POSSIBLE FUTURES FOR TRANSPORT IN SOUTH AFRICA TOWARDS 2035

By

Qawekazi Wanda Mnqeta

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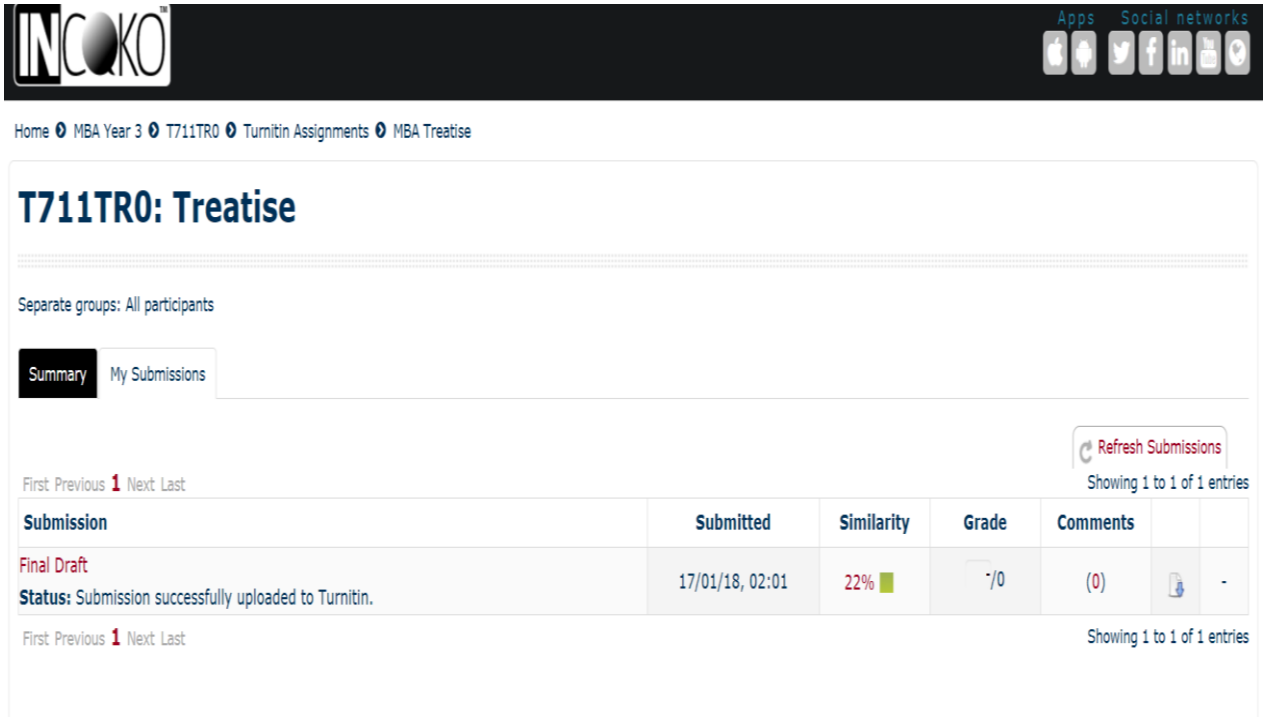
Supervisor: Prof. C. Adendorff

Co-Supervisor: Mr. D. Giyose

TURNIT IN REPORT



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ABSTRACT

It is evident that there is a great dissatisfaction with the current model of transport as the level of accidents continue to rise. The containment on carbon emission levels are illusive and transport congestion is becoming impossible to handle. The number of cars in cities is increasing rapidly, resulting in increased traffic congestion, less mobility, poor air quality and more road accidents. In the National Development Plan (NDP), one of the challenges identified is that despite a slowdown in the growth within urban areas, 14 million people are projected to move to South African cities between 2010 and 2050 (UN-Habitat, 2014).This will exert pressure on service delivery by municipalities – including transport and transport infrastructure. A large proportion of these new urban residents will be poor, further enhancing the pressure. Transportation networks or systems are therefore key to the spatial transformation of South Africa's urban areas.

Although there has been significant progress in some cities in delivering new public transport infrastructure, the major shift from supporting private cars to incentivising public transport is yet to happen. The NDP vision for urban South Africa is that by 2030, South Africa should observe meaningful and measurable progress in reviving rural areas and in creating more functionally integrated, balanced and vibrant urban settlements. For this to happen, it is said that the country must clarify and relentlessly pursue a national vision for spatial development, sharpen the instruments for achieving this vision and build the required capabilities in the state and among citizens (The Presidency of South Africa, 2011).

The outcomes of this analysis of future studies theory and practice supported the argument presented at the beginning of this research that there is robust requirement for a fundamental shift in the ways and methods of planning the future of South Africa's transport industry towards 2035.

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1. INTRODUCTION, PROBLEM STATEMENT AND DERMACATION OF THE STUDY

1.1 Introduction

Henry Ford once said, "I will build a motor car for the great multitude. It will be large enough for the family but small enough for the individual to run and care for. It will be constructed of the best materials, by the best men to be hired, after the simplest designs that modern engineering can devise. But it will be so low in price that no man making a good salary will be unable to own one--and enjoy with his family the blessing of hours of pleasure in God's great open spaces" (Henry & Crawther, 2005).

Ian Cheney described this approach by Henry Ford as throwing industrialism into high gear by revolutionising transportation. This approach to packaging and compensation eventually flowed throughout the United States and the rest of the world. The Industrial Revolution had already begun in America and Europe, but Ford threw industrialism into higher gear. Ford is regarded as one who revolutionised transportation and in the process brought other industries along for the ride (Cheney, 2017).

The chairman of Ford Motor Company stated that, "Growing up, there was something almost heroic about the car. The automobile represented possibility. I think we are there again." (Ford, 2015). This statement affirms that the history of transport has mainly been influenced by the curiosity of man over the years. The desire to discover and explore bigger and further areas has enabled innovation and creativity towards more efficient modes of transportation. This has further evolved to the need for mass or bulk transportation of people to enable the mobility of people to take place simultaneously and timeously. This however comes with some drawbacks.

An increase in the population and expansion in living zones meant that automobiles and air services could not afford mass transit anymore. Therefore, the need for

innovation in transportation has increased. To fittingly serve the public, new-generation transportation systems should be able to meet certain standards such as safety, reliability, and rapidity. Moreover, these should be environment-friendly, require low maintenance, be convenient, compact, and still suited to mass-transportation (Lee, Ki-Chan, & Lee, 2006). It is therefore fitting that a study be conducted to ascertain and develop possible, probable and preferable transport futures for South Africa. This study will be focusing on an approach that is layered in order to see how the world is viewed and ultimately shape the future that is seen (Inayatullah, 2015).

1.2 Problem statement

Millions of South Africans travel to various destinations daily by making use of various modes of transport. According to the South African Road Traffic Report (2011), the number of registered vehicles increased by 266 032 (2.75%) from 9 678 989 in March 2010 to 9 945 021 in 2011. The biggest change was for buses which accounted for 4.23% of the increase, followed by motor vehicles at 3.72% (Road Traffic Management Corporation, 2011). It goes to illustrate then that the bulk of people make use of public transport like buses and taxis, while some make use of their private vehicles, depending on which Living Standard Measurement (LSM) scale they fall under.

The limited availability of safe, reliable and affordable public transport infrastructure in South Africa has attributed to the increase in the number of privately owned vehicles on the roads. Although there is a clear government focus on investing in transport infrastructure and addressing these issues, public opinion shows that the predetermined policy imperatives are not being met (Luke & Heyns, 2014).

The challenges that face South Africa are therefore:

- The sustainability of the existing transport infrastructure
- The impact on the economy and environment going forward
- How to leverage on emerging technologies for the improvement of transportation

The Road Traffic Management Corporation (RTMC) annual report of the 2015/2016 financial year reports that, “the economic and financial impact of *deaths and injuries* in South Africa is expected to cost the country around R487 billion per annum”. (Road Traffic Management Corporation, 2016). In addition to this, it was reported that of the 80% of *carbon emissions* attributable to cities, about 15% to 40% of that is from transport (Zhang & Zhao, 2016). This is especially so in developing countries because of the vast number of people who aspire to have their own cars. The 2012 World Energy Report also attributed 22% of global energy end-use-related carbon emission to transport, three quarters of which come from road vehicles (International Energy Agency, 2012). Creutzig (2015) confirms this, stating that over a quarter of overall energy use can be credited to the transportation industry (Creutzig, 2015).

In addition to the above contributory reasons, this research will also look at the increasing *congestion within cities*. This can be attributed to the increasing dependence on the transport sector especially in developing economies, which is caused by the shift from industrial to service sector (Figueroa & Ribeiro, 2013). The National Transport Master Plan 2050 (NATMAP 2050) that was finalised in 2010/11, highlighted transport as a crucial aspect of the South African economy; this plan would serve to stimulate the socio-economic development of the country and alleviate poverty by providing access to regional and global economies (Department of Transport, 2011). This then makes transportation infrastructure a pre-requisite for South Africa’s socio-economic development.

1.3 Research objectives

The evolution of transportation has meant that planning has also evolved with more knowledge being required in assessing urban transportation systems. This knowledge is useful to planners and decision makers in the development and implementation of transportation system changes (Weiner, 2016).
The various stakeholders for the purposes of this study include:

- *Commuters*
- *Service providers*

- *Legislators*
- *Environmentalists*

At times, stakeholders may have different and opposing perspectives as to what the possible futures are. This goes to show that futures work is required in this field to explore, envision, and model alternative futures; thus leading to better, possible and preferable future eventualities, within the South African context.

In June 2012, the United Nations held a conference on Sustainable development in Rio de Janeiro. In the resolution document that was adopted by the General Assembly after this conference, it was noted that transportation and mobility were vital to sustainable development. This meant that the forum was promoting an integrated approach to policy making, including energy efficient multi-modal transport systems for both urban and rural areas, more particularly in the public transportation sphere (United Nations, 2012).

A Global Sustainable Transport Conference was then held in November 2016. This has affirmed sustainable transport into the United Nations global sustainable development agenda and has presented it as a collective global mission. This forum categorised sustainable transport from three dimensions:

- The environment (green transport)
- Society (Inclusive transport)
- The economy (efficient and competitive transport)

This means the consensus is that there should be available infrastructure services and operations that are safe, reliable, environmentally friendly, accessible and affordable to all levels of society (Global Sustainable Transport Conference, 2016).

1.3.1 Primary research objective

The *primary objective* of this study then is to explore the plausible and possible futures of transport for South Africa towards the year 2035. The evaluation of this objective

will be mainly against the three dimensions mentioned above, such as the environmental, societal and economic impact. The problem herein requires an exploratory approach research, based on the nature of the objective. According to Inayatullah (2004), the causal layered analysis methodology seeks to integrate different modes of knowing, while also assisting to create transformative spaces for the creation of alternative futures. This would be useful in the development of deeper, more effective and inclusive policy in the long run, thus creating shared discourses while opening an authentic and open conversation (Inayatullah, 2004).

1.3.2 Secondary research objectives

To address the main objective of this study, the following *secondary objectives* will be pursued:

- To determine the way in which development and failure in the South African transport industry takes place
- Analysing the degree in which future ideas are identified and comprehended by the various stakeholders;
- Examining the issues that hinder the implementation of the plausible future;
- Establishing recommendations that can be implemented to address the major issues that hinder plausible transport futures in order to improve the feasibility of implementation for the Republic of South Africa.

1.4 Research questions

This study seeks to explore the possible futures of transport in South Africa towards the year 2035. In so doing, the following questions will be answered to respond to the main objective of this research:

- What is the current state of the transport industry globally and in South Africa?
- What are the critical technologies that influence the global transport industry at present?
- How is South Africa leveraging from these technologies?
- What are the innovative developments that challenge the industry going forward?

- What do these developments mean for South Africa and the various stakeholders?

1.5 Research methodology and framework

This study will adopt an exploratory approach in researching the field of transport. Mouton (2002) states that the response of questions posed towards specific problems with the aim of unfolding and comprehending them from different perspectives is used in the qualitative research approach (Mouton, 2002). This is supported by Collis and Hussey (2003) stating that the effortlessness and speed with which research can be conducted is considered to be one of the main advantages of a quantitative approach (Collis & Hussey, 2003, p. 162). However, this paradigm would not assist in the endeavour of developing probable, possible and preferred futures for transport and would therefore not be useful for the purposes of this study. Therefore, an interpretivist paradigm will be followed as it is pertinent to understand these phenomena from the person's perspective and how they experience and view the world (Taylor, Bogdan, & De Vault, 2015, p. 3).

Inayatullah (2015) differentiates between four dimensions of futures studies: predictive, interpretive, critical and participatory action learning. This research will be employing the *critical* dimension (Inayatullah, 2015, p. 6). According to Inayatullah (1999), the goal of critical research is to disturb present power relations through making problematic the categories and evoking other scenarios of the future. It is through this historical, future and civilizational distance that the present becomes less rigid and instead becomes remarkable. This allows the spaces of reality to loosen and the new possibilities, ideas and structures, to emerge. Therefore, critical futures research provides a richer account of what is being studied than the more common empiricist or predictive orientation which merely `skims the surface' (Inayatullah, 1999, p. 2).

The researcher will also follow a conceptual framework known as the six pillars method. This will provide the framework towards futures thinking while linking it to set out tools and methods (Inayatullah, 2015)

These six pillars will be used as a guideline throughout this research discourse. They include:

I. Mapping of the future

- This will entail an environmental scan of the transport industry, mapping the past, present and future. This will be done by applying one of the three tools specified by Inayatullah (2015), the Futures triangle. (Inayatullah, 2015, p. 9)

II. Anticipating the future

- In this pillar, an analysis of emerging issues and drivers will be performed to identify where social innovation starts. This will be to identify issues in advance, while searching for new possibilities and opportunities (Inayatullah, 2015, p. 9).

III. Timing the future

- This will entail a search for the designs, the stages and instruments of a sustainable change. Also, to determine the social structure and parameter changes that are required to encourage palpable change for the South African transport industry towards the preferred future in 2035.

IV. Deepening the future

- For purposes of this study, the Causal Layered Analysis (CLA) methodology will be used to deepen and unpack the future. The four dimensions of CLA (The Litany, The Systemic Causes, The Worldview and The Metaphor) will be employed to create transformative spaces for the construction of alternative transport futures.

V. Creating alternatives

- Inayatullah (2015) highlights that the most critical method that can be used in this pillar is scenario planning (Inayatullah, 2015, p. 15). Therefore, this method will be used to create alternatives for the South African transport futures. The double-variable scenario method will be used by identifying two major uncertainties and developing alternatives based on those.

VI. Transforming the future

- In this final pillar, the future is narrowed down towards the preferred. The transformed future is focused on uncovering win-win solutions with neither compromise nor withdrawal.

Inayatullah (2004), also states that CLA can be used as a research method within this kind of study and would be best placed in critical futures research and post structural theory in general (Inayatullah, 2004, p. 19). It is from this premise that this research will embark on the CLA methodology to unpack and deepen the future of transport (Pillar 5), while strengthening and supporting the development of stronger scenarios for the transport industry in South Africa (Pillar 6). It is in these last two pillars that value will be created.

Further detail on the research framework and methodology to be followed in this study will be discussed in the second chapter.

1.6 Outline of the study

Chapter 1 provides an introduction and outline of the study. It presents the problem, the objectives, the questions to be answered and an overview of the research framework and methodology. This chapter summarises the justification of why this research study is conducted and the method with which it is carried out.

Chapter 2 clarifies the framework and methodology used in this discourse. This comprises of the research paradigm utilised in the study. The six pillars approach is discussed extensively in this chapter.

Chapter 3 concentrates on the review of the literature that will be used to shed light on the global emerging trends and a detailed environmental scan of the South African transport industry. Dominant drivers of change affecting the industry towards 2035 will be identified, starting from a global perspective, filtering down to South Africa.

Chapter 4 provides an analysis of the ideal, realisable future for South Africa's transport industry and its stakeholders through a "transport of the future" vision and a set of practical recommendations.

Chapter 5 the conclusions of the analysis conducted above will be deliberated and outcomes will be drawn. The chapter will also include strategies and recommendations, limitations of the study and also present possible areas for future research.

Chapter 2

2. RESEARCH METHODOLOGY

2.1 Introduction

The previous chapter aimed to introduce the context and parameters of this research study as well as the definition of the research problem. It also presented the concept of futures thinking and its potential role in the strategic planning of South Africa's transport industry. This chapter will therefore further explore the theory of futures studies, the methodologies utilised in the study of the future, including the six pillars approach, causal layered analysis (CLA) and scenario planning. This will include the research process followed as well as the tools used in ensuring an acceptable research outcome. This chapter is mainly constituted of the work and output of Professor Sohail Inayatullah.

2.2 Futures studies

Bell (2004) described Futures Studies as a discipline of inquiry that involves systematic thinking, based on distinctive perspectives. It makes use of specific theories and values to demystify the future therefore increasing human control over it (Bell, 2003). This was supported by Glenn (2009), stating that the purpose of futures research is not to disclose the future but to assist with improved decision-making today (Glenn, 2009). Roux (2010) further affirmed this by saying the purpose of futures study is to systematically explore, construct, and measure both possible and desirable futures to improve decision-making (Roux, 2010).

According to Bell (2003), the purposes of futures studies are:

- To interpret the past and orientate the present;
- Integrate knowledge and values for designing social action;
- Communicate and advocate a particular image of the future.

This modern approach to the study of the future includes an attempt to discover and where possible, influence the future and shape it to human will (Bell, 2003).
Inayatullah (2008) refers to the following six foundational concepts of futures thinking:

The used future- This looks at whether the transport industry has purchased a used future with the vision of its desired future borrowed from elsewhere or influenced by someone else (Inayatullah, 2008).

The disowned future- This relates to deferring or ignoring the future of self or organisation, in order to focus on certain strategic plans. The challenge is therefore to integrate the disowned self by moving the future closer; meaning "from a goal oriented neo-Darwinian approach to a softer and more paradoxical Taoist approach" (Inayatullah, 2008).

Alternative futures- This concept dismisses the belief that only one future exists and there are no alternatives. It also enables a mind-set that avails options, an ability to avoid repeating mistakes and better prepare for the future. This research effort intended to focus on the detection and mapping of a variety of alternatives to improve the planning for uncertainties.

Alignment- refers to the linkage of the vision for the transport industry and the day-to-day realities. A direct connection between a vision for the transportation industry in South Africa and the measuring thereof and the external reality, forms the basis of this study of the future (Inayatullah, 2008).

Models of social change- convey hopes of the future; is the future considered to be positive and can it be influenced? This research effort believes in a positive future for the South African transport industry that can be shaped and influenced by daily actions and measures.

Uses of the future- relates to the futures thinking applied in this research study which aims to assist with the creation of more effective strategies and innovative thinking. The aim is to increase the confidence of the transportation community to generate preferred futures. By considering the alternative, used and disowned futures, the

South African transport industry can take the future as an asset; deconstructing the preconceived ideas, to become more innovative and proactive in creating the ideal and desired futures.

Inayatullah (2015) also differentiates between four types of futures studies.

I. The first one is the *predictive*, wherein language serves as an invisible connection between theory and data, without constituting the real. In this type, the assumption is that the future can be known and linear forecasting is employed more, while scenarios are used as slight changes from the norm (Inayatullah, 2015, p. 6).

II. The second is the *interpretive,* where the goal is not to predict but to provide insight. In this type, the truth is considered to be relative, where both language and culture are involved in creating the real. This type is less technical and provides insight into the human condition through examining and comparing different national, gender or ethnic images of the future (Inayatullah, 2015, p. 6).

III. The third type is the *critical*. The goal of critical research is to disturb present power relations through making problematic the various categories and evoking other scenarios of the future. It is through this historical, future and civilizational distance that the present becomes less rigid and instead becomes more remarkable. This allows the spaces of reality to loosen and new possibilities, ideas and structures, to emerge. Therefore, critical futures research provides a richer account of what is being studied than the more common predictive orientation which merely `skims the surface' (Inayatullah, 1999, p. 2).

IV. The fourth type that Inayatullah refers to is the *participatory action learning*, which is the used to establish probable, possible and preferred valuations of the future. This is done by looking at the perspective of the various stakeholders through deep participation, therefore ensuring that the future is owned by those who have an interest in it (Inayatullah, 2015, p. 8).

2.3 The six pillars approach

Although the theory of the future is constructive, it had previously been criticised for lacking a conceptual and foresight process to understand the future (Inayatullah, 2015, p. 8). It is from this premise that the six pillars approach was developed, in order to "provide a theory of futures thinking that is linked to methods and tools, and developed through praxis" (Inayatullah, 2008, p. 7). This framework will therefore be applied throughout this research effort.

2.3.1 Mapping the future

In this pillar, the past, present and future are mapped. This clarifies where we come from and where we are heading (Inayatullah, 2008).

The futures triangle is one of the tools that can be used to map today's understandings of the future through three dimensions, as depicted in figure 2.1 below. The image of the future pulls us forward. While the future is vast, Inayatullah (2008) states five images as standard: Evolution and progress, Collapse, Gaia, Globalism, and Back to the future (Inayatullah, 2008). The image or vision of the future of transport in South Africa is contained in the National Transport Master Plan 2050 as;

"*An integrated, smart and efficient transport system supporting a thriving economy that promotes sustainable economic growth, supports a healthier life style, provides safe and accessible mobility options, socially includes all communities and preserves the environment*" (Department of Transport, 2011).

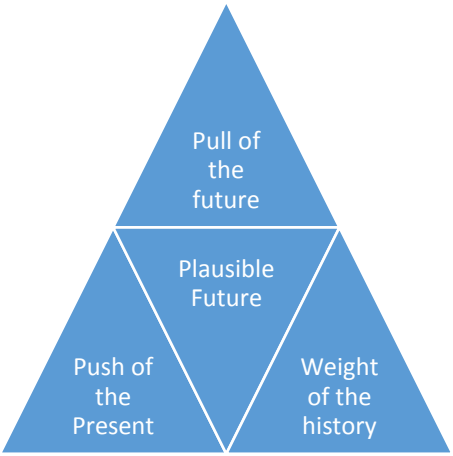

Figure 2:1: The Futures Triangle (Source: Inayatullah, 2008)

This vision can be aligned to that of Globalism. This is described as a need to focus on bridging economies and cultures using technology and a free flow of capital to bring riches to all. Traditionalisms and dogmas are the barriers that are restricting the achievement of this new world (Inayatullah, 2008).

There are also pushes of the present which can be referred to as quantitative drivers and trends that are changing this future (Inayatullah, 2008). The increased levels of traffic congestion are an example of such a trend. The future of where this trend will be pushing towards, in conjunction with the increased levels of carbon emissions, is what should be explored concerning the futures of transport.

There are also weights, varying with each image, which are the barriers to the change we wish to see (Inayatullah, 2008). Those who imagine a globalised world are weighed down by nationalists and the brutal fact that while capital may be freer, labour is still tied to place. It is by analysing the interaction of these three forces within the futures triangle, that one can develop a plausible future (Inayatullah, 2008). Specific to the transportation industry, factors such as fiscal constraints, trust issues, and fear of job losses can be identified as weights.

2.3.2 Anticipating the future

The second pillar seeks to challenge the image of the future by analysing emerging issues. This analysis of emerging issues and drivers, as represented in Figure 2.1, is performed to identify regions where social innovation starts.

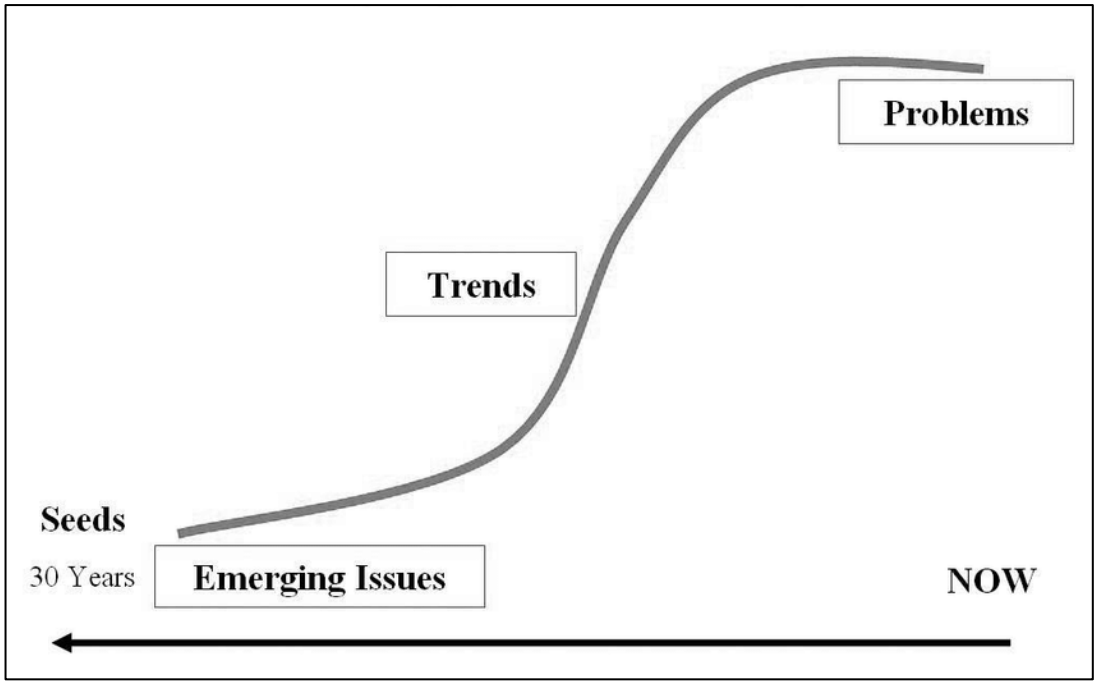

Figure 2:2: Emerging Issues Analysis (Source: Inayatullah, 2008)

Critical questions regarding the South African transport industry are posed during this phase in accordance with guidelines proposed by Horton (1999), who regarded the response to these questions as fundamental in the process of foresight creation (Horton, 1999):

- What does this mean for the South African transport industry?
- What are the implications for its stakeholders?
- What are the issues that challenge the realisation of the future?
- What can be done about it today?

2.3.3 Timing the future

The third pillar involves searching for the grand patterns of history and identifying each one of the models of change. The timing of the future, which comprises issues like the effect people's actions may have on the future and the possibility of mitigating or planning around those actions.

Inayatullah (2008) refers to the following foundational ideas:

- The future is linear, progressive and the good future is realisable through commitment and hard work.

- The future is considered cyclical with ups and downs. Those at the top will one day in the future find themselves at the bottom. Because they are on top, they are unable to adapt to the changing world, with their success based on mastery of past conditions and environments;

- The future is spiral. Fearless leadership with foresight can create a positive spiral, taking ownership of the past and integrating it with the road towards an ideal future;

- New futures are often driven by a creative minority, challenging the notion of a used future through social, political, cultural, spiritual or technological innovation; and these change agents imagine a different future, and inspire others to work toward it.

- There are key periods in human history when the actions of a few can result in a spectacular transformation. Established ways and methods of behaviour are no longer effective during these periods. The South African transport industry is most likely in this phase at present.

Conscious evolution is the key in this approach. The world is a complex adaptive system and once the future is mapped, it alters. Vision is required instead of a blueprint (Inayatullah, 2008).

2.3.4 Deepening the future

The fourth pillar seeks to deepen the future by unpacking the images of the future. There are two methods that are considered decisive during this phase: Causal Layered Analysis (CLA), as developed by Inayatullah and four-quadrant mapping, as developed by Wilber and Slaughter (Slaughter & Bussey, 2010).

Inayatullah (2008), the originator of the CLA, considers it to be the pivotal multi-dimensional method to unpack the future during this critical phase; it is a method that seeks to deepen the future and create transformative spaces for the construction of alternative futures (Inayatullah, 2008). For purposes of this research study, CLA was applied as the methodology to deepen the future of the South African transport industry, and is therefore the cornerstone of this research effort.

2.3.5 Creating Alternatives

This pillar focuses on methods to create alternative futures. It is during this phase that the future is broadened through the construction of scenarios, a valuable method of revealing the present, establishing the extent of uncertainty and presenting alternatives (Inayatullah, 2008). If the stakeholders of the South African transport industry strive to achieve progress by shaping the future, an analysis of the various available options and the consequences thereof are required, including an assessment of how much room there is to manoeuvre (Ogilvy, 2002). Scenario planning is based on the observation that an informed strategy to implement plays out across several possible futures with the main objective to identify the forces that will push the future in different directions.

2.3.6 Transforming the future

In the final phase, transformation, the future is narrowed down to the preferred (Inayatullah, 2008). The emphasis is on uncovering win-win solutions without compromise or withdrawal. Sustainability is employed as a guiding principle throughout this phase. The topics that need consideration include the formulation of a future as desired by all the stakeholders of the South African transport industry and the meaning of progress on the route to the ideal future for the industry leading up to 2035 and beyond.

2.4 Deepening the future with causal layered analysis

According to Sohail Inayatullah, the development of the CLA methodology was influenced by Richard Slaughter's elegant typology of futures studies into popular futures, problem-solving, and epistemological futures. It was reflected in the typologies being offered that with extensive rethinking and reworking, it could be developed into a fully-fledged methodology (Inayatullah, 2009).

Causal Layered Analysis can therefore be defined as a theory of knowledge seeking to integrate empirical, interpretive, critical, and action learning modes of knowing. It can also be defined as a methodology that does not predict the future but creates transformative spaces, in order to further create more effective policies and strategies. This methodology has also been used as the primary research method for many postgraduate students around the globe (Inayatullah, 2004).

CLA therefore focuses on creating alternative futures by opening up the present and past, and not necessarily forecasting a certain future (Inayatullah, 2004). This methodology does not focus on the horizontal dimension of futures compared to tools like emerging issues analysis, scenarios and back casting, but more on the vertical dimension such as the various layers of analysis. Slaughter considers it a paradigmatic method that reveals deep worldview commitments behind surface phenomena and believes CLA to "provide a richer account of what is being studied than the more common empiricist or predictive orientation which merely 'skims the surface" (Slaughter, 2002).

Inayatullah outlines the four layers of CLA in the following dimensions (Inayatullah, 2015, p. 12):

I. The *litany* or the day-to-day future is the data or the commonly accepted headlines of the way things are or should be. Solutions to problems at this level are usually short-term oriented.

   This is the official public or media description of an issue, wherein the descriptions focus on quantitative trends and problems. The descriptions are usually inclined to be visible and obvious and issues that are presented as separate, provoking feelings of vulnerability and indifference.

   The litany layer, in relation to this research, will deal with the propagation of transport in the South Africa. A specific analysis on trains, self-driving vehicles and the various new technologies will also be carried out.

II. The *systemic* is a deeper dimension, focusing on the social, economic, environmental and political causes of the issue. This dimension provides an interpretation based on quantitative data, technical explanations and theoretical analysis. The actions that lead to an issue are analysed at this level but, while assumptions may be challenged, the paradigm within which a problem is framed remains unchallenged (Inayatullah, 2004).

   At this layer, the research will focus on several drivers of change (social, economic, cultural, political and historical factors) that intensify the usage and willingness from the various stakeholders, as outlined in chapter 1; to explore various and innovative modes of transport.

III. The third is the *culture* or the *worldview*, which focuses on what is thought to be real or not real. This dimension is the cognitive lens that is used to understand or view the world.

   This includes society-based assumptions rarely questioned by people, until they are exposed to other communities or cultures (Ramos, 2003). Inayatullah

defined it as the pursuit to find deeper social, language, and cultural processes that are actor-invariant (Inayatullah, 2004). Detecting the deeper assumptions behind the issue is fundamental at this level, as are efforts to re-vision the problem. At this stage, one can explore how different discourses do more than cause or mediate the issue, but constitute it. Within this level, four sub-levels are identified at which discourse may be analysed, depending on the situation: stakeholder interests; ideological positions (for example, Economist *versus* Sustainability *versus* Neo-Marxism); civilizational worldviews (for example, Western, Islamic and Confucian); and the epistemic (for example, postmodern, modern and pre-modern) (Inayatullah, 2004). Every challenge that needs to be solved will call for a particular discourse or a mixture of a few (Inayatullah, 2004).

This research will seek to understand the deeper issues that constitute the perception of transport in South Africa and what it represents. The subsequent influence of new technologies in this industry will be established at this point.

IV. This dimension is the deepest and is the level of *metaphors and myths*, with a focus on the deep stories, the collective archetypes and the unconscious dimensions of the problem or the paradox (Riedy, 2008). At this level the language used is less specific, more concerned with evoking visual images, with touching the heart instead of reading the head, with the intention to draw out and deconstruct conventional metaphors, articulate alternative metaphors and bring the unconscious and the mythic to futures work (Inayatullah, 2004).

By moving up and down these layers, practitioners of CLA seek to test assumptions and create transformative spaces that can support new types of thinking about the future and lead to more effective policies and actions. The layered understanding of reality at the heart of CLA provides a basis for managing information and in practice, CLA has proven to be of great value for drawing out the deep cultural commitments, worldviews, metaphors and myths that shape the way people interpret their world (Riedy, 2008).

> Inayatullah recommends that the examination of futures-related issues should be from numerous angles and at multiple levels. He further stated that the understanding of multiple issues is broadened through the application of CLA by creating deeper, more meaningful scenarios by discovering myths and new litanies based on the perspectives of different stakeholders in an organisation (Inayatullah, 2009). CLA is presented as a theory and method that seeks to integrate empiricist, interpretive, critical, and action learning modes of knowing as a method (Riedy, 2008). Its utility is not in predicting the future but in creating transformative spaces for the creation of alternative futures as well as in developing more effective, deeper, inclusive and longer-term policy (Ramos, 2003). At this stage, this research will seek to paint a picture regarding the possible futures of transport, the usage and impact of new technologies within the industry. This research will tell a new story about transportation and all related technologies at this point.

Accordingly, this research study seeks to use CLA to reinforce and support the development of more robust scenarios for the South African transport industry. This would be employed by assisting with an improved understanding of current reality of the industry and the creation of alternative transport futures that are dynamic in their implementation.

CLA does not favour any particular truth, but seeks to discover how a discourse becomes favoured, who benefits and who loses when a particular discourse becomes prevalent (Inayatullah, 2008). The analysis of the conclusions and assessment of the future images created with scenario planning for the South African transport industry, in terms of depth and insight to support these conclusions, is imperative to deepening and improving the scenarios constructed in the sense of the way reality is formed. Inayatullah (2008) states that scenarios are evaluated to be effective only when they are based on a sound analysis of reality and the decision-makers' images of reality and assumptions are changed about how the world functions (Inayatullah, 2008). Scenarios are complex strategic decision-making processes that embrace both the inner worlds of human and cultural meanings, and the outer worlds of empirical reality (Slaughter, 2008). The research study, through the application of CLA, aims to balance

and stabilise the situation by giving substance to these inner worlds of human and cultural meanings.

2.5 Creating alternatives with scenario planning

Scenarios have been defined as “a set of hypothetical events set in the future, constructed to clarify a possible chain of causal events as well as their decision points” (Amer , Daim, & Jetter, 2013). One of the most important aspects about scenario planning is that it is closely related to strategic planning (Lingren & Bandhold, 2009). The use of scenario planning has increased significantly in recent years, with research linking the adoption of scenario planning techniques with uncertainty, unpredictability and instability of the overall organisational environment (Amer , Daim, & Jetter, 2013). Increased uncertainty has amplified the value of recognising future trends and anticipated organisational landscape (Amer , Daim, & Jetter, 2013). The use of scenario planning by organisations has consequently increased due to greater complexity and uncertainty in the environment.

Scenario planning supports decision-making, illustrating and revealing possible future events and situations, inspiring improved planning and aiding an organisation to become more flexible and adaptable (Schoemaker, 1995).

Dator’s (1979) work on alternative futures, where futures studies function as the basis of present actions, articulates and proposes four scenario models:

- Continued growth, with a future where it is assumed that current trends and conditions are developed further;
- Collapse, with a future that is the result of the failure of continued growth and the emergence of great contradictions;
- Steady state, with a future that seeks to arrest growth and find a balance in the economy and with nature, underlining a secure and non-discriminatory society;
- Transformation, with a future that attempts to change the basic assumptions of the other three scenarios through dramatic technological or spiritual change (Dator, 1979).

This approach facilitates scenario planners' abilities to label and frame their own ideas and concerns, as well as their potential for change (Inayatullah, 2013). As previously stated in chapter one, scenario planning is used to create alternatives for the South African transport industry. Inayatullah (2015) states that the double-variable scenario planning method is excellent for strategy development (Inayatullah, 2015, p. 15); this method is therefore employed to outline the key uncertainties based on the CLA outcomes in this study. This is to uncover the present and establish the range of uncertainty. The uncertainties identified can therefore provide the basis of four possible futures for the South African transport industry.

2.6 Conclusion

The future thus has six foundational concepts. As the world becomes increasingly diverse and as events from remote places dramatically impact on how, where, when, why and with whom we live and work, futures studies can help us recover our agency (Inayatullah, 2009). Through the mapping of the past, present and future, the anticipation of future issues and their consequences; consideration of the grand patterns of change; deepening our analysis to include worldviews, myths and metaphors; the creation of alternative futures; and the selection of a preferred way forward, the world we aspire to live in is created.

This research study assumes an optimistic future that can be shaped by the South African transport community's present-day actions. It focuses on the exploration and the mapping of a variety of alternatives to improve uncertainty planning in the South African transport industry on the road to 2035. This industry needs to establish the allowed scope of adjustment and options available, and determine what the consequences are of certain choices in shaping the ideal world, in which they aspire to thrive. The aim is to increase the confidence of the stakeholders of the South African transport industry in assisting with the generation of a preferred future for the industry through the creation of more effective strategies and innovative thinking: creating capacity to ensure long-term progress. It is from this premise therefore that this research discourse will use the six pillars approach to unpack, deepen the future of transport (Pillar 5), while strengthening and supporting the development of stronger

scenarios for the transport industry in South Africa (Pillar 6). It is in these last two pillars that value will be created.

The next chapter with focus on the review of literature, with an in-depth discussion on what is regarded to be the nature of progress and failure in South Africa and what sustainability means, from a transport perspective.

Chapter 3

3. LITERATURE REVIEW

3.1 Introduction

The previous chapter explored the conceptual framework and methodology that will be employed in carrying out this research study. An overview of future studies and methodologies in conjunction with related tools and techniques was captured.

The current chapter seeks to conduct a review of literature in the transportation industry. The aim of this literature review is to contribute to the attainment of progress in South Africa through the sustainable development of the transport industry. It will deal with the current state of the transport industry and the measure of human progress. The driving forces influencing the industry will also be explored in this chapter: The political, environmental, societal, technological and economic factors (PESTEL).

3.2 Current state of transport

Karl Benz, a German engineer is credited as the inventor of the first practical motor vehicle that was powered by an internal-combustion engine in 1885, with his three-wheeled Motorwagen (CBA, 2016). Motor vehicles have since evolved significantly, and progress has also been made in ensuring and enhancing vehicle safety. Globally, policies, legislation and road safety measures have evolved in line with increases in vehicle speed, capabilities, the rolling out of road networks, and the number of motor vehicles on our roads. It is appropriate, therefore for evolution and progress to have been the central theme of this discourse.

One of the main postulations in the field of Futures Studies is that instead of one single determined future, there are many possible futures that can unfold (Bell, 2003). From that premise therefore, once can make the resolve that the present holds the seeds of

how the future will change, and therefore considers the present in order to identify and explore the possibilities of the future. This requires creativity in terms of thinking about the future and also for one to dispel any preconceived ideas in terms of what opportunities lie therein.

When it comes to transport, Meersman & Van de Voorde (2017) stated that the focus of transport policy and research after the Second World War was to primarily invest in mobility of people and goods. This was an effort to ensure the revival the economy after the war. However, this surge in transport also resulted in some negative effects such as congestion and pollution. The progress made in terms of advanced technology and research has not been sufficient to avoid these repercussions. The challenge that remains therefore is to establish future transport research areas to focus on, in order to ensure sustainable transport that will contribute to a sustainable society (Meersman & Van de Voorde, 2017).

Transport integrates the world and is fundamental for international trade. The sector itself forms the economic fabric of the world and adds value by reducing unemployment (Meersman & Van de Voorde, 2017). According to the transport figures released by the European Union (EU) in 2017, the transport and storage services sector in the EU employed around 11.2 million persons, which is 5.2 % of the total workforce. About 52% of this number worked in land transport, 3 % in water transport, 4 % in air transport and 25 % in warehousing and logistics such as cargo handling, storage and warehousing. The remaining 16 % worked in postal and courier activities (EU, 2017).

Meersman and Van de Voorde (2017) reported a 70% increase in the number of new registrations in electric cars between 2014 and 2015, including both the battery and plug-in hybrid electric. More than 550 000 of these vehicles were sold worldwide in 2015, although they still have a low market share when comparing with the total number of cars (Meersman & Van de Voorde, 2017). According to the International Energy Agency, the United States of America and China are the two main electric car markets. In addition, seven more countries reached beyond the 1% mark in electric vehicle market share for the year 2015. These countries include Norway, Sweden, the

Netherlands, Denmark, France, China and the United Kingdom; with China having a high market share in e-scooters and electric buses (OECD/IEA, 2016).

The United Nations envisage that the population of the world will grow by more than one billion people in the next few years, reaching an estimated 8.5 billion by 2030; a further projection to 9.7 billion by 2050 and 11.2 billion by 2100 means that this growth trend will continue to rise. This high population growth however is said to be concentrated on the least developed countries, while the European countries are projected to experience shrinkage in this regard. It is further reported that the aging population in Europe will continue to be a challenge, with the number of people over 65 accounting for about half of the population, therefore putting pressure on the government systems (UN, 2015).

By 2050, projections are that 66 percent of the world will be urban, while 2030 will see the world having 41 mega-cities containing no less than 10 million people (UN, 2014). As a result, these cities need to be sustainable in order to support this growing population. Applied to transport, this sustainability implies that people and goods should be transported in a manner that reduces the burden caused to the environment, society and the economy. Technology will therefore play a critical role in in mitigating the current challenges, starting with the way in which personal mobility is consumed. The pertinent matter therefore is the length of time it will take for these changes to be effected and for this technology to be fully implemented and effect the progress required by the world (Meersman & Van de Voorde, 2017).

3.3 The nature and measure of progress

Bury (1932) once described progress as the development of human kind and civilisation towards an improved future (Bury, 1932); according to Hall, et al. (2010), the promotion of better societies has always been a powerful motivation for people, but the concept of progress has always been met with diverse viewpoints, with each gaining support depending on environmental conditions, dominant political regimes and cultural influences. In order to improve societies therefore, the basis of people's choices must be a solid foundation, a basic structure or framework that can be applied

to present a preferred and reliable approach to an idea. (Hall, Giovannini, Morrone, & Ranuzzi, 2010).

Hall et al. (2010) also states that, although the notions of progress may differ, the unifying factor is that these notions are composed of both the material and immaterial components. The progress of society is dependent on much more than just improvements in income and wealth. The choice to improve societies should be based on a reason or goal that is rooted in frameworks that seek to promote progress and enhance people's wellbeing. Therefore, societal progress will take place when there is development in the sustainable and equitable well-being of a society (Hall, Giovannini, Morrone, & Ranuzzi, 2010).

According to Wahl (2017), the one standard measure for human well-being today is the Gross Domestic Product (GDP), which in essence, only measures the size of an economy. Wahl states that this has been the focus and the general measure of success such that political leaders make annual announcements of GDP growth in order to assure the public that all is well. This use of money flow volumes as the main measurement of societal wellbeing and a yardstick for evaluation of important policy decisions is clearly flawed (Wahl, 2017). In essence, what is being measured is the money that is spent and not the value of what the money is spent on.

This is supported by Giannetti et.al (2015), who state that the GDP as a yardstick for progress is influenced by the myth that economic growth is synonymous with enhanced quality of life; while disregarding natural, social and human capital. Giannetti further adds that in order to monitor progress towards sustainability and improved wellbeing, governments should work with scientists to develop alternative metrics that go beyond material wealth or income (Giannetti, Agostinho, Almeida, & Huisingh, 2015).

Wahl (2017) continues to highlight that with the growth of the economy, collective wellbeing grows as well, without recognising the constraints of GDP as an efficient and true measure of wellbeing. Wahl states that there are many factors that can contribute to the totality of one's happiness – or lack thereof, like traffic congestion, accidents and consumption of cigarettes, war and ecological disasters requiring major

clean-up operations. Although these factors can have an adverse effect on wellbeing, they can be somewhat "good" for the economy. On the other hand, there are other factors that are not included in the GDP, like love, friendships, free time. Although these factors do contribute to human wellbeing, they are not included in the GDP (Wahl, 2017).

In an effort to design quantitative as well as qualitative measures of genuine progress, Wahl (2017) suggests that attention should be paid to what is measured and in what way. Wahl therefore, outlines the following alternative indicators that can be used in measuring what constitutes real wellbeing of humanity, while also adding value to the economy. These are regarded as all-encompassing measures of progress.

I. *Genuine Progress Indicator (GPI)* – This corrects the shortcomings of the GDP by including the components that are not monetary, like separating welfare enhancing benefits from the welfare detracting costs (Talberth, 2007). Wahl (2017) further affirms this by listing some factors in a variety of indicators including costs of crime, transport accidents, commuting, air pollution, land degradation, loss of native forests, depletion of non-renewable energy resources, ozone depletion and many others (Wahl, 2017). This ensures that value versus cost is measured and kept in perspective.

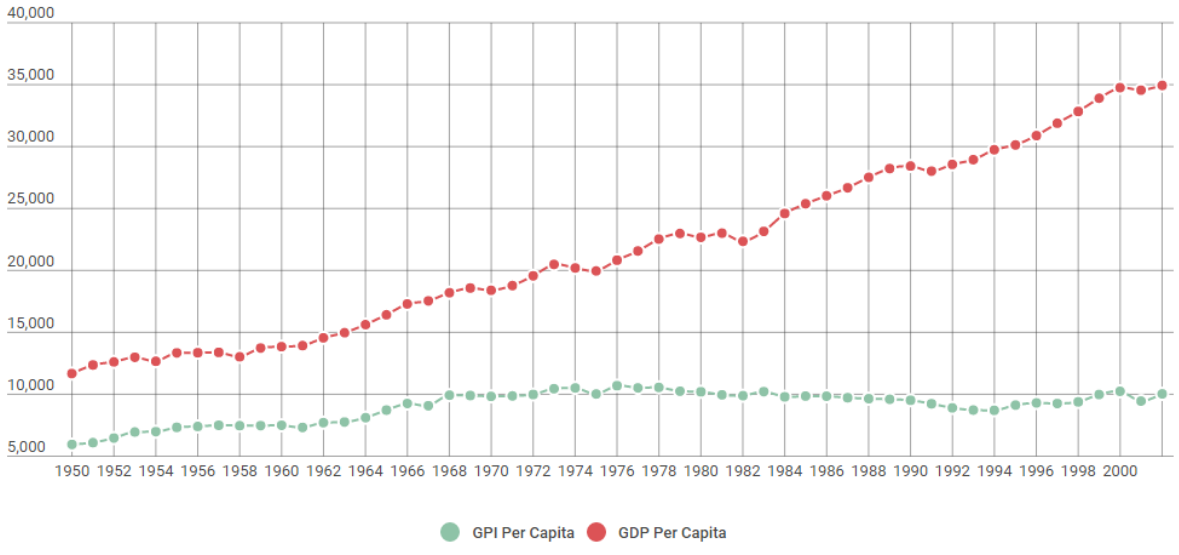

Figure 3:1: GPI versus GDP (Source: www.redefiningprogress.org)

II. *The Human Development Index (HDI)* – This keeps track of the country's average level of human development, focusing of three basic dimensions: a decent standard of living, access to knowledge and a long and healthy life. This serves as a point of reference to social and economic development by setting goal posts against which the country gets measured. The result of this is expressed as a value 0 and 1 (Gaye, 2007). The HDI has a significant impact on gaining the attention of relevant stakeholders, including policy makers towards aspects of development that focus on a wide variety of choice and freedoms, beyond just income (Wahl, 2017).

III. *The Happy Planet Index (HPI)* – measures the environmental efficiency with which human welfare is delivered. It is comprised of three indicators, including the ecological footprint, subjective feelings of wellbeing and longevity. This index seeks to determine and identify the resources required in order for citizens to live long and happy lives (Wahl, 2017). A study that was done to compare the progress of various nations towards achieving the goal delivered high levels of experienced happiness within the limitations of reasonable and responsible resource consumption (Thompsom , Marks, & Abdallah, 2007).

IV. *Gross National Happiness (GNH)* – GNH seeks to develop an indicator that incorporates all values relevant to life on this planet, including the most subtle and profound: happiness. It can also be viewed as the next stage in the development of economic indicators for sustainable development, going beyond merely measuring values that can be expressed in monetary terms (Tideman, 2011).

According to Wahl (2017), the notion of GNH is based on the foundation that, real development of human society takes place when material and spiritual development occur side by side to complement and strengthen each other (Wahl, 2017).

Wahl identifies the four pillars of GNH as:

- The preservation and promotion of cultural values,
- the promotion of equitable and sustainable socio-economic development,
- conservation of the natural environment and
- establishment of good governance

When conceptualising progress, Itay (2009) refers to the following approaches and theories as presented in Figure 3.1 below. Itay highlighted various areas that progress can be comprised of: technological, economic, political, environmental, scientific, social, moral, and financial. These realms were said to trade against or reinforce each other at times (Itay, 2009).

Itay further proclaimed that defining progress demands reflection on different aspects thereof, both in terms of fundamental attitudes towards progress and in the choices regarding its content. Within the different ideas of progress, two fundamental approaches to defining progress can be identified, as well as four current theories of progress, describing the relationship of progress to other values. At the core of every examination of progress are the two fundamental approaches of scepticism and optimism with conflicting views on whether humanity should or should not strive for progress and human improvement.

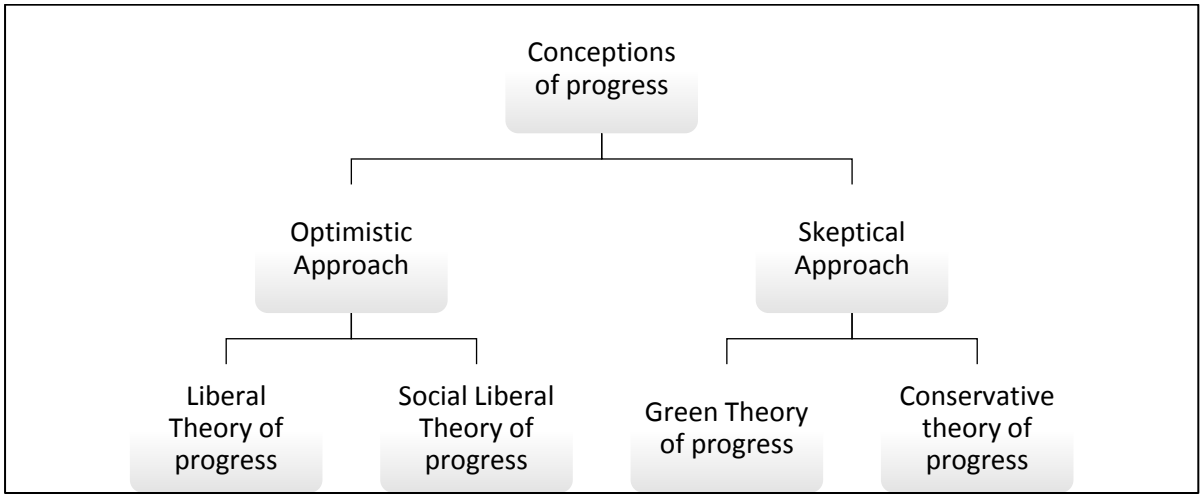

Figure 3:2: Conceptions of Progress (Source: Itay, 2009)

The sceptics of progress view the yearning for social progress as dangerous, since it seeks human perfection which they consider beyond reach and aspiring to it can be very costly. They argue further that this aspiration for progress can lead to totalitarian regimes and genocide. These sceptics believe that society should not strive to achieve or guide progress, and that doing so harms those in society who do not share the same view of progress. On the other hand, the optimistic proponents of progress believe that striving for progress keeps the world from chaos and allows the improvement of circumstances. They maintain that without the aspiration to progress, there can only be change for change's sake, with no actual advancement. Within these two fundamental approaches of scepticism and optimism, Itay identified four contemporary theories, discussed in detail below: The Liberal Theory of Progress; The Social Liberal Theory of Progress; The Green Theory of Progress and The Conservative Theory of Progress (Itay, 2009).

I. *The Liberal Theory of Progress* - relies on economic indicators as the measurement of progress and refers to economic growth as both the generator and essence of progress. The major technological discoveries of the last century and the growing dominance of the free market system resulted in economic growth. This was measured by GDP and was widely recognised as the indicator of societal progress. The Liberal Theory, which highlights neutrality and civil rights, supports this conventional theory to both define and pursue progress, perceiving the free market as a generator of progress in all spheres of life. This theory grew more popular as it became evident that economic growth does indeed bring with it an increase in human well-being because there is a correlation between growth in GDP and other aspects of human life, such as life expectancy at birth, health and social cohesion. This theory, however, is controversial both in its demand for a particular form of capitalism and in the costs this model of progress incurs, predominantly in environmental damage and social costs. Over the years, it became clear that not only was GDP growth not intended to measure progress, but it also provides a very fractional picture of progress. It fails to take into account those transactions that are not money-based, activities that are generally agreed upon as central to human life, such as family life and clean air to breathe.

Nevertheless, GDP remains the main indicator in the literature and in politics when considering progress, while GDP growth remains the primary goal of many of the world's policy-makers.

II. *The Social Liberal Theory of Progress* - perceives progress as a concept in which the social dimensions should be emphasised, putting greater emphasis on social indicators, rather than economic indicators, to measure progress. Its different representatives might equate progress with an increase in social capabilities, relief of poverty or other concepts of social justice.

III. *The Green Theory of Progress* - regards progress as being in harmony with the earth, introducing notions of sustainability that emphasise the problems of limited resources and the interests of future generations. There are two main views of progress within the Green Theory:

- The *environmental view* which operates within mainstream political systems and demands that environmental costs are to be considered more fully when measuring progress.

- The *ecological view* that maintains that the search for growth and progress has been very costly, stressing the need for a methodological shift in the way history and progress are perceived and asserting that the focus on progress prevents people from realising what costs it involves.

IV. *The Conservative Theory of Progress*- opposes the pursuit of progress in the social sphere and regards progress as possible only within the technological and scientific spheres. This theory does not regard knowledge in the social sphere as cumulative and consequently proposes that political and social ideas should not aspire to progress. Most conservatives regard changes in the social sphere with scepticism and furthermore consider human attempts to achieve progress in the social sphere as not only damaging social structures and family values, but also as the cause for all major atrocities in history. According to this

view, the political sphere should deal with current affairs without aspiring to progress, which can only occur in the natural sciences and technology.

3.4 Driving forces affecting transport towards 2035

There are numerous factors that could affect the future of transport in the year leading up to 2035. According to Adendorff and Collier (2015), excellent governance of the country is required to realise economic progress and innovation for the development of human well-being. This includes an analysis, understanding and implementation thereof, at regional government, after which an international standards assessment is conducted (Adendorff & Collier, 2015, p. 71). Although there is no guarantee that the current trends will persist, they do however affect the course of political, economic, social and environmental change, which then inevitably might strongly influence the future in the long run.

3.4.1 The political

As an entity responsible for the implementation of policy that has an influence on the business landscape, the government continues to be a critical and influential stakeholder in a country's political environment. Therefore, political risk factors such as nationalisation, corruption and terrorism, remain relevant when considering globalisation stakeholders (Adendorff & Collier, 2015, p. 72). Inayatullah (2003), further adds to this, stating that long term projects have become riskier as political transformations may possibly change the price of oil, which is a major commodity when it comes to transport. An understanding of the future, at the various levels – beyond just the surface, should therefore be developed in order to mitigate these risks (Inayatullah, 2003). In the South African context, the instability caused by the constant reshuffling of senior and key leadership at executive level further adds to this risk, and can reduce confidence and undermine morale going forward.

3.4.2 The environment

Sustainability of transport has become a cause for major concern, with planners and policy makers encountering challenges in solving this issue. Economic growth at the start of the twenty first century led to a strong increase in both the global and per capita carbon emissions. (Meersman & Van de Voorde, 2017). During this period, sustainable transport became an issue, especially in urban areas at a time when the focus is on improving connectivity between humans, vehicles and infrastructure.

An estimated 14% of the world's greenhouse gas emissions (GHG) in 2010 came from the transport sector, specifically 10% from road transport (IPCC, 2014). Huang, Liu and Pan (2016) reported that the transport sector is the fastest growing direct CO2 emitter in recent years (Huang, Liu, & Pan, 2016). This was supported by Meersman and Van de Voorde (2017) stating that while most of the sectors in the EU have reduced their GHG emissions compared to 1990, the levels within the transport sector remain high (Meersman & Van de Voorde, 2017).

It has been reported that mankind's energy production is the principal contributor to this release of greenhouse gases, in particular CO2, to the atmosphere with fossil fuel combustion as the key factor. According to Höök & Xu (2013), anthropogenic GHG emissions and human-induced global warming are primarily linked to future energy production. Forecasts on the development of the global energy system over the next century are foundations of the assessment of future climate change caused by mankind. The Intergovernmental Panel on Climate Change (IPCC), amongst others, make use of various climate models that rely on different emission scenarios to portray possible trajectories for future fossil fuel production and their correlating release of CO2 (Höök & Xu, 2013).

The diagram below depicts a schematic illustration of the Special Report on Emission Scenarios (SRES), scenarios with their driving forces and main orientations.

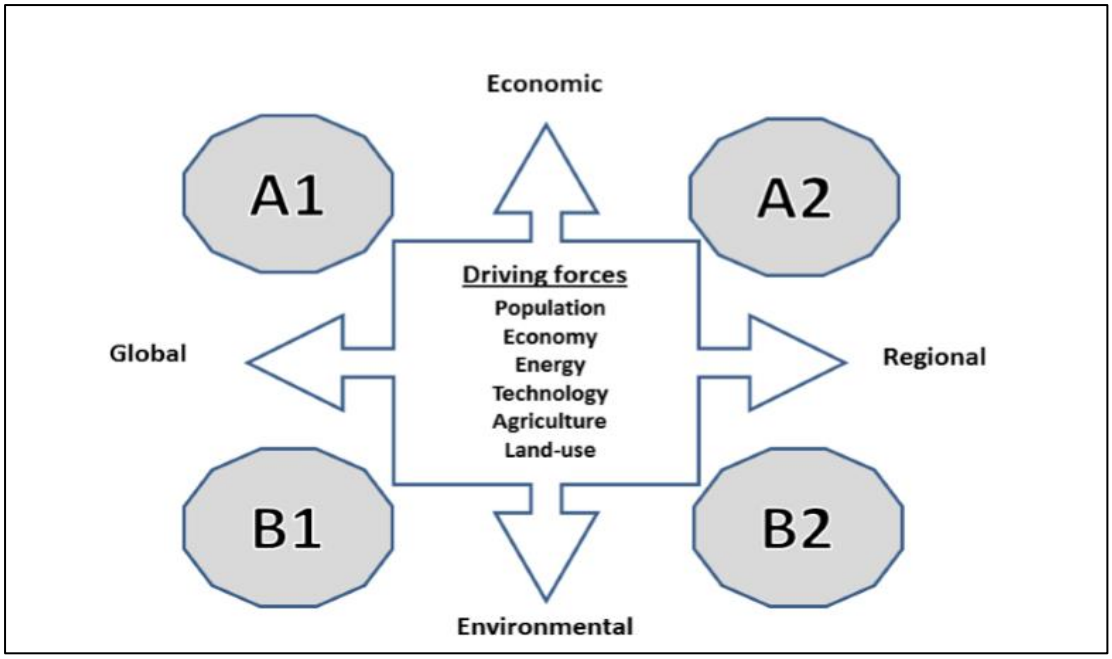

Figure 3.2: Special Report on Emission Scenarios (SRES) scenarios (Source: Höök & Xu, 2013)

In terms of energy resources, Canada is reportedly one of the important players in the world as the second largest supplier of natural uranium, a leader in hydroelectricity generation and an important producer of oil, gas and coal in particular from unconventional (oil) resources (Vaillancourt , et al., 2013). Given the fears about climate change around the world however, the unconventional oil industry is facing important environmental and reputational risk challenges.

Canada imports a large percentage of the energy consumed in the country, especially oil products, for transportation in the Eastern and Central provinces. Accordingly, energy security has become a priority on political agendas for non-producing provinces even though Canada is an important energy producer. This means that the energy systems of the Canadian provinces are diversified, resulting in various future challenges, especially pertaining to environmental and energy security. In addition to these future challenges, there is no national energy strategy to optimise the management of energy systems and the initiation of consistent energy policies (Vaillancourt , et al., 2013). It is from this premise that feasible measures including the upgrading of gas quality, the reduction of heavy polluting cars, and popularization of new energy vehicles have been introduced (Huang, Liu, & Pan, 2016).

3.4.3 The society

Analysis of change in accessibility in developed economies generally shows that accessibility is falling for many people (Koopmans, Groot, Warffemius, Annema, & Hoogendoorn-Lanser, 2013). According to Halden (2014), there were plans to increase accessibility by reaching an optimal balance between supply and demand of transport, consistent with sustainability. With these increased accessibility plans by authorities, only a small minority of people were covered. The focus remained on social group that faced particular challenges, like personal mobility restrictions. However, the emphasis should be on improving accessibility, cost of transportation and reducing total travel time for all social groups (Halden, 2014).

The association between progress and well-being has been reported to question which well-being to consider, how to measure it and whose well-being is being considered. The conception of progress as well-being differentiates between progress and its determining factors. Progress refers to the increase of people's well-being, while its determining factors have to do with conditions of habitability, with greater knowledge and its proper utilisation, with the availability of material goods and with the existence of certain rules for coexistence. This conception allows identifying and qualifying the determining factors of progress according to their influence on well-being (Rojas, 2009)

Progress is also associated with the idea of human well-being. The universal discontentment of the exclusive use of economic indicators for measuring progress resulted in a couple of important movements in the conception and measurement of progress: the 'social-indicators' movement and the 'capabilities and functionalities' movement (Rojas, 2009).

3.4.4 The technology

The first issue when looking at the possible futures in transport is the relevance of issues pertaining to urban planning. Inayatullah (2003) states that a long-term approach and focus is critical when it comes to transport as wrong investments could possibly lead to massive economic losses. Ecology has developed around the industry whereby transport has become a transport system. According to Inayatullah, the decisions made today cannot be seen in isolation as our travel choices are creating new meaning, systems and values, thereby forming the basis for future civilisation. Once a new technology is introduced, it is very difficult to remove due to the seriousness of the future and the importance of decisions made today (Inayatullah, 2003).

According to the Rand Corporation, the way countries addressed congestion in the past was through additional investment in infrastructure. However, this approach was limited and therefore not sustainable, due to resource constraints amongst other factors. It was from this dilemma that alternative solutions were explored, such as using emerging technologies to improve the effectiveness and efficiency of the transport system in the United Kingdom (Rand Corporation, 2016).

This Rand Europe project considered the factors that might influence travel towards the year 2035, by focusing on technologies that are currently in development. This was done through looking at the activities that generate travel, such as commuting to work, short and long-distance commute, health, retail and the movement of goods. Interviews were conducted with experts in the field, out of which some technologies that would likely have an impact were identified. These were technologies that would influence the demand in travel, improve the transport capacity network or increase the productivity of the commuters (Rand Corporation, 2016).

Six technologies that were identified included the following:

- Autonomous Vehicles – technologies that will enable vehicles to be propelled without human input.

- Information and communication technology (ICT) connectivity – a range of faster telecommunication technologies that will enable telecommuting, retail and telehealth activities.

- Computer applications, Big Data, intelligent information processing – collection and analysis of vast amounts of data, to provide personalised information, therefore creating opportunities for new mobility services and vehicle sharing platforms, etc.

- Advanced manufacturing – Novel technologies like 3-D printing might influence transportation of goods.

- Internet of things – a network of objects of things that can communicate or detect each other. This could affect freight and logistics etc.

- Novel materials and embedded sensors in infrastructure – advancements in materials science and production techniques which could improve the maintenance of road surfaces or automatically repair abrasions, therefore reducing travel delays.

The developments in the employment of wireless communication technologies, real-time data collection, increased automation in driving and traveling, active coordination of vehicles in real-time were tested to see how they could help to set up transport systems where combinations of modes would be seamless, efficient and without unnecessary time loss (Meersman & Van de Voorde, 2017). This will further assist in the development of reliable public transport systems which will be a necessity for liveable cities. To counter the negative effects of transport, a lot of research has gone

into development of green technologies like electric and hybrid cars, energy efficient truck designs, retrofitting of ships, clean public transport systems, lighter airplanes, and to technologies which will further increase the safety of transportation systems. These technologies have not been exploited to their maximum potential due to high costs (Meersman & Van de Voorde, 2017).

The fuel efficient zero emission vehicles with or without drivers, vehicle-to-vehicle and vehicle-to-infrastructure communication, the internet of things, 3D printing, a completely automated supply chain, robotics, artificial intelligence are technologies which are already available. The sharing economy in combination with pay per use mobility will have an impact on car ownership and the stock of vehicles. A lot of research attention is going to data fusion, data mining and data optimisation but also privacy concerns need to get sufficient attention. Big data has the potential to improve transportation planning but sometimes good surveys, especially for freight transport, can contain more useful information (Meersman & Van de Voorde, 2017).

Therefore, groupings like cars, trains and boats may become obsolete, with designers only being limited by their imaginations towards 2035. We can differentiate between two groups of transport that will influence the industry: mass transit transport and personal transport. We can also differentiate between transport for long distance and short distance. The following are some of the modes of transport that will greatly influence the transport industry towards the future.

3.4.4.1 *Magnetic Levitation*

In order to address the issue of congested, costly, inefficient and dangerous transport, Magnetic Levitation (Maglev) projects are rolled out around the world in various forms. This addresses the issue of old, obsolete and unsafe infrastructure while reducing operating and maintenance costs. The dependency on fossil fuels is also reduced and by default, results in a drastic reduction in carbon emissions (Powell & Danby, 2013).

Maglev makes use of the notions of electromagnetism and electrical machinery to float and propel a train along a track with their speed limited only by atmospheric drag. Maglev is more than just a faster train. It is a new mode of transportation that was

invented even after the introduction of airplanes, and differs in that it does not have wheels. Maglev vehicles are magnetically levitated above a guideway and move without any mechanical contact (Powell, Danby, & Jordan, 2011). Maglev vehicles have no engine, do not use fuel and therefore to not emit any carbon emissions or engine noise. In evacuated tunnels, these vehicles can potentially reach orbital speeds of 8 km/s (18,000 mph). When traveling in the atmosphere, Maglev vehicles have reached 580 km/h (361 mph). These vehicles are not controlled by on board engineers, but a central control traffic centre views the entire guideway in real time to detect potential hazards and control the location and speed of each vehicle (Powell & Danby, 2013).

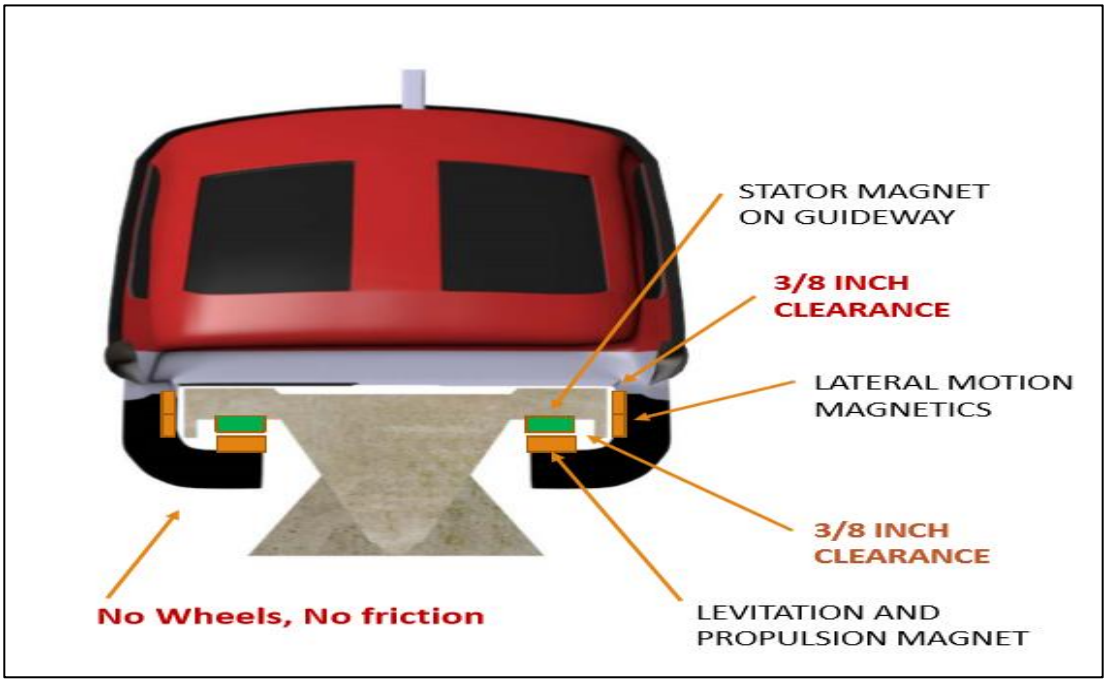

Figure 3:3: Maglev Train (Source: Powell & Danby, 2013)

3.4.4.2 *High Speed Rail*

As a new means of transportation, high-speed rail (HSR) lines have also been rapidly proposed and constructed in many nations throughout the world. This mode of transport potentially provides a safer, quicker and cost-effective alternative in comparison with other traditional form of land transport, for example, conventional railway, car and bus. It is due to these advantages that more countries are expanding

their own HSR networks. As in the case of other transport-related infrastructure improvements, the development of a HSR network will inevitably result in the “collapse” or “compression” of the time and space between HSR cities, which can be reflected by the change in accessibility (Wang, Liu, Sun, & Liu, 2016).

By 2013 China had constructed the world's largest high-speed rail network. According to the “Mid-to-long Term Railway Network Plan” of China's National Railway Administration, China is to accelerate the construction of its network of passenger-dedicated lines, which will connect all of the provincial capitals and cities with a population of over half-a-million, covering more than 90% of the total population (NRA, 2008). As part of China's HSR network, Jiangsu province has developed an HSR building program and planned to increase its HSR operating length from 773 km in 2013 to over 3350 km by 2030. By shortening the travel time, such large-scale transport projects will inevitably cause the phenomenon of time-space convergence and enhancement of regional accessibility (Wang, Liu, Sun, & Liu, 2016)

3.4.4.3 *Evacuated Tube Transport*

Technology company ET3 (Evacuated Tube Transport Technologies) believes that transportation should be clean, green, fast, comfortable and affordable for all. They also believe that it must also be financially sustainable on a global level, and are therefore promoting a futuristic tube transportation system on Vancouver Island that could move passengers from Nanaimo to Swartz Bay by means of magnetic levitation (ET3, 2010). According to the founder of the company, Daryl Oster, this mode of transportation is literally “space transport on earth”. The system contains car-sized vehicles that are magnetically levitated, operating within a network of tubes that have almost all the air removed in order to eliminate the friction associated with transportation. Oster reports that the vehicles would move at a speed of 600 or 700 kilometres per hour; one 1.5 metre diameter tube can handle the equivalent of 23 lanes of freeway traffic of cars. This would ensure that the whole island can be serviced at a lower cost than the currently proposed light rail. The company has already released adverts touting the evacuated tube transport technology in local newspapers. Oster reported that full-scale prototypes of up to 15 metres have already been built and tested (CBC News, 2015).

Figure 3:4: Evacuated Tube Transport (Source: www.ET3.com)

3.4.4.4 *JetPacks*

Eric Strauss and Troy Widgery of JetPack International believe that JetPacks are the future of short distance personal travel. These are machines that give humans the ability to fly without wings and they are working on developing them for the average consumer. The aim is for everyone to be able to fire up their own personal rockets and jet into the clouds. JetPacks were developed to enable flight in space however the earlier models proved to be too impractical and hard to use. The new models are now experimenting with carbon fibre and nanotubes to make them lighter, faster and stronger. In the future, Jetpacks could be used to commute back and forth to work to eliminate traffic and time constraints (Oppenheimer, 2009).

3.4.4.5 *Personal Aircraft*

The answer to the congestion on roads is to take to the air in a plane-car hybrid that will revolutionise the way society works. This was revealed at the 2008 Electric Aircraft Symposium held near San Francisco airport in California. This was revealed as twenty-year vision of the future. According to Richard Jones, a technical fellow at Boeing Phantom Works, this proposal was about making aviation available to

everyone as a daily means of transportation. Boeing's research group is therefore designing a hybrid aimed at travelling up to 300 miles at a time. It will use precision navigation systems that would allow the average 'driver cum pilot' to fly without special training thanks to a computerised 'flight instructor' built into the cockpit (Shiels, 2008).

This stance was further affirmed by the development of the Viper Aircraft or Viper Jet in 1996. This is a small homebuilt jet aircraft by Viper Aircraft Corporation, conceptualised by brothers Dan and Scott Hanchette. It is a conventional, low-wing monoplane with swept wings and tail and two seats in tandem under a bubble canopy, with the ability to utilise its turbo engine for better fuel economy. The jet intakes are located at the sides of the fuselage and the tricycle undercarriage is retractable (Rosales, 2008). Construction throughout is of composite materials, with a fibre carbon frame and uses 55 gallons of fuel per hour versus the 400 gallons of a conventional jet, and the cost of a viper jet assembly kit is also a small fraction of that of an average corporate jet. It is reported that the Viper can fly about 760 miles without refuelling, making it unique within the kit-airplane market. This means that in the future, long distance personal travel will be much more affordable (Joshi, 2007). "This is definitely a multi-purpose airplane," Dan Hanchette stated that with a full tank of fuel and at economy cruise, this is a great cross country airplane (Rosales, 2008)

Figure 3:5: The Viper Jet (Source: www.JetForums.net)

This was further supported by Schmidt (2017), stating that drone technology is advancing so rapidly that the airspace regulatory authorities are struggling to keep up. It is reported that “urban air mobility” is the next big thing. This entails a development that combines driverless care, taxi application and drone technologies to deliver a pilotless, flying taxi that can be hailed by a smart phone. (Schmidt, 2017).

With these personal aircrafts, Richard Jones proposes that there should be a highway in the sky. This technology would then enable anyone to fly these vehicles in a safe manner, with minimal or no training at all. As such, Boeing is now developing a system that will create flexible and trackable pre-programmed routes that will allow the aircraft to take off, fly and land themselves. They will be able to navigate the traffic and talk among themselves (Oppenheimer, 2009).

3.4.4.6 *Drones*

In September 2017, Dubai staged a test flight for what was reportedly the world’s first drone taxi service. This flying taxi was developed by Volocopter to resemble a two-seater helicopter with eighteen propellers. This innovation was unmanned and meant to fly without remote control guidance for a maximum duration of 30 minutes (Reuters, 2017). The head of the city's Roads and Transportation Agency announced at the World Government Summit that this drone would soon begin regular operations, with passengers selecting their destinations on a touch screen, as there are no other controls inside the craft (BBC, 2017).

The assertion that Schmidt made that drone technology was advancing rapidly, was further proven true when the European aviation company, Airbus, also started working on a self-driving aerial taxi, with this one being scheduled to launch in 2018. It is reported that the first tests will be unmanned, but the company plans to have humans pilot the four-person aircraft when it is planned to start flying in cities around 2023, before eventually transitioning to fully autonomous trips (Lumb, 2017).

The design of Airbus' innovation is a quad-rotor design familiar to any drone fan, allowing for a vertical take-off and landing (VTOL) electric-powered aircraft that will swiftly transport four passengers through urban areas. This has also prompted Uber

to fast track its flying taxi plans, targeting to have a test vehicle airborne by 2020 (Lumb, 2017).The future promises to be air bound.

3.4.4.7 *Water Cars*

According to the US Geological Society, an estimated 71% of the earth's surface is covered by water (USGS, 2016). It would then make sense that in the future we should use this water surface to relieve the pressure on land. It is from this premise that a Swiss company called Rinspeed started working on an underwater car, named the Rinspeed sQuba. This car can both drive on roads, and then - at the push of a button - dive up to 10 meters under the sea. It can drive on land, over a river or through a lake. The sQuba can remain underwater for a maximum of three hours. It is a fast and stylish vehicle, yet with zero carbon emissions. It is also modern in that it can also drive itself at the touch of a button (Oppenheimer, 2009). This type of innovation promises to bring about a future where we work with the natural elements instead of working against them.

3.4.4.8 *Telepresence*

The globalisation of business means that people's requirement for commuting or travel in order to execute their jobs might not be necessary in the future. Telepresence technology, like Cisco's TelePresence Suite, can enable people to work from any location, bringing life size people to attend meetings at the push of a button, which would inevitably decrease the need for travelling. The video and audio quality is so good and fast that people can feel like they are in the same room (Davis, 2009).

Figure 3:6: Telepresence (Source: www.cisco.com)

This is also affirmed by technologies that enable transported presence, whereby one can experience a place, right from where they are. Interactive maps of the future or Geo-browsers like Google Earth can achieve this by enabling a person to not just look, but project their presence. This is done by mounting special omnidirectional cameras on top of cars, with a vision that extends far beyond street corners. This map can take you everywhere as "everywhere" will be captured on video, for example, underwater cameras and cameras in space (Chandler, 2007, p. 277).

3.4.5 The economy

Economic growth implies more economic activity, higher incomes, greater consumption and an increased demand for transport. This increase is particularly noticeable in road haulage and generates a number of negative external effects. These effects, including congestion, accidents and damage to infrastructure can compromise the functioning of the transport system and traffic circulation which will in turn have an adverse effect on economic activity and growth. In other words, transport not only contributes to economic growth, development and wealth, but it also generates adverse effects that may jeopardise the level of welfare and wellbeing in society. It is this duality that constitutes the main challenge in developing a sustainable mobility policy (Meersman & Van de Voorde, 2017).

It was reported that about 1.2 million people die each year because of road accidents. This makes it the most important cause of death of young people, with much of these accidents caused by human behaviour (WHO, 2015). One of the uncertainties currently is the pace with which globalisation will continue to grow. It is however clear that economic growth will be higher in the developing countries than in the OECD countries. This will result in a changing globalisation which will no longer be driven by the developed economies, but much more by the emerging economies. Apart from China and India, other economies could also see an increase in their growth resulting in a redistribution of consumption and trade flows (Meersman & Van de Voorde, 2017).

Traffic congestion also leads to considerable time losses especially in road transport. All these effects are to a very large extent present in and around cities thereby threatening their liveability, the social network and the economic performance. As a consequence, the many benefits that transport can bring might be lost. Policy makers are aware of this and have put sustainable transport on their agenda. (Meersman & Van de Voorde, 2017).

Congestion as a result of increased demand for private vehicle use will result in wide ranging negative social, economic and environmental impacts such as degradation of the natural environment, noise pollution, reduced quality of life, reduced economic

productivity, increased road accidents and CO2 emissions (Luc Honore Petnji, Frigola Fortià, Saurina Canals, & Marimon, 2015).

3.4.6 The legal

Lund and Kempton (2008) state that extensive sustainable energy systems are a requirement for a significant reduction of carbon emissions. However, these implementations are confronted with two major problems:

- The replacement of oil as an energy source within the transport industry
- Maintaining a balance between demand and supply of renewable energy resources and electricity

Plug-in electric vehicles (EVs) could reduce oil for the light vehicle fleet to the point of elimination (Lund & Kempton, 2008). However, these factors may require regulation and intervention from the government.

3.5 Conclusion

Having observed developments in the transport industry from right after the Second World War to the various perspectives at present, it is clear that decisions made going forward have great importance toward human well-being and progress from a policy perspective but also as far as the technologies that are introduced are concerned. It is therefore critical for the researcher to consider what Inayatullah (2003) refers to as a shift of the industry from being just about the transport itself, to being an ecosystem, and approach this research from that viewpoint (Inayatullah, 2003). Furthermore, the contribution towards this conversation will be taking into consideration the South African perspective and what can work in this environment. This is what the following chapter seeks to achieve, whereby possible futures will be explored specifically for the South African context, making use of the tools and methods outlined in chapter 2.

Chapter 4

4. SOUTH AFRICAN TRANSPORT: ROADS TO THE FUTURE

4.1 Introduction

The preceding chapter aimed to review the literature of the transport industry. The focus was on exploring the current state of the industry, while also reviewing the meaning and various perspectives of progress in as far as humans are concerned. The PESTEL factors were looked at: the political, environmental, society, technological, economy and the legal. An in depth look in the critical technologies that affect the transport industry was also explored.

This chapter will therefore apply Inayatullah's six pillars approach in the study of the future, incorporating the various tools and methodologies within each pillar, in order to elicit visions and recommendations. These tools are structured in a way that assists one to question, map, anticipate, deepen, and create alternatives to transform to a future that they envision (Inayatullah, 2015, p. 39). This will mainly be from a South African perspective.

4.2 Mapping the future: Futures Triangle

The mapping of the future was described as the collection, collation and summarisation of available information, including trends and expected developments, of which ultimately the consequence is the creation of foresight knowledge (Horton, 1999). Lindgren and Bandhold (2009) affirm this, terming it the "tracking" phase because of how it tracks the changes within the environment that may have an impact on the central question about finding trends, drivers and uncertainties that need to be considered since they influence the central question (Lingren & Bandhold, 2009). Cornish (2004) supported this, stating that a distinct value of trends is that they provide a bridge from the past into the future, allowing the conversion of information of what

has happened in the past into knowledge about what might happen in the future (Cornish, 2004).

In this research discourse, the futures' triangle is used to map today's view of transport futures through three dimensions: the images of the future, pushes of the present and the weights. According to Inayatullah (2015), there is a variety of images of the future at a global level, but the following five are standard:

I. Evolution and progress: Where man is the centre of the world, there is more technology and a belief in rationality.

II. Collapse: This is the belief that man has reached his limits and there is world inequity, nuclear holocaust, climate disasters, basically going towards a worsening future.

III. Gaia: is the belief that there needs to be social technologies in order to restore and repair the damage caused to people and nature, focusing more on what is important. The co-relation between men and women, humans and nature, humans and technology become the next evolutionary jump.

IV. Globalism: refers to the elimination of barriers between nations and cultures, moving to a free-market system, with technology and free-flow of capital bringing riches to all.

V. Back to the future: is the need to return to simpler times where technology was less disruptive.

Along with these images, Inayatullah (2015) refers to the quantitative drivers and trends that aim to change the future, as well as the barriers to the desired change (Inayatullah, 2015).For purposes of this discourse, the image or vision of the future of transport in South Africa is contained in the National Transport Master Plan 2050 (NATMAP 2050) as follows:

"*An integrated, smart and efficient transport system supporting a thriving economy that promotes sustainable economic growth, supports a healthier life style, provides safe and accessible mobility options, socially includes all communities and preserves the environment*" (Department of Transport, 2011).

The NATMAP 2050 document was developed from 2007 and finalised in 2010/11. The NATMAP 2050 Cabinet Synopsis was submitted to Cabinet in 2013 after a lengthy consultation process. Cabinet approved that the NATMAP 2050 Cabinet Synopsis be updated in consultation with the Presidential Infrastructure Coordinating Commission (PICC) to address key concerns that were highlighted and ensure its alignment and integration with relevant strategies and policies, data and planning developments that have occurred since 2007 (Department of Transport, 2011). This is supported by the general awareness that public transport has a substantial part to play in enhancing urban mobility, reducing road congestion, decreasing the impact on the environment through harmful emissions and better serving the economy (Walters, 2008).

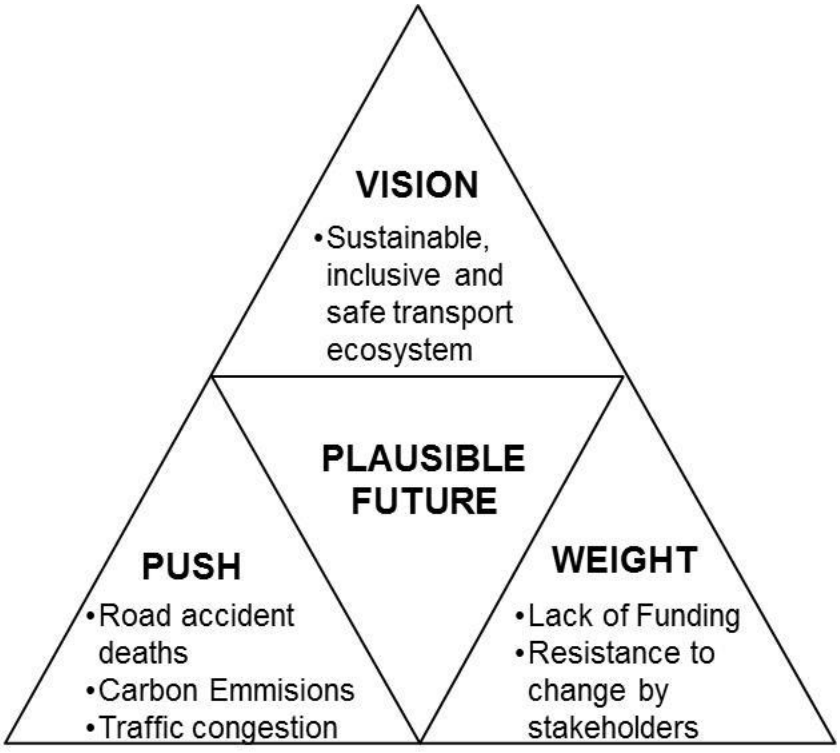

Figure 4:1: The Future's triangle (Source: Adapted from Inayatullah, 2008)

In conjunction with the futures triangle, an in-depth environmental scan of the South African transport industry is performed to detect the forces of the present, exposing

some of the critical quantitative drivers and trends that exist and will influence the future of the industry. The environmental scan will assist the South African transport industry to form a strategic standpoint from which it can deal with external forces over which it has little or no influence (Albright, 2004). Environmental scanning (ES) was defined by Choo (2003) as “the acquisition and use of information about events, trends and relationships in an organisation’s external environment, the knowledge of which would assist with planning the organisation’s future course of action” (Choo, 1999). This was further supported by Albright (2004) describing it as the “internal communication of external information about issues that may influence an organisation’s decision-making process” (Albright, 2004).

In selecting our future, it is critical to understand the possibilities of the future as these driving forces and trends provide an excellent way to commence this task, enabling improved decision-making about what should be done (Cornish, 2004). As such, mapping does not seek to define or predict one single future, but rather to describe several plausible futures.

The unique changes that have been taking place in human life and the speed of these changes reveal that something astonishing is happening in the world (Cornish, 2004). The environment, in terms of technology, economy and social institutions is going through enormous changes. It is easy to sense the interconnectedness of all these changes and with so much interlinking, to appreciate that the environment is dealing with a super all-inclusive transformation. Cornish (2004) referred to this phenomenon as the ‘Great Transformation’. The far-reaching effects of interconnected global trends and the collisions among them that reshape and disrupt the economic and commercial landscape have been witnessed in the past. Global trends are the great forces in societal development that will very likely influence the future in all areas for many years to come (Larsen, 2006). These trends represent knowledge about the probable future. The forces that define the present and future world and the interactions between them are as important as each individual global trend.

Based on the pushes and weights in the futures triangle above, it is important to highlight and expand on some of these trends, to assist in uncovering and mitigating

the weights, issues and uncertainties that distinctively shape the transport landscape of the future.

4.2.1 Road accident deaths

Reports by the South African Road Traffic Management Corporation anticipated that road crashes could be the fifth leading cause of fatalities worldwide by 2030 (Road Traffic Management Corporation, 2016). These projected high levels of road crashes and deaths have intensified the Corporation's implementation of road safety programmes in collaboration with the private sector. The intention is to partner with the Department of Transport (DoT), road entities, provinces, municipalities, government departments and all interested groups to reduce road fatalities and injuries. The UN's Decade of Action for Road Safety 2011-2020, launched on the 11th of May 2011, provides an action plan, for reducing road traffic fatalities by 50% from the 2010 baseline. The Global Plan for the Decade of Action for Road Safety 2011-2020 provides guidelines for reducing road fatalities (Road Traffic Management Corporation, 2016).

The National Road Safety Strategy (NRSS) 2016 – 2030, engaged in numerous consultations with different stakeholders to ensure that this strategy represents a holistic view which addresses key road safety challenges at different levels. The efforts previously made towards addressing the challenges of road safety in South Africa were also considered and reviewed. The outcomes of these strategies included lack of adequate resources, lack of stakeholder participation and misaligned prioritisation. As such, the focus of the NRSS is to ensure that the proposed interventions are structured in a manner that is realistic and implementable. In addition, the NRSS acknowledges that a number of key institutions were established through previous efforts and that the present task is the effective utilisation of these institutions through the enhancement of coordination and accountability in addressing road safety issues (Road Traffic Management Corporation, 2016).

4.2.2 **Carbon Emissions**

Kay (2004) states that a shift in public priorities may seem far-fetched today because the decisions makers of 2030 and beyond are currently in school, university, or yet to be born. Their values will most likely differ from the widespread values of society today. It may be that vehicle fuel cells offer the best hope for the future of the private car, as they offer the promise of zero emission vehicles. Alternatively, the technology could already exist and is proven, with the only remaining barrier being the cost, which will surely come down with time and innovation (Kay, 2004).

The vision contained in the National Development Plan document is that by 2030, the transition of South Africa towards becoming an environmentally sustainable, climate change resilient and low carbon economy will be well underway (NPC, 2012). The current Medium Term Strategic Framework (2014 – 2019) (MTSF) focuses on the creation of a framework for implementing the transition to an environmentally sustainable low carbon economy. This phase will include minimising regulatory constraints, data collection and establishment of baseline information and indicators testing some of the concepts and ideas to determine if this can be scaled up (MTSF, 2014)

The DoT also aims to implement the Green Transport Strategy to reduce Greenhouse Gas (GHG) emissions from the transport industry. Also, contained within the Strategic goals of the DoT is the plan to increase the contribution of transport towards environmental protection by implementing policies that aim to mitigate climate change and adaptation responses through reduction of GHG emission. Upon reaching a consensus with the stakeholders in favour of reducing greenhouse gases, various mitigation methods will be implemented, for example, through reduced private vehicle ownership, or the introduction of emissions reducing technology, amongst others (DoT, 2016).

4.2.3 Traffic congestion

The number of cars in cities is increasing rapidly, resulting in increased traffic congestion, less mobility, poor air quality and more road accidents. In most cities, the economic dimensions of such challenges tend to receive most attention. The traffic gridlocks experienced on city roads and highways have been the basis for the development of most urban transportation strategies and policies. The solution prescribed in most of these had been to build more infrastructures for cars, with a limited number of cities improving public transport systems in a sustainable manner (UN-Habitat, 2014).

According to Stats SA (2013), 32.6% of households indicated that travel time was the primary determinant of their transport choice; this was followed by travel cost (26.1%) and flexibility (9.2%) (Stats SA, 2013). The current layout of wide living areas, combined with the lack of a public transport network, encourage the use of private transport as the most reliable means to get from place to place. If transport congestion is primarily seen as a case of reducing traffic jams during peak hours, and the main purpose of public transport is seen as taking people to work, then no effective traffic solutions can be developed without reference to work and the likely future of work (Kay, 2004).

The UN-Habitat (2014) reports that increased sustainability of urban passenger transport systems can be achieved through modal shifts. This refers to increasing the modal share of public transport and non-motorized transport modes like walking and cycling, while also reducing private motorized transport. However, in most countries there is a considerable stigma against public transport. The private car is often seen as the most desirable travel option. There is thus a need to enhance the acceptability of public transport systems; more needs to be done to increase reliability and efficiency of public transport services and to make these services more secure and safe (UN-Habitat, 2014).

In South Africa, according to the 2013 survey, motor cars and trucks are the most important mode of transport used by workers in metropolitan areas and in smaller

urban areas, followed by minibus taxis. Despite being the only subsidised modes of travel, buses and trains are used by only 15.5% commuters in metropolitan areas. People in rural areas are much more likely to walk or cycle to work than to travel by car, bus or train (Stats SA, 2013). The State of the Cities Report 2016 argues that 'Providing reliable and affordable public transport would be a game changer for South Africa's spatially dispersed cities, with their extensive road networks and orientation towards private car usage' (SACN, 2016). With some 70% of South Africans living permanently in urban areas towards 2035, the shift to an almost three-quarters urban-based population will have an impact on politics, food security, and service delivery-especially transport (PCAS, 2008).

4.3 Anticipating the future: Emerging issues analysis

In anticipating the future, information gathered during the mapping phase is interpreted through an analysis of emerging issues and drivers to identify regions where social innovation begins (Inayatullah, 2008). The process seeks to identify issues before they become unwieldy and unmanageable, and to identify new opportunities and possibilities. As described by Horton (1999), the anticipation pillar forms part of the interpretation phase, which he considered a key step that is at the heart of the foresight process. As previously mentioned in the second chapter, the essence of the process, according to Horton (1999), is to respond to a few critical questions, essential to the creation of foresight. These include: What does this all mean for the South African transport industry? What are the issues that challenge the realisation of the future of the South African transport industry? What can be done about it today? (Horton, 1999)

The following questions can be put forward:

- Commercialisation of drones?
- Improvement of technology, leading to a reduction in travelling?
- Rising cost of fuel?
- Increase in the sharing economy?

The Policy Co-ordination and Advisory Services conducted a study in an attempt to understand a wide range of forces at work in the world and in South Africa in 2008. This involved 65 interviews with well-placed South Africans, as well as a series of working sessions with a core group of about 40 people drawn from academia, business, unions, political parties, and think tanks. As a result, 24 variables were identified as key shapers of the South African reality and which need to be understood in order to construct views of the future (PCAS, 2008).

The following are some of the relevant key drivers and critical uncertainties that were identified:

- Economic Growth – This explores the likelihood that the economy of the world would remain healthy or worsen, and whether the cooperation within African countries will continue or deteriorate. It also looks at whether South Africa would make the transition to a more knowledge-based economy and sustain elevated real growth through the exploitation of the country's resources.

  How would South Africa deal with the country's shortage of skills, the unstable exchange rate, complex tariffs pertaining to trade, the limitations affecting entry of new investment, and structural capacity restrictions? Will the existing investors gain more confidence in the country's economy and invest further? How will South Africa's road and rail infrastructure and the elevated communication costs affect growth rates?

- Urbanisation - With some 70% of South Africans living permanently in urban areas towards 2035, how will the transmission towards an urban-based population impact on the various functions, including transport and the delivery of basic services?

- Infrastructure – Will South Africa's infrastructure be able to keep up with the increasing urbanisation and economic growth of the country?

- Health – Will South Africa be able to support its citizens in terms of provision of quality health care, considering the projected increase in mortality?

- Energy Prices – How will the rapid depletion in oil reserves affect prices?
- Climate Change – In what way would the economic growth rates or lack thereof, affect South Africa? How will the country deal with the deterioration of soil quality and capacity, droughts, and the effect of global warming on the amount of arable land in South Africa?

- Technology - What does South Africa need to do to create a nation of pioneers, innovators, and remain competitive? Will the country's technology when it comes to communications develop beyond the monopolisation of the telecommunications suppliers and the elevated prices that currently prevent the majority of South Africans from going online?

- Migration and Demographics - What will the coming African 'youth bulge' mean for South Africa? How will the xenophobic attacks impact on long-term migration patterns? How will migrants from the rest of Africa affect South Africa's population growth? How will South Africa attract and retain skills in a world where the average age of the population is much older than any time in history (PCAS, 2008)?

4.4 Timing the future

The third pillar involves searching for the grand patterns of history and identifying each one of the models of change. The timing of the future comprises issues like the effect people's actions may have on the future and the possibility of mitigating or planning around those actions.

Inayatullah (2008) refers to a few foundational ideas(detailed in chapter 2) which are involved in timing the future. One of these is that there are key periods in human history when the actions of a few can result in spectacular transformation. Established ways

and methods of behaviour are no longer effective during these periods. The South African transport industry is most likely in this phase at present.

4.5 Deepening the future

Inayatullah (2004) defines CLA as a theory of knowledge, seeking to integrate empirical, interpretive, critical, and action learning modes of knowing. Furthermore, it is a methodology that does not predict the future but creates transformative spaces to further create more effective policies and strategies (Inayatullah, 2004).

Inayatullah (2008) considers it to be the pivotal multi-dimensional method to unpack the future during this critical phase; a method that seeks to deepen the future and create transformative spaces for the construction of alternative futures (Inayatullah, 2008). CLA adopts four levels of analysis (Inayatullah, 2015, p. 12):

- The *litany*, representing the data and the commonly accepted headlines of the way things should be.

- The *systemic view* concerned with social causes, including economic and political causes of the issue.

- The third, deeper level, relates to culture and its supporting *worldview*.

- The level of *metaphor* represents the narrative and are often the vehicles of myths.

The following table reflects the application of CLA in the identified issues faced by the South African transport industry:

CLA level	Issue
Litany	• Uncertainty about the stability in the South African transport industry, with the departure of large corporations like General Motors. • Uncertainty in the public transport system with entry of companies like Uber, Taxify, and their impact towards the functioning of minibus taxis, amongst other modes of transport.
Systemic causes	• The ripple effect in loss of employment and income when large transport corporations pull out of the country. • The unsupportive regulations are detrimental to transport industry growth.
Worldview	• A large portion of the South African transport industry remains informal and is yet considered to be critical towards the country's economy.
Myth/ Metaphor	• Vehicles are seen as a status symbol and measure of achievement.

Table 4.1: CLA Applied

The emerging map from the CLA exercise (as shown in Table 4.1) reflects a view of some of the issues faced by South Africa's transport industry; these also contribute towards the impediment of South Africa's national progress and sustainable development.

At the *litany level***,** is the view of transport as it is seen now. The main issue put forth is the uncertainty within the industry. This level represents quantitative trends and problems, which require minimal diagnostic abilities. There are a variety of causes including the economic, political and social background of the country that have contributed to the certain level of complacency of the transport industry towards sustainable development and progress. This is supported by the fact that companies like General Motors (GM) are pulling out of the country. Woosey (2017) reported that

the company determined that continued and increased investment in South Africa would not provide the company with the desired returns in comparison to other investment opportunities around the globe. According to GM CEO Mary Barra, GM is focused on deploying capital to higher return initiatives that put them in the leadership position in their core business and future mobility (Woosey, 2017). This confirms that global companies do not have confidence or see investment potential in South Africa. On the other hand, however, minibus taxis remain marginally unsubsidised by the government although the industry transports around 70% of commuters, when comparing with the 10% in trains and 20% in buses (Walters, 2014).

This is one of the main issues with public transport provision, with financial compensation for minibus taxis being a highly-contested discussion with the DoT. This includes the unsafe habits of taxi drivers, triggered by the competitive need to get more customers, being a contributing factor that may be affected by subsidies. In addition, the diverse disciplines which are involved in the design, planning, implementation, operation and maintenance of public transport systems working in silos rather than working in an integrated manner. A great threat applies to the objective of integrated public transport systems if the relevant industries are not in communication with each other (Mthimkulu, 2017).

One of the major issues therefore, remains the integration of the various modes of transport via integrated plans in order to render seamless public transport services across all transport areas. This will require significant public participation with all the affected stakeholders in an effort to convince such parties of the benefit of a systems approach. Possible solutions that can be proposed at this level are as follows:

- South Africa must increase internal investment and intensify research about transport technological efficiency and innovative solutions.

- Improve sustainable economic development by increased investment in local communities through development of local brands and infrastructure in transport, for example, government and private partnerships in the development of a local brand of vehicle. This ensures that South Africans feel

a sence of ownership and inclusion in the progress of the country and confidence is restored.

- Formalisation and intergration of the transport industry so as to enable it to be more receptive of competition and globalisation.

At the *systemic level* the challenge is the uncertain transport regulatory environment, loss of employment and market share coinciding with entry of globalisation. Walter (2008) reports that law enforcement, in both road traffic and road transport, is often a challenge in emerging economies, often giving rise to unlawful operations and poor driving habits (Walters, 2008). Although South Africa is attempting to address these issues with programmes like the Administrative Adjudication of Road Offences (AARTO) demerit system, there is uncertainty that this may have detrimental effects towards the overall economy of the country as it may result in a further increase in the country's unemployment rate.

The systemic view is concerned with social causes, including economic, legal, political and historical factors. The solutions proposed at this level are:

- Invest in re-skilling the existing workforce to enable employment in other industries and methods to accommodate the imminent automation in the industry.

- Challenge and address resource governance structures to focus on the realisation of long-term national benefits from the South African transport industry. Create a stable and positive transport regulatory environment to support the growth of the industry and globalisation.

At the *worldview and myth levels* the issue is considered to be a misperception that protecting the transport industry as South Africa's main economic engine is in the country's long-term national interest, alongside the theory that development and progress are achieved through meeting short-term interests. This is because taxis are used by a significant percentage of workers: 26,5%, those using buses being 7,6%,

while those using private transport being 30,8% (Stats SA, 2013). This means 65% of South Africa's workforce is dependent on this industry to keep the economy running. This third level, relates to structure and its supporting *worldview***,** while the level of *metaphor*, represents the deep stories, the unconscious and often emotional dimensions of the dilemma or problem.

Solutions proposed at these levels include:

- Respond to a more inclusive, rational viewpoint of national progress and sustainable development by the formulation of a long-term industry strategy for South Africa.

- Develop new measures, in support of South Africa's National Development Plan, to define the transport industry's progress, reflecting the importance of sustainable development and long-term contributions to South Africa's progress.

4.6 Creating alternatives

Inayatullah (2015) defines the mapping of scenarios as the most important method in this pillar, quoting it as the "tool par excellence of futures studies" (Inayatullah, 2015). According to Inayatullah (2008), the future of the South African transport industry is extended during this phase of creating alternatives achievable with the construction of scenarios. This is to further outline what can be done within the industry to further enhance human progress. Inayatullah describes scenario planning as a most valuable method of revealing the present, establishing the extent of uncertainty and presenting alternatives (Inayatullah, 2008). The objective of this important phase of creating alternatives is to apply the scenario method by studying the plausible scenarios to confront the key uncertainties on the CLA outcomes, faced by South Africa's transport industry in support of its contribution to national progress towards 2035. This is to enable the persuasion of the South African transport industry to adjust its current course and policies to stay clear of undesirable futures and instead realise the ideal future.

To analyse the driving forces, critical uncertainties are used to frame the future landscape (Inayatullah & Milojevic, 2015). From the futures triangle and emerging issues analysis, a range of scenarios can be derived to present the desired future (Inayatullah, 2015, p. 15). As outlined in chapter 2, the double variable method can be employed by selecting two key variables or drivers. This method is excellent for strategy development, although it is important to debate these key variables (Inayatullah, 2015, p. 16).

Dator (2009) outlines four scenario archetypes (Dator J. , 2009); these are articulated through this method as follows:

- *Continued Growth*: is where current conditions are enhanced. This is where more roads are constructed, there is a growing population, an increase in innovative technology and more products are developed. This is the official view of most countries where the economy is growing in all respects.

- *Collapse*: emerges as the "continued growth" fails, where the contradictions are too drastic: between the economy and nature, technology and culture, etc. It should be emphasized here that the "collapse" future is not and should not be depicted as the "worst case scenario".

- *Discipline*: is where the future seeks to arrest growth and strike a balance between the economy and nature. This usually arises when continued economic growth is considered to be either undesirable or unsustainable.

- *Transformation*: this is a future that seeks to change the basic assumptions of the other three. It focuses on the powerfully transforming power of technology – particularly robotics and artificial intelligence, genetic engineering, nanotechnology, teleportation, space settlement, and the emergence of a "dream society" as the successor to the "information society". It anticipates and welcomes the transformation of all life, including humanity from its present form into a new "post human" form, on an entirely artificial Earth, as part of the

extension of intelligent life from Earth into the solar system and eventually beyond.

However, this method does not cater for what is not known – what Inayatullah refers to as an "outlier scenario" (Inayatullah, 2015, p. 16). For the transport industry of South Africa, this can be demonstrated as displayed in figure 4.2 below, where two variables have been derived from the emerging issues analysis above. The two variables yield the four scenarios mapped in the axes below.

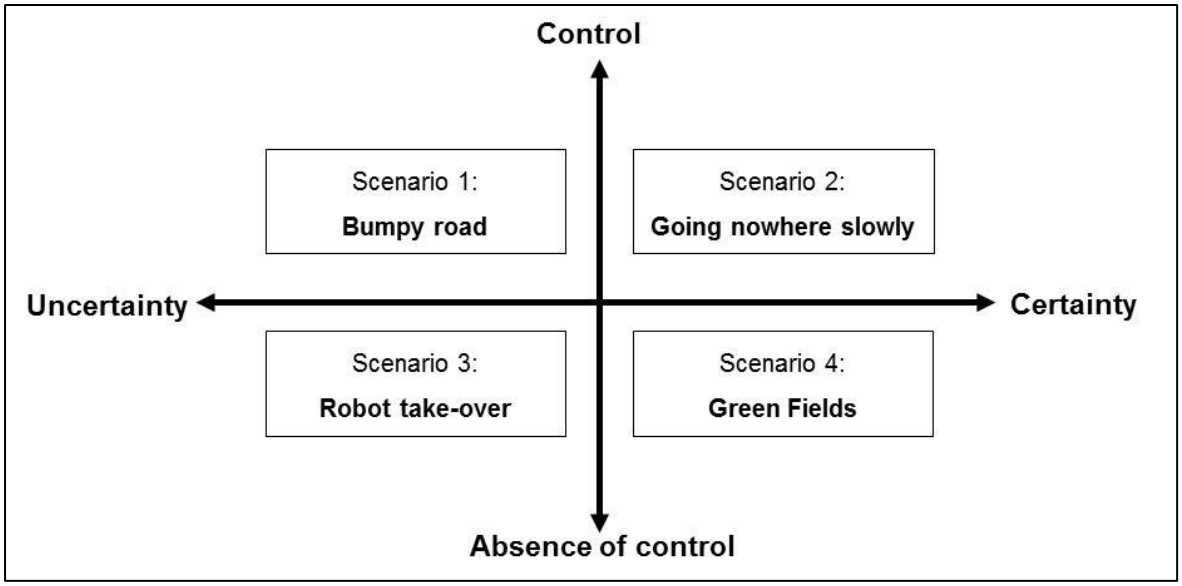

Figure 4:2 : Adapted from the 2 x2 Scenario Matrix (Source: Researcher's own construction)

Below is a brief description of the above scenarios for South Africa's transport industry towards 2035.

- *Bumpy Road*: This scenario depicts a future where South Africa insists on retaining the status quo and not change with the progression of times, trends and the arising innovations. This is where the country does not invent, or consider the environmental and economic impact of the current state of the industry.

- *Going nowhere slowly*: In this scenario, alternative modes of communication are used, such as telepresence technologies to hold meetings and 3D printing

for manufacturing etc. This results in a drastic reduction in travelling due to people spending more time communicating via screens.

- *Green fields*: This scenario sees the focus of the country being on attempting to alleviate and reverse the man-made effects of global warming, this being done through an increased use of renewable energy and more natural gases for fuel. This would result in the pollution of air from transportation being a thing of the past.

- *Robot take-over:* This scenario is where everything becomes automated. The internet of things is fully implemented with little or no interference of humans. This is where unmanned aircrafts, trains and vehicles are the accepted norm.

As previously stated in chapter three, the progress of society depends much on the enhancement of people's wellbeing and sustainability of society as a whole. Therefore, the choice for improvement should indeed be anchored in frameworks that seek to promote this progress (Hall, Giovannini, Morrone, & Ranuzzi, 2010). The four scenarios for South Africa's transport futures towards 2035 can also be presented into the following four dimensions, as represented in Schwartz's scenario model (Inayatullah, 2015, p. 18):

Scenarios	**Preferred**	**Disowned**	**Intergrated**	**Outlier**
Litany	• Green, ecological and inclusive transport	• Pollution rife, expensive and unsafe transport	• Intergrated and accessible transport	• Highly technological transport
System	• Intergrated transport ecosystem • Car-less cities	• Drivers, Roads, Vehicles, Regulations	• Automated transport • Self driving vehicles	• Teleportation
Worldview	• Interdependent	• Seperation and silos	• Integration	• Survival

Scenarios	Preferred	Disowned	Intergrated	Outlier
Metaphor	• "The way"	• "Separate Ways"	• "Our way"	• "No way"

Table 4.2 : Schwartz's scenario model applied – "South Africa's possible futures towards 2035"

According to Glenn (2009), it is not wise attempting to find the preferable or the most likely outcome of the future, as depicted in table 4.2 above. This can be mistaken as predicting the future, therefore pulling the contributors away from the scenario analysis (Glenn, 2009). It would therefore be advisable to make use of the preceding 2 x 2 scenario matrix when exploring the South African scenarios of transport.

4.7 Transforming the future

Although there are major transport initiatives being introduced to improve both public and private transportation in the country, it is also evident that this process will take an extended period to be concluded as each mode is being dealt with from a "silo" approach (Walters, 2008). In 2016, the 21st yearly session of the Conference of the Parties (COP21) in Paris picked up momentum, where governments around the world, including South Africa, made known their intensions to decarbonise their economies through the Montreal Protocol. An agreement was reached to ban hydrofluorocarbon (HFCs) and other refrigerants that cause global warming. This was done through an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion known as the Montreal Protocol. Since transportation accounts for around 25% of energy-related global greenhouse emissions, it is critical for the mobility sector to play a big role in order for Governments to achieve their decarbonisation commitments (WEF, 2017).

For the change to decarbonisation to become a reality in the transport industry, systemic leadership is essential to synchronize and support the inputs of both private and public-sector stakeholders, to cooperatively define clear targets and an actionable

roadmap for decarbonisation within the transport industry, and align governments with whatever is required to attain the set targets (WEF, 2017).

South Africa's approach towards this curbing of emissions seeks to strike a balance with the country's economic growth, poverty alleviation and job creation. It is through implementation of various strategies, policies and planning instruments that the South African government can ensure that the Paris climate change negotiations produce a multilateral legal agreement that is ambitious, fair, effective and balances development priorities with the need and urgency to address the global challenge of climate change towards 2035 (DoEA, 2011).

CLA can also be applied to enhance the richness of the discussion, as demonstrated in Table 4.2.This allows for the transformation of strategy from the current reality, to a reality considered from other perspectives, and then to the intergrative view (Inayatullah, 2015, p. 40). This, therefore creates a transformative and longer lasting change – knowledge that serves.

CLA level	**Current**	**Transformed**
Litany	• Accident deaths • Carbon Emissions • Traffic Congestion	• An integrated, safe and sustainable transport system
Systemic	• Drunken driving, corruption, Lack of strategic city planning and design	• Automation • Use of solar energy in the industry
Worldview	• Convenience • Time-saving/Speed • Economic progress	• Greener, inclusive, progressive
Metaphor	• "Get there quick"	• "Means to an end"

Table *4.3* : CLA Applied – Integrated, Safe, Accessible transport

4.8 Conclusion

This chapter focused on how the transport industry will have to make a shift from the silo approach and transform into an integrated and innovative industry in order to minimise the challenges it faces and position itself to take advantage of the arising opportunities leading up to 2035. The industry should be constantly aware of technological advancements and ensure that stakeholder participation takes place so as to avoid resistance and ensure effective collaboration in seeking the creation of shared value across the industry spectrum. This collaboration will then result in productive, beneficial relationships between stakeholders in transforming the industry towards a sustainable future.

The transport industry has many obstacles to overcome to transform itself into a sustainable and progressive industry; it has an extensive list of issues that need to be addressed through collaboration, innovation and inspiration. It is the objective of this research report to illustrate that, depending on the actions of mainly the industry stakeholders, many things are indeed achievable and possible to produce a preferred future for all stakeholders of the South African transport industry.

Chapter 5

5. RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The preceding chapter aimed to analyse the possible futures of transport towards 2035 in South Africa. The futures triangle was used to map the future by isolating South Africa's vision of transport, the pushes towards this vision and the weights or restrictions from attaining this vision. Thereafter, an emerging issues analysis was done to anticipate the factors that could influence or affect this vision from coming to pass. Effort was also made to suggest workable solutions to address the various research questions raised and to ultimately address research objectives. The future is then narrowed down to the transformed with the focus on revealing win-win solutions for the South African transport industry without concession.

This chapter aims to reflect and provide a vision for the South African transport industry in 2035, while also providing recommendations and conclusions to the questions raised by this research. Key uncertainties, outcomes of the CLA and scenario analysis will be analysed further in order to raise questions that could possibly contribute towards policy discussions regarding the future of transport in South Africa towards 2035. This chapter will also incorporate the role of innovation in promoting technological developments and advancements that can enhance a nation's economic climate and human progress.

5.2 Reflections

It is evident that there is great dissatisfaction with the current model of transport as the level of accidents continue to rise, the containment on carbon emission levels are illusive and transport congestion is becoming impossible to handle. The number of cars in cities is increasing rapidly, resulting in increased traffic congestion, less mobility, poor air quality and more road accidents. In the National Development Plan,

one of the challenges identified is that despite a slowdown in the growth within urban areas, 14 million people are projected to move to South African cities between 2010 and 2050 (UN-Habitat, 2014).This will exert pressure on service delivery by municipalities – including transport and transport infrastructure. A large proportion of these new urban residents will be poor, further enhancing the pressure. Transportation networks or systems are therefore key to the spatial transformation of South Africa's urban areas.

Although there has been significant progress in some cities in delivering new public transport infrastructure, the major shift from supporting private cars to incentivising public transport is yet to happen. The NDP vision for urban South Africa is that by 2030, South Africa should observe meaningful and measurable progress in reviving rural areas and in creating more functionally integrated, balanced and vibrant urban settlements. For this to happen, it is said that the country must clarify and relentlessly pursue a national vision for spatial development, sharpen the instruments for achieving this vision and build the required capabilities in the state and among citizens (The Presidency of South Africa, 2011).

The outcomes of this analysis of future studies theory and practice supported the argument presented at the beginning of this research that there is robust requirement for a fundamental shift in the ways and methods of planning the future of South Africa's transport industry towards 2035.

5.3 Strategic issues for South Africa

The development and execution of strategy is reportedly the engine for ensuring value creation and sustainability in any industry (Hough, Thompson Jr., Strickland III, & Gamble, 2011). This is further supported by Nutt & Backoff (1997), who state that for a vision to inspire diverse possibilities, it must be attractive, actionable and be representative of all relevant stakeholders (Nutt & Backoff, 1997). Morley, Morris, Semaan and Hancox (2017) further confirm this by stating three characteristics of a good strategy. These include:

- An all-inclusive view that incorporates all the risk factors
- A good approach to the analysis and management of data
- Strong partnerships with stakeholders to ensure a common goal, a clear plan and responsibility (Morley, Morris, Semaan, & Hancox, 2017)

This study has therefore attempted to analyse the transport industry at a macro level, through the review of literature and application of various futures tools and methods. This is done in order to develop strategies for the betterment and progress of humanity through transport.

The outcome provides an opportunity to make submissions on possible guidelines that can be applied by the industry and various stakeholders. From this premise, the following strategic issues for the South African transport industry can be highlighted:

- How to keep transport related injuries and fatalities to a minimum
- How to ensure minimal environmental impact resulting from transport
- How to maximise spatial development to reduce the strain on urban transport infrastructure
- How to promote innovation and education in the transport industry

5.4 Recommendations and practical guidelines for South Africa

The following are practical guidelines for South Africa's transport industry; these are derived from the drivers for change, the CLA outcomes and the scenarios in the preceding chapter.

5.4.1 To reduce road accidents

Morley et al. (2017) propose the following model to ensure the executing of a safer road strategy.

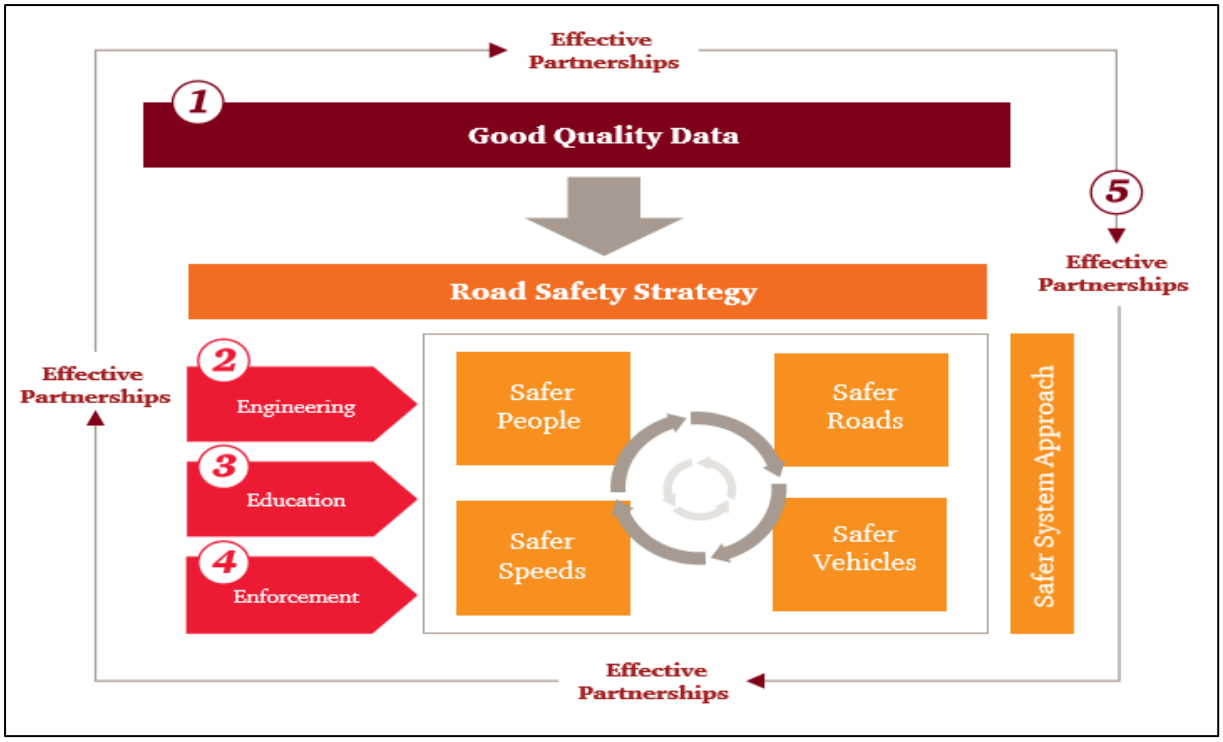

Figure 5:1: Safer Road Strategy Matrix (Source: Morley et.al (2017))

This matrix in figure 5.1 refers to what the conventional road has been known as, thus far. With the advancement in technology and possibilities of highways in the sky, the road of the future may be completely different from what is currently known. However, the principle remains that towards 2035, in order to reduce accidents, the following are required:

- Reliable data in terms of population growth, mortality rates and urbanisation
- Creative Engineering that is environmentally adaptable
- Quality Education pertaining to transport
- Strict enforcement of transport laws
- Effective partnerships amongst all stakeholders

In addition to this, automating the driving process to ensure minimal risk of accidents is pertinent. The technology available and emerging innovations allow for this to take place, as determined in chapter 3. This will also enable commuters to use their time spent commuting in a constructive manner.

5.4.2 Reducing the impact of transport on the environment

It has been reported that in order to reduce the environmental impact of transport, there should be strategies that are implemented in relation to both cleaner vehicles and how general mobility is managed. These management strategies would then ensure that energy conservation and emission reduction targets are achieved (Litman, 2017). Further to this, the following strategies can be employed:

- Subsidising the manufacturing of vehicles that make use of alternative fuels and impose heavy tax levies on those that manufacture vehicles running on fossil fuels.
- Putting a timeframe on the use of alternative fuel instead of fossil fuels, to minimise carbon emissions.
- Reduction of private vehicle ownership and investment on sustainable public transport infrastructure
- Investment in proper and sustainable public transport infrastructure that services all the major centres of the country
- Partnership with the vehicle manufacturing industry to improve fuel efficiency of vehicles

5.4.3 Reducing the strain on urban transport infrastructure

- In order to reduce the strain on transport infrastructure, policy makers should acknowledge the diverse modes of transport and cater for each of them. This is especially applicable to those that improve the country's objectives and have a positive contribution to the economy and human progress, for example, cyclists, pedestrians and public transport.

- An acknowledgement that spatial planning and transport infrastructure development should work hand in hand when it comes to city planning and the building of integrated and inclusive cities.

5.4.4 Promoting innovation and education in transport

- Stakeholder engagement would play a critical role in promoting innovation and education in the transport industry. This is the space where solutions are developed. Encountered challenges will be innovatively addressed and mistakes in what investments are made are kept to a minimum.

The rate of fragmented change has increased considerably during the last few years. The South African transport industry is feeling under threat by a horde of disruptive forces and appears to be facing an uncertain future. It is becoming progressively hard to anticipate the future landscape and external conditions with any assurance as existing business models and established practices become obsolete in this constantly-changing environment. With taxis competing with technology companies, is has become increasingly important and urgent for legislation to adapt more rapidly. The existing format of the NDP and RTMC still refers to roads, cars, ships, trains, and so on when discussing and planning for transport.

The research study has revealed that distinguishing between these modes of transportation is no longer relevant and will soon become obsolete, as demonstrated by the literature in chapter 3. Moreover, the NDP as it stands now is not a detailed plan at all and therefore is not measurable in terms of timeframes. For progress to truly take place, it should be divided into deliverables that can be kept track of and measured.

On the road leading to 2035, subsidies for low-income commuters will increase the affordability of public transport. However, it is to be acknowledged that although public transport is expanding, urban populations will continue to make use of and prefer private transport. Therefore, authorities are obligated to incorporate this in their planning and invest in the construction and maintenance of infrastructure and technology, as recommended in chapter 3. With the increasing demand of public transport, trains can deliver the lowest-cost transport service in metropolitan areas, all things remaining equal. Old rolling stock, which is often unreliable and uncomfortable, must be replaced with modern technology to improve service levels to cater for South Africans (NPC, 2012).

In order to contribute meaningfully to the attainment of human and societal progress in South Africa, both the government and the private sector should play an active role in the growth of the transport industry. This includes letting all stakeholders into the conversation to benefit from the integration and consolidation of resources for sustainable development, instead of working in silos. This includes benchmarking with other countries, like Brazil and the Embraer Case study, which saw the country transform its aerospace industry through internationalisation (Cervo, 2010). It is important for South Africa to form strong partnerships with countries like Germany, Japan and China in order to leverage on the research and transportation innovations taking place in other countries around the world in order to advance the status quo. That way, the pace with which advancement is taking place would be much faster.

This research also revealed what South Africans view as “progress” and how this progress should be measured. It was established that progress in South Africa should be appraised in terms of the social, economic and environmental gains for its people. It was further revealed that transport is a “means to an end”, and should therefore exist to serve the people of South Africa in order to get people to work or school safely, timeously, in a convenient and affordable manner. All the while, doing as little damage to the environment as possible. The results of the analysis of future studies theory confirm that a strong need exists to overhaul the ways of planning for the future of the South African transport industry towards 2035. Exploring and accepting uncertainty will enable the transport industry to see familiar themes when moving towards the future, and therefore be able to develop new insights. Through the application of futures studies, wisdom in this sphere, will then be created.

5.5 Addressing the problem statement, research questions and research objectives

This treatise aimed to provide insight and knowledge affecting the South African industry in the years leading up to 2035. The research focused on Inayatullah’s six pillars of futures studies, with the focus on scenario planning and integrating the application of CLA as futures method to deepen the future and enable the viewing of issues from different perspectives in creating transformative spaces. By applying scenario planning and CLA as tools, both a horizontally and vertically extended view

of the industry's highly-uncertain world was taken through stories about the future, assisting the industry's stakeholders in recognising and adapting to the dynamically-changing environment. Scenarios were used to highlight different, possible pathways in the future, embracing today's choices and actions with perceptiveness of how they might turn out. This allows the industry's stakeholders to see the future in different, plausible ways. The constructed scenarios form the foundation for the vision of an Integrated Transport system for South Africa towards 2035, ultimately providing the instrument for a preferred future for the industry. It can therefore be said that the primary objectives of the research study were achieved.

5.6 Contribution of the research

The research study contributed by exploring a diverse body of literature resources to review while considering the future of the South African transport industry. Thereafter, the six pillars framework of futures studies was followed, while incorporating the futures triangle and the emerging issues analysis tools. The CLA method was also used to deepen the future, which resulted in producing scenarios relevant to the future of the South African transport industry and the identification of the preferred future. The scenarios constructed would enable the transport industry stakeholders to integrate diverse interpretations and insights into several interpretations of the possible roads that the future may take. The scenario exercise supported the creation and formulation of the preferred future for the South African transport industry leading up to 2035, providing the basis for the industry to take advantage of the opportunities offered by technological advancements to attain sustainable, broad-based progress.

5.7 Strengths and weaknesses of the research

An environmental scan and literature review to explore the transport industry and its possible direction was performed to detect the forces of the present and uncover the existing quantitative drivers and trends that will impact on the future of the industry. The literature review, although detailed, did not extract the personal opinions and views of a substantial number of industry experts. Consulting industry experts would further enrich the process of gathering information and inputs.

5.8 Future research opportunities

The aim of this research was to increase the confidence of the relevant stakeholders within the South African transport industry by assisting with the generation of a preferred future. Through the creation of more effective strategies, innovative thinking and creating capacity to ensure long-term progress, this can be achieved. It is from this premise therefore that it is recommended that new strategies, policies and new innovations should be developed for further value creation towards the future including:

- Further policy research to refine strategies for realising the proposed vision
- The creation of an innovative think-tank capability for the vision and all associated activities.

These coordinating tasks, comprising the whole range of activities under the implementation plan, are greatly dependent on a strategic management function.

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