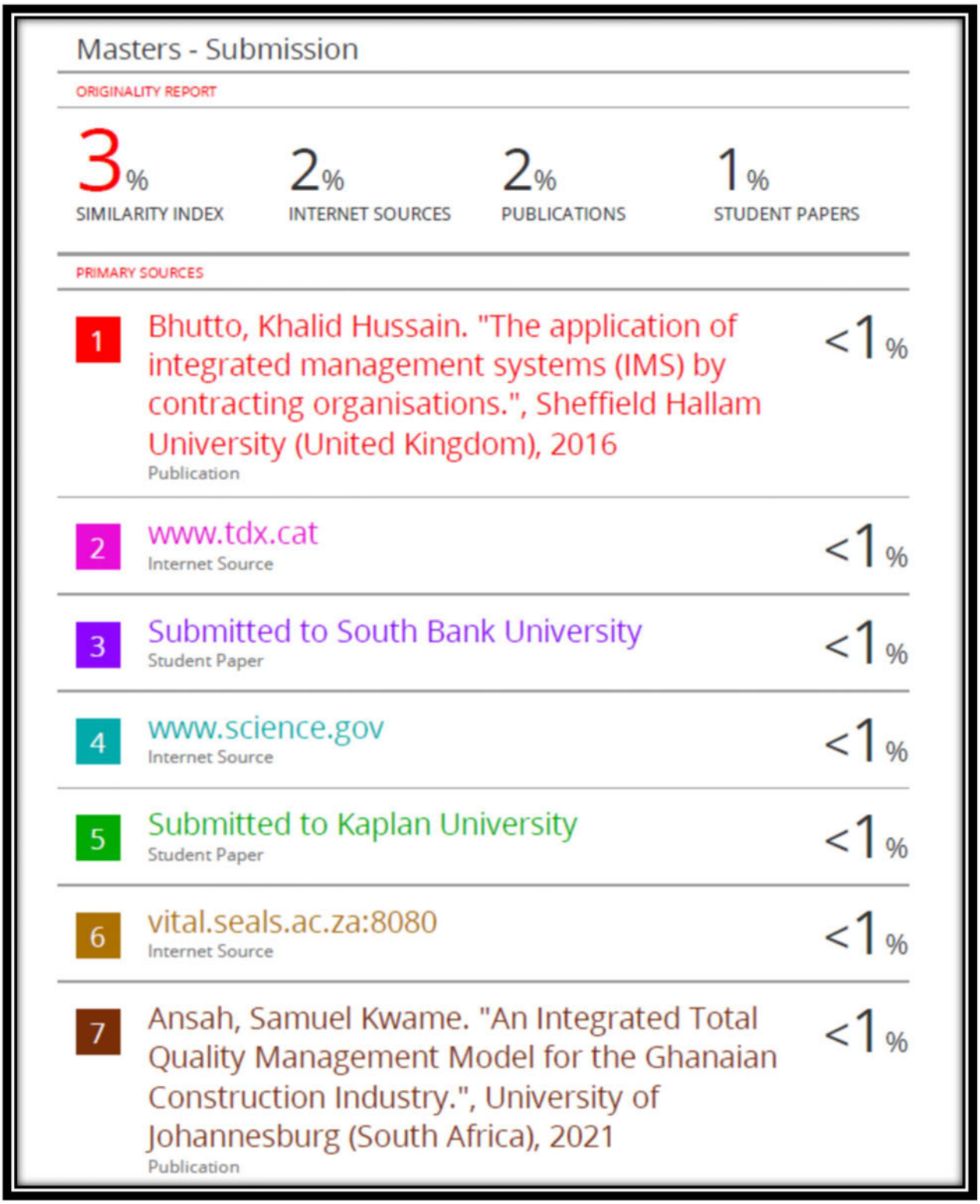
Appendix M



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