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DISSERTATION

**Contributions of a minerals industry cluster to sustainable
development: A case study on human and social capital in
Richards Bay, South Africa**

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Abstract

The South African economy has developed with its strong connection to the minerals extraction and processing industries. Rich endowments of coal and a well-established mining sector in the country enabled the generation and supply of competitively priced electricity to energy and capital intensive processing and chemical industries. Although the minerals industry cluster remains globally competitive at the present time, whether it can be a catalyst for sustainable development, economically, socially and environmentally is in question.

Field work was carried out in Richards Bay to analyse the development contributions of the local aluminium industry cluster in terms of two of the five capitals essential for sustainable development, viz. human and social capital. This town is the host of world class aluminium smelters as well as mineral sands mining and smelting, amongst other energy intensive industries such as paper pulp and phosphate production. The analysis interrogates the importance of skills development and of collective action between various stakeholders centred on the Hillside smelter of South 32, and including interviews with representatives of ten further stakeholders.

Evidence found shows that the minerals industry cluster has contributed to human capital development, and continues to do so, through well-established in-house training and mentorship programmes as well as their corporate social investment into enterprise and supplier development, education and primary health care. However, a more competitive and environmentally responsible industrial cluster would require continuous improvement through institutional and individual capabilities. Research and training institutions and government intervention have important roles to play in this regard.

One of the major challenges is rooted in the lack of social capital development in the past. Although no single accepted definition nor standard for measuring exists, social capital can be defined as the norms and networks that enable people to act collectively. The racially segregated development pattern in the region had left residents with huge disparities and a trust deficit. This mitigated against collective actions within the community except in the few cases of natural

disaster responses and crime prevention. This is evidenced in the free-riding of skilled labourers by some companies in the region and the failure of socio-economic development programmes in the past due to the low level of community buy-in.

The research highlights that the significance of the local minerals industry cluster remains undoubtedly high; however, a facilitative process of social capital development is necessary to promote collective actions. The process requires accountable formal institutions who can mitigate social distrust, create dialogue and a cooperative environment between different interest groups. This is particularly important as the government resource-based industrialisation policy is centralised in developing linkages from extractive sector (downstream, upstream, and side-stream) but little attention has been paid to the aspect of social capital development. It is expected that the study itself contributes to social capital development and works as a communication platform to further promote studies in applying multidisciplinary learning-by-doing process across academia, policymakers, and practitioners.

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Glossary

ABI	Aluminium Beneficiation Initiative
AFSA	Aluminium Federation of South Africa
AMV	African Mining Vision
AU	African Union
B-BBEE	Broad-Based Black Economic Empowerment
BBSEE	Broad-Based Socio-Economic Empowerment
CBOs	Community Based Organizations
COMRO	Chamber of Mines Research Organisation
CPC	Central Processing Plant
CSI	Corporate Social Investment
CSR	Corporate Social Responsibility
DACT	Downstream Aluminium Centre of Technology
DTI	Department of Trade and Industry
EDTEA	Economic Development, Tourism and Environmental Affairs
EIA	Environmental Impact Assessment
EITI	Extractive Industry Transparency Initiative
EM	Ecological Modernization
ESD	Enterprise and Supplier Development
GDP	Gross Domestic Product
GRI	Global Reporting Initiative
HDSA	historically disadvantaged South African
ICMM	International Council on Mining & Metals
ICT	Information and Communication Technology
IDC	Industrial Development Corporation
IDP	Integrated Development Plan
IDZ	Industrial Development Zone
IPAP	Industrial Policy Action Plan
KZN	KwaZulu-Natal
LED	Local Economic Development

MMCP	Making the Most of Commodities Programme
MMSD	Mining Minerals and Sustainable Development
MPRDA	Mineral and Petroleum Resources Development Act
NDP	National Development Plan
NERSA	National Energy Regulator of South Africa
NGOs	Non-Governmental Organizations
NGP	New Growth Path
NPA	Negotiated Price Agreement
OEM	Original Equipment Manufacturer
PPP	Purchasing power parity
QCD	Quality, cost, and delivery
R&D	Research and development
RBCT	Richards Bay Coal Terminal
RBIDZ	Richards Bay Industrial Development Zone
RBM	Richards Bay Minerals
SDGs	Sustainable Development Goals
SEDA	Small Enterprise Development Agency
TIKZN	Trade and Investment KwaZulu-Natal
TNPA	Transnet National Ports Authority
TVET	Technical and Vocational Education and Training
UAE	United Arab Emirates
UCT	University of Cape Town
UNECA	United Nations Economic Commission for Africa
WBCSD	World Business Council for Sustainable Development
ZCBF	Zululand Chamber of Business Foundation
ZCCI	Zululand Chamber of Commerce and Industry
ZRF	Zululand Rural Foundation

1 Introduction

1.1 Background

The South African economy has been developed with strong connections to the energy and capital intensive minerals extraction and processing industries, which had evolved in tight relation to a racial segregation regime known as Apartheid in the history and largely contributed to the unequal development pattern (Walker & Minnitt, 2006). Rich endowments of coal and a well-established mining sector in the country have enabled the generation and supply of competitively priced electricity to the capital intensive minerals processing and chemical industries. However, whilst the extraction of mineral resources has been generating necessary financial capital for the country, coupled to an obvious accumulation of productive capitals such as infrastructure and equipment for manufacturing, it is clear that the extraction of non-replenishable natural capital cannot be sustained indefinitely. A transformation of economic structure to reduce the dependency on resource extraction is thus needed in the long-term.

South Africa has undergone the significant transformation since its democratisation in 1994, however, the high unemployment and low growth rate pose significant threats to its social stability. Rodrik (2006) argues that the disappointing economic performance is attributable to the under-performance of the manufacturing sector since the early 1990s. Therefore, the relative importance of the mining sector still remains as one of the highest in the country, accounting for 8,3% of GDP in 2013; primary mineral exports accounted for R279,5 billion or 30,5% of South Africa's total merchandise exports in 2013 (Chamber of Mines South Africa, 2014; South African Revenue Service, 2015). According to the South African Revenue Service (SARS), the mining sector paid R21,524 million as Company Income Tax (CIT) or 11,53% of the total CIT and R5,422 million as Mineral and Petroleum Resource Royalties in the financial year 2014/15 (South African Revenue Service, 2015).

It is commonly argued that the country still needs the economic growth engine to

alleviate poverty and reduce the high rate of unemployment. Many also argue that domestic production linkages to the sector need to be developed, especially by creating downstream value-add activities, thus extending local minerals value chains. However, others are doubtful whether resource-based industrialisation could fundamentally address economic growth in the midst of commodity price fluctuation and fast global technological change, let alone in a more inclusive manner.

Swilling and Annecke (2012) argue that the minerals sector in South Africa has been developed at the expense of potentially more labour-intensive and/or innovation-driven sectors, and it is now using 'too big to fail' logic and technocratic language to crowd out alternatives. After the democratisation in 1994, the government has been working to alter the historical legacy, especially to foster a great diversification of manufactured exports. However, Black and Hasson (2016) point out that there has been ongoing intensive policy supports in favour of the capital-intensive industries and the situation damages not only employment but also economic growth, and they suggest the importance of industrial policy intervention to promote labour-absorbing industries. The heavy-industry bias also contributes to the carbon emission intensive economy. While there are potentially environmentally cleaner and economically viable technologies available, most of the firms in the industry are 'locked-in' to maintain their existing technologies and production systems to recover the large upfront costs rather than constantly investing into new technologies (Gouldson & Murphy, 1997).

It is often the case for minerals extraction that the importance of geological conditions exceeds other factors for the operation to take place e.g. linkages to other industrial sectors and large labour forces (Humphreys et al., 1995). As a result, it has been widely discussed that the extractive industry is inherently 'enclaved' and it creates limited number of direct jobs and linkages to local economies (Barnett & Bell, 2011; Bourgooin, 2011; Ramdoo, 2013; Ramdoo, 2015) and it is not unique to South Africa.

However, there are some, although it is limited to a few countries, examples of successful economic transformations from resource-based economy and their socio-economic development benefits in the experience of countries like Finland, Sweden, and Japan (Blomstrom & Kokko,

2002; Dahlman et al., 2006; Hayashi, 1990). According to Porter (1990), such successful industrialisation requires industrial clusters formation as a result of collective action taken between globally competitive, highly specialised and capable organisations facilitated by government under shared goals.

In this dissertation, a “cluster” is defined as a series of continuous economic cooperations resulting from high human and social capital development in one area: skilled labours, high level of knowledge and skills, division of labour, trust, ease of transaction, etc. and is central to innovation and competitive advantage. Given the examples of some countries, it is likely that the implementation of industrial policy in a resource rich country like South Africa could mitigate against the ‘resource curse’, by harnessing the comparative advantages and the productivity growth of the extractive sector to the other local economies. However, it remains as a question whether and how minerals industry can contribute to human and social capital development as a precondition of such successful cluster formation and industrialisation.

Therefore, it is proposed that the historical minerals industry cluster formation and its contribution to economic and social development in South Africa, challenged by its historical trust deficit and unequal social systems, needs to be reviewed to extract learnings for future sustainable development. As will be explained later, this dissertation aims to do so by means of one case study.

1.2 Problem Statement

The importance of the minerals industry to economy in South Africa has been largely recognised by various stakeholders. Several commentators have however critiqued the disproportionately high expectation coming from the government of material supply contributions into domestic downstream value-add industries, the so called ‘beneficiation’ policy. A comprehensive examination of this policy by Hausmann et al. (2008) concluded that it can be misleading for the economic development in South Africa, let alone sustainable development, if the policy intervention is not based on the reality of the society and the competitive advantage of the economy. Therefore, the mining industries’ impacts on economic and sustainable development,

especially in terms of social sustainability as a combination of human and social capital development, in the host communities, need more thorough studies. This is significantly important in South Africa, where historical trust deficits and unequal social systems are pervasive and low levels of educational attainment, skills shortages and mismatches have been huge obstacles for industrialisation and job creation.

1.3 Objectives and scope

This study aims to develop a grounded view of the concept of sustainable development and its relevance to minerals resource-based community development by investigating one historical South African minerals industry cluster, focusing on its contribution to human and social capital development. Specifically, the study aims to identify methodology used in precedent sustainable development studies and its applicability to the minerals resource-based community. It is hoped that this could help improve measurement of the contribution of the minerals sector to sustainable development of a community, where there is currently a lack of comprehensive understanding. Furthermore, it is hoped that the data collection contributes to better collective actions between government, industry and society to make plans and implement them in the future.

The data analysis of the case study was conducted with a sustainability framework called the five capitals framework, developed by the Forum for the Future (Uren et al., 2003). The framework was combined with the concept of the three production linkage categories, based on Hirschman's original linkage theory, and applied to the Richards Bay minerals industry in South Africa. The linkages studied were:

- downstream linkages, which consist of industries that use the inputs from the extractive sector into other activities;
- upstream linkages, which relate to industries that supply inputs to the extractive sector;
- and side-stream linkages, which consist of developing activities that may not be directly linked to the extractive sector but might have the potential of unlocking

indirect business and employment opportunities in other sectors of the economy (Ramdoo, 2013).

Financial linkages to the extractive sector such as tax revenues and minerals royalties paid by mining companies, and how to effectively collect and manage resource rent have significant importance in resource-based sustainable development, but it is out of the scope of this study (except some cases of the CSR activities of the company explained later). The framework for the analysis is explained more in detail in [Chapter 3: Research Questions and Methodology](#).

1.4 Outlook and dissertation structure

In [Chapter 2: Literature Review](#), the theory of ‘resource curse’ and some of the arguments to challenge the view are introduced, followed by some of the lessons from the examples of foreign countries, which have succeeded to diversify their economy through resource-based industrialisation. Subsequently, the definition of industrial clusters and sustainable development are explained, which comprise the framework used in this dissertation (see [Chapter 3: Research Questions and Methodology](#)). The collected data from the field research, which comprised of a number of in-depth interviews are presented and analysed in [Chapter 4: Case Study](#). The conclusions are drawn and some recommendations for further studies are made in [Chapter 5](#).

2 Literature Review

This chapter comprises of two sections: the first section explains what factors possibly determine the successful economic development in resource rich countries, whilst the second moves beyond development to sustainable development. In the first section, it is of interest how some countries have used the initial comparative advantage coming from their natural resource endowments and how they diversified through competitive industrial clusters formation, whilst in others, natural resource extraction has undermined economic performance and human development. The second section further expands the scope and integrate the industrial cluster formation into the concept of sustainable development. Human and social capital are focused on specifically not only as key factors for industrial cluster formation but also for sustainable development.

2.1 Resource-based industrialisation

2.1.1 Natural Resources: Curse or Blessing?

Many African countries still heavily depend on extractive sectors for their source of government revenue, employment and foreign currency to purchase industrial and consumer goods. The 2000s commodity boom started largely due to the increase in demand in emerging countries like China, and much lesser extent India. The commodity prices had fallen sharply after the 2008 financial crisis. However, the price level is still maintained at more than double that of the beginning of the 2000s and have boosted the economic development in many resource rich countries in Africa.

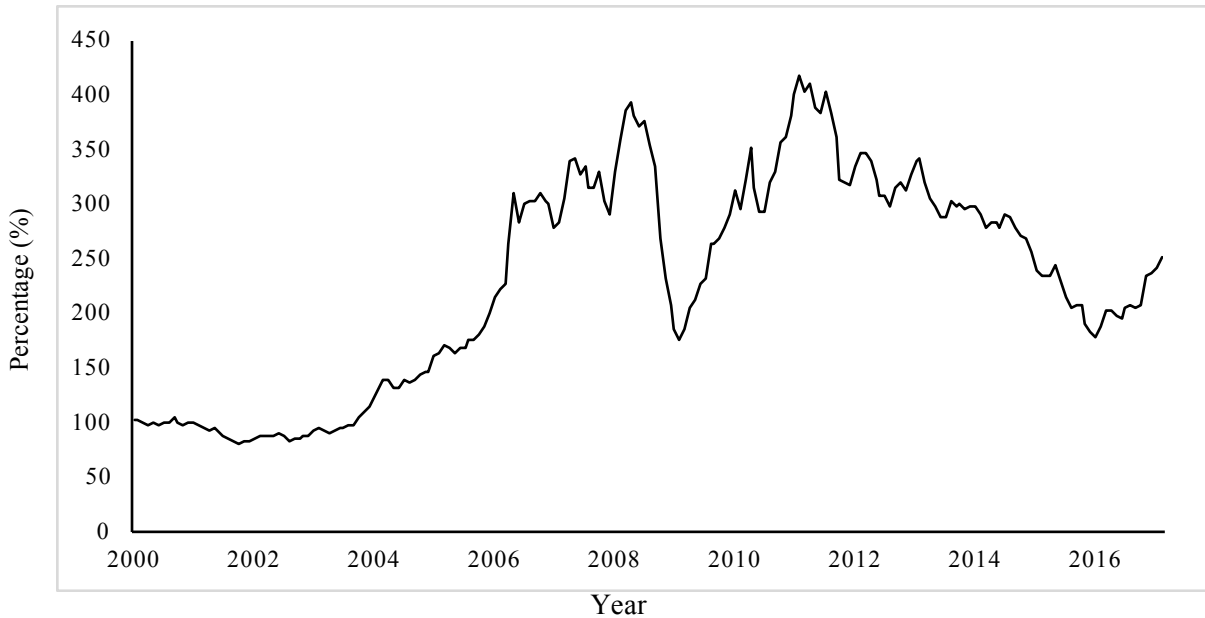


Figure 1. Minerals, Ores & Metals Price Index (2000 = 100 %) 2000- 2017 (UNCTAD, 2017)

High dependence on primary commodities, however, is known to have three major structural problems for economic development: highly volatile commodity prices leading to macroeconomic shocks; rent seeking and associated poor governance; and higher risk of civil war (Collier, 2002). While other resource rich developing countries, especially in Asia, have successfully diversified their economy and broken into the market for global manufacturing, many African countries have been lagging behind (Collier, 2002; Sachs & Warner, 2001). Many argue that the conventional wisdom of economic theory, ‘resource curse (Auty, 1993)’, which countries rich in natural resources perform poorer in overall development, seems to be more pervasive in African countries.

The resource curse has multifaceted impacts on economic development; broadly divided into economic and political spheres. Economic issues include ‘Dutch disease’: which comes about when development of the natural resource extraction sector and the associated increase in the mineral exports leads to other important tradable goods sectors like manufacturing becomes less competitive through the appreciation of the exchange rate (Bourgoin, 2011). Moreover, many countries which responded to the Dutch disease by protectionist policies, experienced inefficiencies in their productive sectors (Kaplinsky, 2011).

It is also suggested that minerals extraction activities are intrinsically ‘enclaved’ with the core activities of mining companies being highly capital intensive with few linkages to the local economy. This leaves the economy of the resource rich countries more vulnerable to commodity prices and external demand (Ramdoo, 2013). As McMillan et al. (2014) argue, capital intensification and productivity growth in the productive sectors including the extractive sector have reduced overall productivity growth on average in resource rich African countries over the period of 1990-2005. Although highly productive in the most cases, the extractive sector had not been able to absorb the surplus labour from lower productivity sectors such as agriculture. As a result, the surplus labour often ended up in informal sectors and/or unemployment, theoretically zero productivity (McMillan et al., 2014).

Political issues include rent-seeking activities amongst decision makers; government corruption; and conflicts associated with mineral extraction. The relationship between political systems and rent generated from natural resources takes many forms: firstly, a government with a narrow tax collection base dependent on rent has little incentive to seek accountability for their citizens; secondly, people surrounding extractive industry look for quick cash making rather than long term investments in education and training; and lastly, the extractive sector with higher productivity than any other sectors in developing countries receives favourable political support (Humphreys et al., 1995; Ramdoo, 2013).

The Nigerian experience since the discovery of oil in 1965, provides an example of the significant negative impact of resource rent on overall development outcomes. Nigeria’s PPP per capita GDP was US\$1,113 in 1970 and was estimated to have remained at US\$1,084 in 2000 while the accumulated revenue from oil over the period was over US\$350 billion at 1995 prices (Sala-i-Martin & Subramanian, 2003). Even worse, “the poverty rate, measured as the share of the population subsisting on less than US\$1 per day increased from close to 36 percent to just under 70 percent” (Sala-i-Martin & Subramanian, 2003) and income distribution sharply deteriorated.

While the debates concerning the nonlinear link between natural resource endowments

and development is far from conclusive, some suggested greater emphasis on institutional capability building and government accountability as a possible way out. According to the Africa Mining Vision (AMV) (African Union, 2009), the key element in determining whether or not a resource endowment will be a curse or blessing, is the level of governance capacity and the existence of robust institutions who can invest resource rents into sustainable development and harness extractive industries to the local economy.

Where the capability of a government is weak, a mining company becomes a de facto government and the local community expects them to directly address societal issues where they operate (Hamann, 2003; Kapelus, 2002; Mzembe & Downs, 2014) and globally active civil society groups, specifically environmental and corporate watchdog groups, who are collaborating closely with local community in developing countries have been playing a important role (Kapelus, 2002).

Investors have also become more conscious on issues like environment, social and governance (ESG) and sustainability. The Dow Jones Sustainability Index, for example, is a set of benchmarks of sustainability scores and stock performance of the global leading companies across 60 industries for investors who regard “sustainable business practices are critical to generating long-term shareholder value and who wish to reflect their sustainability convictions in their investment portfolios (Robeco SAM, n.d.)”. The FTSE4Good Index is another index to help investors to identify companies responsible in ESG and transparency and Johannesburg Stock Exchange (JSE) has its own Responsible Investment Index Series in a partnership with FTSE (Hamann, 2003). However, critiques of these indices argue that there are methodological biases and over-generalization of “sustainability”. In fact, there is a major variation between indices introduced above; the Dow Jones Sustainability Index includes aspects of economic performance in its evaluation while FTSE4Good Index contains no measures of economic performance (Porter & Kramer, 2006).

Mining companies operating in developing countries have also recognised the importance of proper management of community relations as their operations are inseparable from physical locations (Kapelus, 2002). According to Hamann and Kapelus (2004), mining companies’

practice have shifted focus from charitable donation to impact-oriented practice to contribute to the host communities, otherwise the lack of their support (known as ‘social license to operate’) can lead to costly suspension and ultimate shutdown of their operation altogether. Major mining companies have started publishing sustainable reports in accordance to global guidelines as represented by the Global Reporting Initiative (GRI) and shown sophistication in their reports (Jenkins & Yakovleva, 2006).

The Extractive Industry Transparency Initiative (EITI) is a global standard to promote open and accountable natural resource management through verification and full-publication of information including “how licenses and contracts are allocated and registered, who are the beneficial owners of those operations, what are the fiscal and legal arrangements, how much is produced, how much is paid, where are those revenues allocated, and what is the contribution to the economy, including employment (EITI, n.d.)”. The EITI procedures are supported by governments and companies in the oil, gas and mining industry in over 50 countries. Although it is voluntary in principle, some of the countries have made the EITI process mandatory by aligning their national legislation with some aspects of the EITI standard (Andreasen & Ponsford, 2016).

In order to develop guidelines for successful environmental protection practice from merely showcasing corporate good deeds to impact oriented implementation, major mining companies have taken a leading role to form international associations (Porter & Kramer, 2006). The Mining Minerals and Sustainable Development (MMSD) was formed to help publications of the serious attempts of the mining industry to construct an agenda for sustainable development and encourage all members of the industry to live up to the highest standard (Hamann, 2003; Kapelus, 2002). The International Council on Mining & Metals (ICMM) succeeded the MMSD as the global association of the major mining companies and became a ‘port of call’ on industrial standards for best practice (Buxton, 2012). Despite the potential of the mining industry’s unique and powerful contribution to sustainable development has been widely realised, implementation of effective actions is subject to local contexts and requires cross boundary approaches.

Many mining companies have been implementing corporate social responsibility (CSR)

activities as contributions to sustainable development of host communities. However, the companies tend to lack clear understandings of the relationship between CSR practice and sustainable development, as well as their institutional capability (Porter & Kramer, 2006). As a result, many companies regard CSR as a cost and a burden to their business operations, and limit their responsibility to the minimum extent. In these cases, more resources are allocated to those who have ability to raise voices in order to placate their negative impacts (Kapelus, 2002), and some NGOs regard the recent boom of CSR as 'green wash' and retain hostile attitudes to the private sector, which makes cross-organisational cooperation difficult (Hamann, 2003; Mzembe & Downs, 2014; Porter & Kramer, 2006). However, Porter and Kramer (2006) argue if a company understands their points of intersection with society and develops their CSR strategies accordingly, CSR can be much more than just a cost, constraint, or charitable deed, and it can have positive effects on both society and the company, and no social programme can rival the business sector when it comes to creating jobs, wealth, and innovation that improve standards of living and social conditions over time.

Research activities in this matter have also been increasing, triggered by international organisations and research institutes to challenge the view of commodities production as an inherently enclave activity and to make the linkages from the extractive sector work for economic development. The AMV is a timeframe to achieve more broad-based sustainable development in African countries (African Union, 2009). The AMV was drafted by United Nations Economic Commission for Africa (UNECA) in 2008 and adopted by heads of state at African Union (AU). The Making the Most of Commodities Programme (MMCP), a research project jointly organised with the Open University and the University of Cape Town, has published a book, "One Thing Leads to Another", which comprised a series of case studies on economic linkages to the minerals industries in African countries and states the importance of "the role of ownership, the nature and quality of infrastructure, the national system of innovation, spill-overs of skills to and from the commodities sector, linkages in regional economies and the nature and consistency of policies directed towards the commodities sectors (Kaplan et al., 2011)".

In addition to the change in the stakeholders' attitude of the extractive sector, there has

been fundamental technological change in many aspects of the extractive activities. Kaplan (2011) argues that the situation surrounding extractive industry is no longer as described in the Singer-Prebisch thesis; natural resource based activities do not provide “the growing points for increased technological knowledge, urban education, the dynamism and resilience that goes with urban civilization as well as direct Marshallian external economies.” (Singer, 1959:476 quoted in Marin et al., 2009:4). This view is supported by Porter (1990) who argues that all industries today are technology intensive which use information and communication technology (ICT) and new materials and constantly improving their way of doing businesses. For example, autonomous haul trucks and loaders have already been used in some mining operations and more and more equipment are expected to be connected and operated by algorithm-driven software (Durrant-Whyte et al., 2015). While it is difficult to predict the impact of these technological advancement, this labour-saving technology is likely to reduce the number of employees in-pit; change in skillset required for operation from low-skills to high-skills; reduce local equipment-related procurement in developing countries and increase import from developed countries (Cosbey et al., 2016).

There is little doubt that effective collection of rent such as tax revenues and minerals royalties and management of the financial linkages to the extractive sector have significant importance in resource-based sustainable development. However, extraction of finite natural resources itself is not sustainable nor simply not enough to sustain large population in African countries. Hence, there needs to be policy intervention to promote transformation of economic structure into more productive sectors, especially through creating production linkages to extractive sectors and promote technological spill-overs. Whether and how governments of resource-rich countries can take such initiatives, especially how to shift into more knowledge-based and less material dependent one has been discussed in a number of literature. While there is no panacea for this matter, some lessons from countries had achieved resource-based industrialisation will be reviewed in the next section.

2.1.2 Examples of Resource-based Industrialisation

In this section, history of economic development in Finland, Sweden, Japan and South Africa

which have succeeded to industrialise based on initial comparative advantage derived from endowments of natural resources are reviewed.

2.1.2.1 Finland

Finland has experienced dramatic economic structural transformation from a forestry-related industry, sawn wood and pulp production, which comprised of 90 percent of the total exports in the 1920s into a knowledge intensive ICT-based industry in a relatively short amount of time. In 2015-2016, Finland was ranked as the 8th (down from the 4th in the previous year) most competitive country on the World Economic Forum's Global Competitiveness Report (Schwab, 2016). The central factor of their success was government commitment to support research and development (R&D) and the development of skilled workers in the midst of severe economic recession triggered by a major banking crisis in the early 1990s. The decision required a great deal of political wisdom and courage while there was possible easier path to generate immediate employment than building up longer-term competitive advantage (Dahlman et al., 2006).

Finland's first step for industrialisation started with timber and pulp production. The country's first ground-wood plant was established in 1860, based on German design and subsequently the first chemical pulp mill in 1880. Within 70 years, domestic producers of pulp, paper and sawmill developed own technologies, which turned out to be globally competitive for the next decades. Primary production of forest-related industry was gradually replaced by manufactured equipment and construction, which eventually succeeded by service and knowledge economy as shown in the figure.

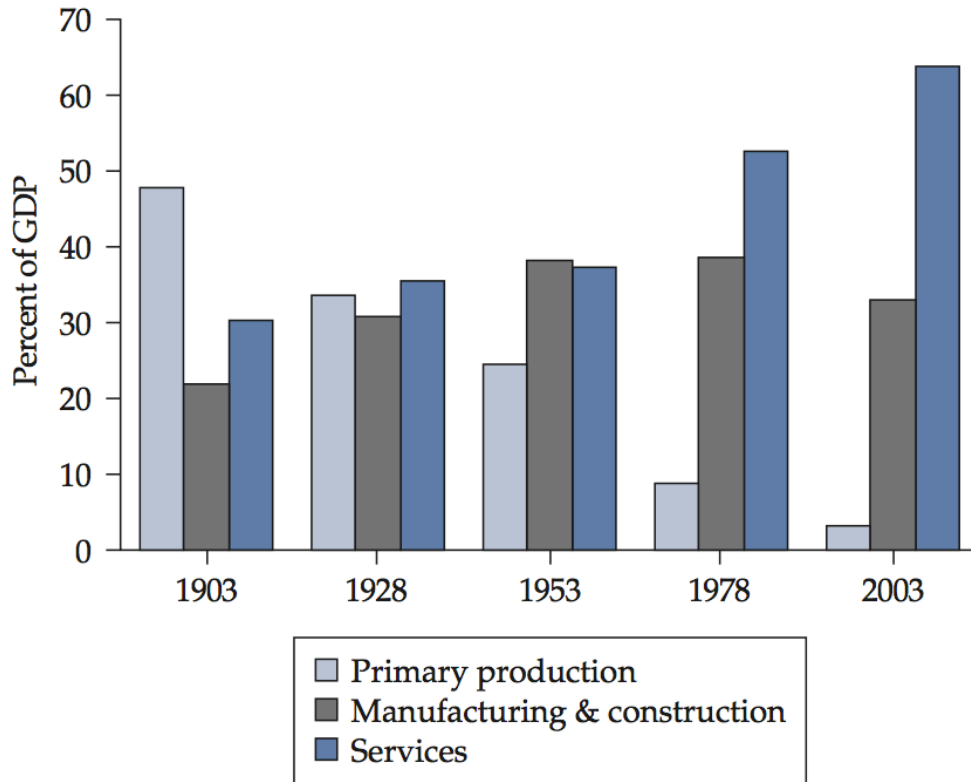


Figure 2. GDP by sectors in Finland in 1903-2003 (Dahlman et al., 2006)

It should be noted that the Finnish government’s focus on collaboration and their R&D funding was tied to “projects that are performed in collaboration with other companies, research institutions, and/ or universities (Dahlman et al., 2006)”. High-tech industries are research and capital intensive and development expenses and marketing costs dominate the cost structure leaving manufacturing and material costs less important. In this sense, there was an effective commitment of the government to support business R&D in order to transform the economy from natural resource-based to knowledge-based in the midst of the budget cutting back on virtually all other expenditures.

Some factors attributed for the success of Finland may not be replicated elsewhere, such as the harsh natural environment above Arctic Circle and homogeneous population, which are considered to create trust and high level of social capital like high-quality governance and collective actions (Dahlman et al., 2006). However, the experience of Finland shows that the conversion of knowledge into economic and social benefits requires good governance and long-

term commitment of the government to invest in innovation systems, including highly qualified personnel and efficient technology transfer and supporting mechanisms. It also shows that the creation of new high technology industries has contributed to maintain and improve the performance and competitiveness of the traditional industries by providing them access to high technology and knowledge (Dahlman et al., 2006).

2.1.2.2 Sweden

Sweden is the home base of the world-class mining-related manufacturers like Volvo, Saab-Scania, Atlas Copco, SKF and Sandvik (Porter, 1990; Walker & Jourdan, 2003). While gradual loss of the initial competitive advantage in natural factors including extensive forests, large deposits of low phosphorous iron ore, and inexpensive hydroelectric power started from the 1970s, Sweden managed to specialise into higher value products in its supporting industries both in upstream and downstream of the natural resources and formed resource-based industrial clusters in some distinctive areas (percentage of total exports in 1985 in parenthesis); transportation and logistics (20,5%), forest-related industries (17,9%), and ferrous metals and fabricated products (12,5%) (Porter, 1990).

The largest cluster was developed in response to transport timber and iron ores. The logistics and material handling industries have evolved with mechanisation and automation in order to keep up with rising domestic wages. Besides, the harsh environmental condition and high safety standards in Sweden required R&D-intensive investment and contributed to create the internationally competitive cluster.

In this relatively small country, world class companies have developed their competitive edge with close cooperation amongst them e.g. Atlas Copco (mining and construction equipment) and Sandvik (rock drills) cooperates closely on marketing and R&D. The roots of this behaviour are in social structure and their emphasis on cooperation in Swedish education system (Porter, 1990). The world 2nd most innovative country (Schwab, 2016) is known to have the least wage difference in the world (Gini coefficient at 27,3 in 2012 in the World Bank estimate) and universally high levels of education.

2.1.2.3 Japan

Since the mid-19th century, Japan had experienced a major technological transfer and industrialisation through 5 key branches; iron and steel manufacturing; railways; mining; textiles; and shipbuilding (Hayashi, 1990). While labour-intensive silk and textile industry had helped the government to earn foreign currency and import productive capitals needed for industrialisation, mining and steel manufacturing technology adopted from Western countries had the most profound impact on technological advancement in Japan. The demand for the modern technology was triggered by a national security threat created by American gunboats forced the country to open its ports. A national consensus to urgently increase the national defence capability by casting modern weaponry like big guns was achieved through rapidly developing related technologies and infrastructure needed in order to mine iron-ore, coal, steel making and related transportation system.

Initial mining equipment was imported and introduced to government-owned mines in order to enhance productivity through mechanising water removal, ventilation and transport system. Experienced foreign engineers and foremen from Western countries were employed by the government, however, professors of Japanese universities, members of the first generation of recipients of a modern engineering education and were appointed as technological advisors, played the central role to transfer technology through; maintenance and repair; imitation and trial production; acquisition of technology; and optimising design to suit local conditions and needs (Hayashi, 1990). Besides, it was a private sector who promoted hiring of university-trained engineers and import-substitution with local contents in order to reduce production costs (imported goods were as much as three times expensive than domestic products because of the weak currency at the time) (Hayashi, 1990).

From 1920 onward, out of mining technology grew technological divisions that of, evolved into separate and independent technologies. For example, Hitachi (established in 1920), which grew out of the electrical machinery division of Hitachi Mining Co. (copper and iron-ore mine), which engaged in the repair of electric motors is now an international conglomerate

manufacturer of construction machinery, power plants, electric appliances, ITC systems, bullet trains etc. Fujitsu was separated in 1935 from the Furukawa Mining Co. (copper-mine) to become a manufacturer of electric wires; it later moved into communications equipment, and is also evolved into an international company with automation machinery and telecommunication systems amongst others.

According to Hayashi (1990), some factors attributable to successful industrialisation were self-sufficiency in energy, initially wood and charcoal and later replaced by coal; trained engineers as valuable human capital; *tomoko*, a nation-wide mine worker union who acted as an information network for employment opportunities for skilled workers, provided on-the-job trainings and schooling programmes and contributed to a division of labour. However, it was only after the development of the railway systems outside of the mines, which linked the accumulated modern technology at the mines to wider society. Hayashi (1990) argues that the technological ‘enclave’ at the mine sites and asymmetry of information between mines and surrounding villages caused not only delay in economic development but also irresponsible environmental pollutions and made some areas uninhabitable.

2.1.2.4 South Africa

South Africa with its more than a century long history of mining industry, has developed the largest industrial cluster comprising of a number of companies with some being world class suppliers of equipment and services (Kaplinsky, 2011). The discovery of diamond and gold in the late nineteenth century provided the initial trigger for industrialisation and created an economic capital, city of Johannesburg. The need for heavy mining equipment and energy supplies into uniquely deep underground ore bodies have enabled large scale infrastructure development such as rail system and coal-fired power stations and electric grids (Walker & Jourdan, 2003).

Due to its unique history of economic sanctions during racial segregation and the highly specific and demanding geological requirements for hard rock face at deep underground of the gold mining industry, South African mining input cluster have developed competitive advantage

in various areas including shaft sinking, water pumping, underground locomotives, ventilation, rock mechanics design, mining explosives, drilling equipment and abrasives, metallurgical processes and plants, and delivering intellectually based services to mines around the world (Kaplan, 2011; Walker & Jourdan, 2003). The coal industry in South Africa has also been a catalyst for the technological advancement in the country such as the development of the hydraulic engineering capabilities due to the specific machinery requirements to wash the mined coals (Pogue, 2008).

During the 1990s, mining and metals industry in South Africa experienced a major transformation from high reliance on gold into mineral resources related processing and manufacturing. As the outcome of the initiative, resource-based and capital-intensive projects such as Columbus Stainless, Hillside Aluminium, Namakwa Sands and Saldanha Steel had started (Walker & Jourdan, 2003). However, problems emerged from the limited amount of job creation from the world class primary beneficiation activities and the lack of linkages to further labour-intensive activities. This is due primarily because of the small demand from the domestic market for final and intermediate products, and low level of competitive advantage in the labour-intensive manufacturing sector faced by fierce global competition (Walker & Jourdan, 2003).

On the contrary to the government's expectation to develop labour-absorbing sector in downstream, the ongoing protection of the primary processing industry with import parity pricing (IPP) which allows primary metal producer to charge more for the products than they do for international markets, it works against the promotion of job creation along with minerals value chains (Black & Hasson, 2016; Walker & Jourdan, 2003). As a result, the competitiveness of the traditional 'minerals-energy complex (energy production from coal, and energy-intensive processing industries of basic chemicals, steel, aluminium and other basic metals)' remain high relative to other manufacturing and the nation has become more dependent on the sector (Black & Hasson, 2016; Fine & Rustomjee, 1996). As a result, the country-wide labour intensity has been declining, even more rapidly after the advent of democratic government in 1994 and economic liberalisation policy (Black & Hasson, 2016).

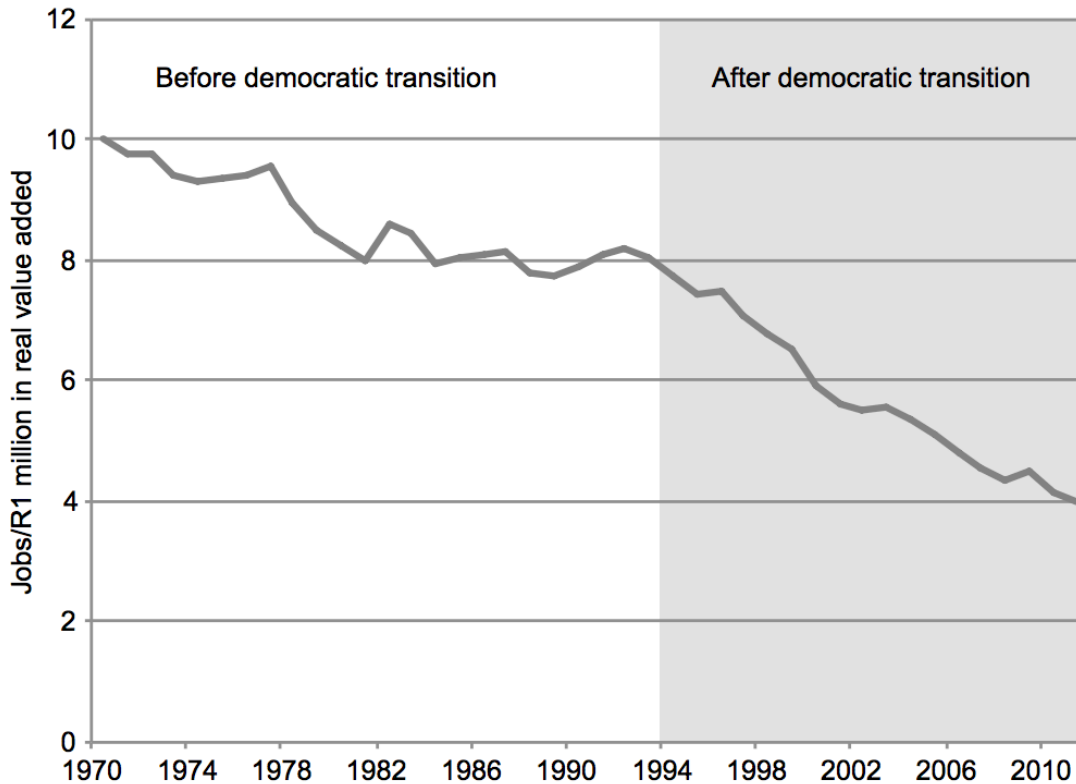


Figure 3. Ratio of formal employment to gross value added for South African manufacturing, 1970–2011 (Black & Hasson, 2016)

Mining and related activities today still have significant importance in technological advancement in South Africa. Kaplan (2011) argues that the sector is “the only cluster where South Africa has a significant number of patents and where the patents have a high value” and mining equipment exports, approximately a third of which goes to Southern African countries, comprises 8,5% of the total exports and 55% of the total capital equipment exports in 2005-2009. The Chamber of Mines Research Organisation (COMRO) was a representative body of mining houses who acted as a facilitator between the mining industry and public research institutes and contributed to the development of the national system of innovation. However, at least since the early 1990s, the mining industry and related parastatals such as railways and harbours and science council bodies have significantly reduced their research and training capacities. As a result, exacerbated by the migration of the skilled labours to competing countries like Australia, the country experienced a substantial shortage of skilled technicians and artisans

(Kaplan, 2011). These difficulties to source skilled labour coupled with some other reasons such as a high crime rate, forces mining input industries in South Africa to relocate themselves outside of the country, almost invariably for design and research capabilities into Australia where there is access to highly skilled labour and well-established research institutes, and component manufacturing into China (Kaplan, 2011).

In South Africa, the importance of creating decent jobs for citizens at large, through industrialisation, is recognised under policies such as the National Development Plan (NDP) (Republic of South Africa, 2012), the Industrial Policy Action Plan (IPAP) (Department of Trade and Industry, 2013) and the Minerals Beneficiation Strategy (Department of Mineral Resources, 2011). However, the outcome has been disappointing and the biased support for heavy capital-intensive firms and subsectors is still ongoing.

2.1.3 Economic linkages to the extractive sector

As seen in the previous section, resource-based industrial cluster formation can be seen in the history of South Africa to some extent. However, resource-based industrialisation has not significantly transformed the structure of economy in South Africa. It supports the view of Ramdoo (2015), that “incentives given to miners does not promise them to become manufacturers”. As a result, dependence on mineral resources has increased even after democratisation and trade liberalisation.

However, given the context of mining operations shifting to highly mechanised and automated processes to increase productivity and safety, mining and mineral processing activities can offer numerous opportunities for industrialisation and knowledge intensive economic structure (Walker & Jourdan, 2003). As the number of miners is reduced and replaced by capital goods, the importance of government intervention to create linkages from the mining industry into the local economy becomes more important than ever. The linkage theory originally introduced by Hirschman are: fiscal, consumption and production linkages, and the importance of the theory lies on strategies promoting collective actions regardless of linkage. Hirschman (1968) argued that the problem is not a “lack of one or even of several needed factors or

elements (capital, education, etc.) that must be combined with other elements to produce economic development, but with the deficiency in the combining process itself”. Morris et al. (2013) adapted the linkage theory into three distinctive forms from the extractive industry; downstream, upstream and side-stream. The three linkages are explained in detail in the following section.

2.1.3.1 Downstream

Downstream or forward linkages, which consist of industries that use the inputs from the extractive sector into other value adding activities known as ‘beneficiation’ in some countries. Although its popularity in resource rich countries to stimulate new export products, the term is loosely defined with the activities ranging from capital-intensive processing such as smelting and refining as well as labour-intensive metal fabrication (Walker & Jourdan, 2003). According to Morris et al. (2011), beneficiation is a manufacturing activity including other value additions different from processing of minerals, which are normally seen as a part of mining companies’ operation. In the case of aluminium metal value chain, for example, beneficiation activities include aluminium sheets for beverage cans, aluminium die cast cylinder heads for car engine components and aluminium rods for electric cable but not smelting of aluminium metals.

Political attention has been drawn to leverage beneficiation opportunities for industrialisation by capturing higher values on mineral resources value chains which are currently missed by exporting raw material or low-level value added products and importing manufactured semi- or final products. This is based on an assumption that the promotion of beneficiation of raw material in downstream sectors is a logical progression and comparative advantage for downstream activities of proximity to the resources. The strategy is rooted in several policies, including the MPRDA, the BBSEE, Precious Metals Act and the Diamond Amendment Act (Department of Mineral Resources, 2011).

However, Hausmann et al. (2007), concluded that “policies to promote greater downstream processing as an export promotion policy are misguided” after a series of research conducted in response to the request from then President of South Africa, Thabo Mbeki.

Critiques of the policy state that very few resource rich countries export processed forms in reality (Hausmann et al., 2007). This is partly due to an advancement in transport technology and information and communication technology, which makes a comparative advantage of one's proximity to resources less significant. Consequently, manufacturing activities along with Global Value Chains (GVCs) are fragmented around the world based on their competitive advantages and MNCs' power over decision making where to locate their production facility exceeds hosting countries. This global trend is evidenced in the rise in the share of international trade in intermediate inputs (World Economic Forum, 2012).

2.1.3.2 Upstream

Upstream or backward linkages, is related to industries that supply inputs to the extractive sector (Ramdoo, 2013). For example, those companies supply mining equipment, machinery or engineering services. Location specific nature of minerals extraction and processing activities gives opportunities for locally operating companies to develop comparative advantage according to unique technological needs deprived from geological, metallurgical and other environmental conditions. As operation differ drastically with different minerals and geography, tailor-made solutions are often required.

In South Africa, legal instruments to support local enterprise development had been "passive" in contrast to heavy commitment of the government to invest into downstream (Kaplinsky, 2011) and "local supply links may merely be importers of inputs previously acquired directly by the resource extracting firm and may involve little addition of value in the supply chain (Kaplan et al., 2011)". However, the introduction of the Broad-Based Black Economic Empowerment Amendment Act in 2013, had broaden its focus from the traditional ownership model to on human resource and skills development, enterprise and supplier development for historically disadvantaged South African (HDSA) (Republics of South Africa, 2014).

Kaplinsky (2011) argues, why resource rich countries have not paid more attention to backward linkages is attributed to the inherited conventional wisdom of the commodities sector

as an enclaved and low technology activity. On the other hand, others argue that minerals extraction requires large capital investment and complex technologies, for which local companies are almost impossible to enter.

2.1.3.3 Side-stream

Side-stream (horizontal) linkages consist of developing activities that may not be directly linked to the extractive sector, but might have the potential of unlocking indirect businesses and employment opportunities in other sectors of the economy. It includes logistics, transport, accommodation, and other ancillary industries, which benefit other sectors like agriculture through infrastructure development.

Extractive industries are knowledge intensive and multidisciplined across various professionals. To mention a few, geologists, metallurgists, chemical engineers, mechanical engineers, electrical engineers, IT specialists, marketing specialists, and environmentalists are involved in their operation. Experience in Finland, Sweden and Japan shows strong correlation between minerals industry and technological advancement. However, extractive industry is also commonly known as ‘enclave’ without proactive government commitment to create linkages.

2.2 Sustainable development/ Five capitals framework

2.2.1 What is sustainable development?

Sustainable development is known as inter-generational equality over natural resources and as coined by the Brundtland Report, “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development, 1987). The concept has been widely accepted because it was rather meant to be a political discourse than practical guidelines and left little room for direct opposition. However, the operationalisation of the concept has been challenging and there have been a number of different interpretations developed (Ratner, 2004). As Ratner (2004) argues, a “dialogue of values (Ratner, 2004)” is necessary in order to integrate

preferences of people between ecological, social and economic goals in a way to satisfy ethical consensus of the society, instead of unifying one definition of sustainable development.

The debates around the conceptualising of sustainable development have been taking place at various levels; international, national, municipal and corporate, and those different definitions are stemmed from one's values such as in human-nature relationships, religious beliefs, indigenous knowledge and traditions, gender equality, global North and South, capitalism and socialism, technology and social needs (Mebratu, 1998). To introduce a few concept of sustainable development, there are 'deep ecologists' at the most radical ecocentric end of the conceptual spectrum, who recognise intrinsic values of nature itself and assume that human beings only can use these natural resources to meet basic needs, and on the other conservative anthropocentric end, technology/ market economy proponents seek technological and institutional solutions compatible with the currently dominant capitalistic norm in order to address environmental issues (Hattingh, 2001; Mebratu, 1998).

2.2.2 Ecological Modernisation

Operationalising sustainability into day to day businesses can be seen in a concept like ecological modernization (EM). EM was introduced to address environmental issues by environmental social scientists in response to the critiques from the radical environmental proponents such as 'deep ecologists' (Korhonen, 2008). EM stands on the position that continuation of current modernization brings solutions to the problems we have as 'business as usual' (Blewitt, 2008). Under the concept of EM, there have been a number of practical tools like eco-efficiency for industries to use in daily businesses as well as policy making process and the concept helps to go beyond the persistent notion of trade-off between environmental protection versus economic development and central role are assigned to science, technology and the state (Gibbs, 2000; Krugman, 2010; Porter & Linde, 1995). Some argue that EM gives much more rigorous guidelines to the discourse of sustainable development (Gibbs, 2000). EM can be divided into two major groups; dematerialisation and substitutions (Korhonen, 2008). Dematerialisation is represented as eco-efficiency discussed in detail below and the process requires to look at the flows of raw materials used and measure the efficiency per production. Substitutions are studies

of alternative materials can be used whether it is raw material or energy. Both approaches are arguably cheaper than traditional ‘end-of-pipe’ approaches, which are to deal with environmental problems by cleaning up afterwards (Gouldson & Murphy, 1997). EM is also categorised as ‘strong’ and ‘weak’ depending on inclination towards ecocentric or anthropocentric view (Blewitt, 2008).

2.2.3 Eco-Efficiency

Eco-efficiency is a management philosophy developed by WBCSD and widely accepted by a number of companies as a technical tool and used as an environmental policy guideline as well (WBCSD, 2000). Eco-efficiency encourages companies to regard environmental regulation as opportunities for innovation rather than costs and to look at more efficient production of goods and delivering services (Porter & Linde, 1995; WBCSD, 2000). While similar concept of cleaner production mainly looks at incremental environmental impacts mitigation measurements, eco-efficiency pursuing for innovation to sometime fundamentally change the way of business (WBCSD, 2000).

The use of eco-efficiency with measurable objectives for environmental policy and management, was brought into sustainable development discussion from the business interest and it recognises that environmental protection and economic growth can be attainable at the same time (Korhonen, 2008; Mebratu, 1998). Proponents of eco-efficiency like Porter and Linde (1995) argue that technological and institutional innovation can significantly reduce material use, pollution and waste generation while creating more value for well-being of human and it can promote decoupling of economic development from material consumption. Eco-efficiency opportunities for companies are not limited to production but also extended along the entire value chain through the life cycle of a product and give useful guidelines for engineering, procurement, marketing and finance division amongst others in a company to look at potential intervention points for improvement (WBCSD, 2000).

Implementing eco-efficiency starts with to look at the opportunities to 1) reduce consumption of energy, water, materials and land, 2) reduce the impact on environment by

minimising waste generation and 3) increase product or service value (WBCSD, 2000). Practicing eco-efficiency can take various forms such as re-engineering their processes, cooperating with other companies, re-design their products and find alternative ways to satisfy customer needs (WBCSD, 2000).

The concept of eco-efficiency perfectly fits into current market-based economy as investment into eco-efficiency gets rewarded by financial profits as well as environmental benefits (Gibbs, 2000). Government roles are important in order to encourage companies to adapt eco-efficiency approach by incentivising the investment into innovation to develop environmentally more efficient and commercially more competitive way of production and value creation system since companies have tendency to think the costs of addressing these environmental issues are higher than they actually are (Porter & Linde, 1995). When governments implement new environmental regulations, it is important to set ‘phase-in’ time for the industry to work on innovative solutions; otherwise harsh introduction of such new regulation only cause costly end-of-pipe clean up measures for companies (Porter & Linde, 1995). As are Porter and Linde (1995) put it, “bad regulation is damaging to competitiveness, but the right kind of regulation can enhance it”. From a number of examples, Porter and Linde (1995) argue that the assumption that the current product design and product process remain the same while the company have to pay extra cost to meet new environment regulation is wrong. They argue companies can benefit in a number of ways through reduced material usage and associated transport and storage costs of the material, increased process yield, better utilisation of by-products, conversion of waste into valuable products and higher quality of products to name a few (Porter & Linde, 1995). They mention that new market emerged and companies are now able to command premium pricing as being ‘green’ (Porter & Linde, 1995).

2.2.4 Green Economy

Green Economy as addressing environmental risks and social equity as an economic activity, has become prominent as a form of alternative way of living especially after the global recession in 2008 (UNEP, 2011). Krugman (2010) argues that Green Economy can be developed much faster than people think, with governments posing tax on negative environmental externalities such as

air pollution and invest them into technologies to improve environment like scrubbers to remove sulfuric dioxide from emissions in economically sustainable manners. Although he recognises the limitation of this market-based approach such as moral and technical issues to set the price of pollution, he suggests to utilise the strong driving force of the incentive system. Green Economy can be integrated into regional economic development policy as Gibbs (2000) argues that ecological modernization can be most beneficial to regional economic development policy as the scale is ideal to integrate economic and environmental policy as opposed to national policy. He also argues that environmental issues are context dependent on each regions and ecological modernization can help to promote sustainable communities by promoting energy conservation and 'green technologies' (Gibbs, 2000).

2.2.5 Limitations of incorporating sustainability into business

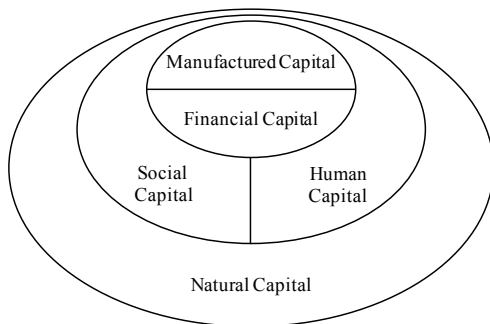
Although its practicality and wide acceptance by industries, an approach towards sustainability like EM has a number of issues to be considered before using it as policy objectives. Berkhout et al. (2000) point out the rebound effect of EM. The rebound effect is stemmed from the improvement of energy efficiency and reduced price of the energy cost, and it has both direct and indirect impacts; 1) substitution effect - the reduced energy costs incentivises people to use more energy, 2) income effect - the reduced energy costs also enlarges purchasing power and leads to more consumption of goods and associated energy use and 3) macro-economic effect – structural shift of spending pattern in both individuals and companies depending on price elasticity of the products. Through these three rebound effects, more efficiency and price reduction can lead to more consumption, and increased net impact of EM depending on the price elasticity (Berkhout et al., 2000).

As recognised in WBCSD (2000), orientation towards business edict cause other harmful effects such as that measurable data can only be considered as parameter in eco-efficiency. Therefore, only some part of environmental issues such as water consumption, material usage and waste generation can be quantitatively measured but most of the other sustainability issues are not quantifiable. Besides, environmental impacts like on water availability can have different meanings in various contexts and cultural belief system. Korhonen (2008) adds to the point,

arguing that EM should not be regarded as the overall goal since the concept does not include social values such as democratisation, redistribution of the wealth and social justice. WBCSD (2000) also acknowledges the point that the concept is also based on economic growth ideology and believes the continuing progress of technological advancement should solve the problems we currently have. Korhonen (2008) concerns the danger of the concept as it can be used to legitimise the on-going environmental destruction as it is merely the part of transition towards more efficient system. In summary, whether concepts like EM can contribute to sustainable development needs to be considered carefully as the concept does not address fundamental sustainable issues of social aspects such as inequality and democracy (Korhonen, 2008).

2.2.6 The five capitals framework

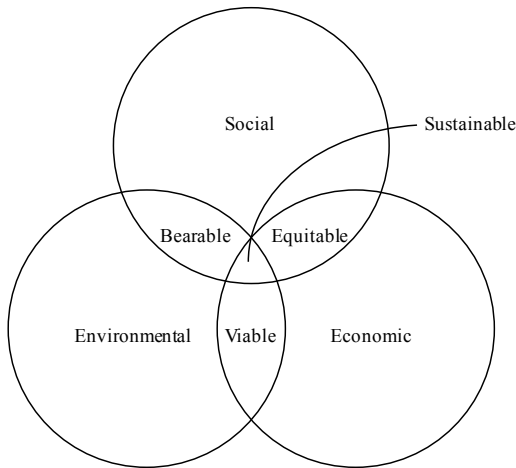
Table 1. The five capitals framework (Uren et al., 2003)



Type of capital	Stock	Flow of benefits
Natural	Soil, sea, air, ecological systems	Energy, food, water, climate, waste disposal
Human	Health, knowledge, motivation, spiritual ease	Energy, work, creativity, innovation, love, happiness
Social	Governance systems, families, communities, organisations	Security, shared goods (e.g. culture, education), inclusion
Manufactured	Existing tools, infrastructure, buildings	Living/ work/leisure places, access, material resources
Financial	Money, stock, bonds	Means of valuing, owning, exchanging other four capitals

The five capitals framework was developed by a UK-based sustainable development charity organisation, Forum for the Future, in response to challenges of putting sustainable development into practice. The framework is based on a widely accepted business term ‘Triple Bottom Line: economy, environment and society’. However, while the environmental and economic dimensions seem straightforward, many people find it more difficult to get to grip with the social dimension of sustainability and social dimension is divided into human and social capital in the five capitals framework (Uren et al., 2003).

Table 2. Triple Bottom Line (Uren et al., 2003)



Human capital is related to individual ability such as health, knowledge, skills, motivation and spiritual ease of people (Uren et al., 2003). Human capital, together with social capital are considered to be essential precondition of sustainable development. This is emphasised in the African Mining Vision, as it states “facilitate and nurture human resources development and skills formation in tandem with the development of resources technological clusters through the facilitation of research and development (R&D) and the building of knowledge networks and niches involving academia, industry, the government and other players”.

Social capital is increasingly recognised as an important factor for our well-being albeit its broad and vague definition. According to Helliwell et al. (2015), it is a measure of “the quality of interpersonal relations, involving trust, honesty, and mutual support, and these in turn increase mental and physical well-being”. Social capital influences collective actions which are important to not only human capital development but also economic development through cooperation, efficient contracting, the division of labour, and the provision of social insurance against shocks (Nahapiet & Ghoshal, 1998; Helliwell et al., 2015). Countries vary widely in their social capital along with three dimensions, although highly interrelated, namely: structural (who you reach and how you reach them), relational (the kind of personal relationships people have developed with each other through a history of interactions) and cognitive (resources providing shared representations, interpretations, and systems of meaning among parties) (Nahapiet &

Ghoshal, 1998).

Social capital has value in use but not easily measured nor traded. Hence, much more research is still needed on how social capital is produced (Fukuyama, 2002; Helliwell et al., 2015; Nahapiet & Ghoshal, 1998). This is because social capital has multidimensional definitions, change over time, and communities themselves are not homogenous (Woolcock & Narayan, 2000). However, some factors are known to have strong correlation to social capital development, for example, perception of corruption and income inequality measured by Gini coefficient is known to have a negative correlation (Helliwell et al., 2015). According to one of the most single direct measurement of social capital in the World Values Survey Wave 6: 2010-2014, only 23,3% of South African people answered that “most people can be trusted”, compared to 60,1% in Sweden.

Social capital has both positive and negative externalities. As Fukuyama (2002) argues, “human beings have a tendency to build “in-group” solidarity at the expense of outsiders” and it is primarily the state’s role in facilitating the gradual broadening of the radios of trust by improving quality of formal institutions. This aspect of negative externality of strong social capital in smaller “in-group” on overall society is well captured in Morris and Levy (2016). In their assessment of the quality of collaborative efforts, they argues that the failure to develop a competitive industrial cluster in the South African garment and textiles sector is attributable to the long history of lack of coordination between them, which stems from the historical fight over the level of textile tariffs and import permits during the Apartheid and Import Substitution Industrialisation (ISI) policy.

The five capitals framework has been incorporated into the design and operation of extractive sector as a guidance of sustainable development principles. For example, Sustainable Operations (SUSOP®) is an emerging industry standard co-developed by the research institutions including the University of Queensland, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Australia, and major mining companies. SUSOP® aims to facilitate discussion amongst stakeholders to identify potential risks and opportunities associated with each operation (Green & Corder, 2012). This is an exploratory approach rather than is to

give a universal set of targets to be accomplished, and leaves much flexibility to stakeholders involved in the project. While this allows different understanding of sustainable development in each region, unavoidable ambiguity potentially causes a dangerous corporate 'greenwash'. Hence, human and social capital development needs to be seen as an important precondition to sustainable development, which requires responsible and knowledgeable citizens to take initiative of their own developmental decision.

According to Woolcock and Narayan (2000), "one of the primary benefits of the idea of social capital is that it allows scholars, policymakers, and practitioners from different disciplines to enjoy an unprecedented level of cooperation and dialogue". As they argue, it is a learning process by doing and partnership over stakeholders and information sharing network is important.

2.2.7 Sustainable Development Goals

The global transformation towards sustainable development has entered into a new phase with the adoption of the Sustainable Development Goals (SDGs) by the United Nations member states as the post-2015 global development agenda. The prominence of the event was that 193 countries, both developed and developing, had agreed to address complex sustainability issues such as climate change, poverty, inequality and energy security by 2030 (Lewis & Flynn, 2016). As Hopwood et al. (2005) conclude that the concept of sustainability needs more clarity in order to become as policy objective, and SDGs are expected to work as a foundation for the further discussion between people with different values such as in developed and developing countries, and environmental protectionists and economic growth proponents. The realisation of the SDGs, similar to EM, assumes a huge role of technology and innovation. In this sense, activities of private companies are regarded as a prominent factor for achieving sustainability. Cooperation between stakeholders is emphasised in the SDGs agenda.

The importance of economic growth towards sustainable development cannot be disregarded. However, as Korhonen (2008) argues, it is also important to consider cultural shift from the current mass production systems with competing each other pursuing the economies of scale into more diversified locally dispersed production systems. This can be done with more

cooperative cultures with a sense of community (Korhonen, 2008). As contrary to the market economy oriented authors, Korhonen (2008) argues that efficiency-oriented policy cause less social sustainability. In this sense, mind shifts are needed both in consumers and producers of products (Korhonen, 2008; Porter & Linde, 1995). Newly emerged Green Economy is a perfect example of this trend and environmentally conscious people are willing to pay extra for ‘green’ products and services (Porter & Linde, 1995). Whether government and industry can see this trend as opportunity or threat make huge difference in future competitiveness (Porter & Linde, 1995). Some of the developed countries which have achieved greater eco-efficiency cannot neglect the environmental degradation in developing countries as more and more environmentally inefficient productions are exported to those countries as known as ‘not in my backyard’ attitudes (Gouldson & Murphy, 1997). Same as any other concepts, SDGs are not panacea. As Moore (2015) argues, the importance of the quality of life and values of our productive life need to be discussed by localising the SDGs agendas.

In South Africa, various policy frameworks like IPAP, NGP, NDP 2030 are set in place to eliminate poverty and achieve non-racial and integrated society by redressing the inequities of the past. Local governments are regarded as a key player to form cooperative environment between various stakeholders for socio-economic development of the region in a sustainable manner. Local Economic Development (LED) initiatives are set in place with great respects to address community needs with whatever available resources locally. Natural resources are often used as an initial comparative advantage. In fact, financial and manufactured capital accumulation due to the mineral resources development is easily observable in South Africa with modernised infrastructure such as roads, commercial complexes, hospitals, power lines, etc. However, given the scale of the unemployment and inequality problems in the country, one could question whether the capital-intensive methods chosen in those areas have contributed to sustainable development. In the following sections, this is investigated by using the five capitals framework.

2.3 Summary

Mineral wealth extraction often does inhibit development but the experience of some countries, as reviewed in section 2.1, suggests that creating linkages from the extractive sector to local economies can help to form competitive industrial clusters as a key factor for a transition to a more balanced economy. Good human and social capital are important preconditions for cluster formation, which involves both cooperation and competition. It also requires government commitment to support long-term investment into education and R&D, both through own and private sector resources, enabled by a conducive policy environment. Strong human and social capital in a society are also recognised as two of the five types of capital necessary for sustainable development.

Advancing human capital development and aiming for more equitable industrialisation are policy imperatives in the post-Apartheid South African context, and are well recognised in established industrial policies. However, the policy focus in the mining industry seems to be too strongly fixated on downstream beneficiation at the expense of upstream and side-stream linkages which may assist better with cluster formation. Such industry-wide collaboration was seen in the joint research initiatives facilitated by the Chamber of Mines Research Organisation (COMRO) in the past and contributed to the development of the national innovation system. In fact, the mining industry is still regarded as “the only cluster where South Africa has a significant number of patents and where the patents have a high value (Kaplan, 2011)”. Since the early 1990s, however, the mining industry and related parastatals such as railways and harbours and science council bodies have significantly reduced their research and training capacities. As a result, exacerbated by the migration of the skilled labour to competing countries like Australia, the country has experienced a substantial shortage of skilled technicians and artisans.

The extractive industries have engaged with sustainable development for some time in response to the public scrutiny over negative impacts caused by their operations. It is often done through the entry points of ecological modernization and eco-efficiency e.g. measurement and improvement of resource efficiency including conservation of water and energy, and also often takes responsibility to directly provide social services to the affected communities near mines.

However, as reviewed in section 2.2, both of these types of engagements have a limited reach to sustainable development. On the other hand, private companies in the extractive sector can be the strongest driver of technological spill-overs into other sectors and could thus contribute to much stronger development through innovation. Tripartite collaboration with government and civil society and the right incentives can expedite this transition, but a sincere and values-based stakeholder engagement is necessary for such development to be truly sustainable.

It is thus summarised that the mining industry in South Africa had contributed to technological advancement and industrialisation in its history but the racial segregation regime at the time had limited human development opportunities for the majority of people and created social inequalities in the country. In order to help to transform the development path into inclusive and sustainable one, this research attempts to generate a better understanding of what needs to be done to re-vitalise and utilise this potential driver of economic and sustainable development in South Africa, where the historical social distrust seems to inhibit collaborative efforts.

3 Research Questions and Methodology

As introduced in the chapter 1, this dissertation explores the possible contributions of a cluster in the minerals industry to sustainable development. This chapter first introduces the research questions to be answered, then presents and justifies the research methodology chosen and finally elaborates on research methods and research ethics.

3.1 Research questions

Based on the literature review and this overall objective of the research, the following research questions arise:

1. Can a minerals industry cluster contribute to develop human and social capital as preconditions of sustainable development?
2. Are industrial policy supports effective to promote economic linkages from/to an extractive sector?
3. Are stakeholder engagements effective to promote a “dialogue of values (Ratner, 2004)” for sustainable development in the area where the cluster is located?

3.2 Methodology: Case study of the Richards Bay cluster

The methodology used to develop answers to these research questions is a single, descriptive and analytical case study. It is structured to focus on historical and current human and social capital impacts of a single minerals industry cluster, the aluminium industry in Richards Bay.

Initial interviews were conducted to scope the aluminium industry stakeholder pool as a part of internship at the RBIDZ. Organisations identified as stakeholders are mapped in Table 3 is shown below.

Table 3. Stakeholder Map

Academic Institute	University of Zululand
Academic Institute	uMfolozi College
Funding Institutions	KZN Growth Fund
Funding Institutions	Ithala Development Finance Corporation Ltd
Funding Institutions	SEDA
Industry	Bell Equipment
Industry	South 32
Industry	Hulamin
Industry	Zimalco
Industry	Isizinda
Industry	Tronox
Industry	Foskor
Industry	RBCT
Industry	Mondi
Industry	RBM
Industry	Transnet
Business Incubator	DACT
Business Incubator	ABI
Business Incubator	Raizcorp
Business Incubator	Mondi Zimele
Business Incubator	Shanduka Black Umbrellas
Chamber of Commerce	ZCCI/ZCBF
Government	TIKZN
Government	RBIDZ
Government	uThungulu District Municipality
Government	uMhlathuze Municipality
Government	KwaZulu-Natal Department of Economic Development and Tourism
Government	Department of Trade and Industry

Background information for the case study came from the recent studies of aluminium and titanium commodity value chains, including a set of feasibility studies of aluminium downstream beneficiation industry development, conducted for the KwaZulu-Natal Department of Economic Development, Tourism and Environmental Affairs (EDTEA), the municipality's Integrated Development Plan (IDP) and the annual reports of the companies operating in the area. Primary evidence was gathered through in-depth interviews with stakeholders selected with the snowball sampling method in the minerals resource related industry in Richards Bay.

Defining an extent of “the community” is always a complex task and largely a subjective matter. Although the research was conducted mainly in the Richards Bay area, developmental issues are discussed at the municipality level, in this case, the City of uMhlathuze. The author is aware that the economic landscape looks very different and the percentage of the population in rural areas relying on the industry's revenue becomes much higher at the Uthungulu District Municipality level, consisting of 6 local municipalities including the uMhlathuze, let alone further complexity at the provincial or national scale. With the limitations noted, however, this study of the community-based sustainable development focused on the two local aluminium smelters' (namely Bayside and Hillside) impacts on the economy of the uMhlathuze Municipality. It should be noted that there are several other capital-intensive minerals industries (e.g. titanium mining and smelting, phosphate production, timber and sugar cane plantation and processing) in the region. It is because of the limited time and resources of this study that the interviews were conducted within the aluminium industry only.

The unique economic geography in Richards Bay was chosen as a natural experiment to investigate the effect of the government intervention to industrialise previously rural areas through minerals resource-based economic development. The historical socio-economic development path of the minerals industry in Richards Bay region is reviewed over 4 distinctive phases: 1. Commencement of industrialisation in the 1970s, 2. Expansion in the 1990s, 3. Post-electricity price surge in 2008, and 4. New economic landscape: IDZ.

Special focus is given on the human and social capital development as important factors

for successful sustainable development and the collected data were analysed with a framework of the five capitals model of sustainable development along with three production linkages, based on Hirschman's original linkage theory, to the aluminium industry as well as construction phase as a historical analysis. This dissertation primarily focuses on the production linkages to the minerals industry. However, given the number of people who currently do not have an access to formal employment nor higher education system in South Africa, some of the financial linkages as a community development scheme is also included in the analysis as shown below.

3.3 Methods

3.3.1 Data collection

This field research was conducted with the full support of the Richards Bay Industrial Development Zone (RBIDZ) in Richards Bay for 4 weeks between September and October in 2016. The initial interviewees were identified through the desktop research and the discussion with representatives from the RBIDZ. Further interviewees were added with a 'snowball method' based on the information obtained through the initial interviews.

Interviews were semi-structured with a brief introduction of the research background and questions to ask interviewee's role in their organisation, their understanding of sustainable development, and contributions of their organisation to sustainable development, especially in terms of human and social capital development. The questions were prepared with information available in published materials e.g. corporate annual report. Each interview was voice-recorded and transcribed afterwards for analysis with a prior consent from each interviewee.

3.3.2 Data analysis

Collected data were analysed with a framework of the five capitals model of sustainable development along with three identified linkages from the aluminium industry as well as construction phase (historical context) and CSI/ CSR as important financial linkages as shown in Table 4 below. The identified interviewees for each section is mapped in Table 4.

Table 4. Sustainability Analysis Framework

	Human Capital	Social Capital
Construction phase	(Literature review)	(Literature review)
Operation phase	South 32	South 32
- Downstream	DACT ABI (South 32) Isizinda	DACT ABI (South 32) Isizinda
- Upstream	South 32 Raizcorp HF Engineering LSG Group JS Day & Night	South 32 Raizcorp HF Engineering LSG Group JS Day & Night
- Side-stream	Bell Equipment uMfolozi College	Bell Equipment uMfolozi College
- CSI/ CSR Community Development	South 32 ZCBF/ZCCI	South 32 ZCBF/ZCCI

3.4 Research ethics

The author obtained free prior informed consent from the interviewees for each interview conducted. The information gathered from the interviews were used for academic purposes only in the preparation of this dissertation. The interviewees are not personally identified in this dissertation. Ethics clearance was obtained for the research ethics committee of the Faculty of Engineering and the Built Environment at UCT.

4 Case Study

This chapter starts with a brief history of the study area, Richards Bay, then is followed by a description of economic linkages to the aluminium industry based on a summary of interviews conducted with identified stakeholders. An analysis of the interviews with the Sustainability Analysis Framework shown in Table 4 is summarised in Table 6 and further explanation follows.

4.1 Background of the study area

4.1.1 Commencement of industrialisation in the 1970s

Richards Bay before the 1970s was a small fishing village and a vacationing spot surrounded by large tracts of land under commercial agricultural production of sugar cane and tree plantations. It is situated on a 30 square kilometre lagoon of the Mhlathuze River on the north-east coast of the province of KwaZulu-Natal approximately 180 km from Durban, the biggest city in the province. The area was originally a part of the Kingdom of Zululand until the outbreak of the Anglo-Zulu war and subsequent colonisation by the British Government. The name of Richards Bay was given by a Rear Admiral of the British Navy, Frederick William Richards, when he landed his ship to survey the coast during the war in 1879. British experts conducted various surveys in their desire to link the gold-rich Gauteng area by rail with Richards Bay and to establish bunker facilities for the British Navy. Although a hydrographic survey showed that Richards Bay offered the best alternatives to the established Durban Harbour, it was only in the early 1950s that interest to develop a new harbour was awakened when the country experienced rapid industrial growth and urgently needed new infrastructures.

As the consequences of a national government intervention to decentralise industrial areas into peripheral areas of the country, Richards Bay, after a series of feasibility studies conducted, was identified in 1971 as an ideal location to develop a port due to its natural deep-water lagoon, suitable for dredging and in close proximity to the Witbank coal mines area and related infrastructures. The port of Richards Bay officially opened on 1 April 1976, under the

ownership and management of a national port authority, Transnet National Ports Authority (TNPA). Although the port is one of the newest in the 8 operational commercial ports under the auspices of TNPA, it evolved into a key economic nodes within a relatively short period of time due to “the combination of specialised cargo handling facilities, fast vessel turnaround, deep-water infrastructure, excellent rail links to the hinterland and the large greenfield development potential (TNPA, n.d.)”. The port became the largest deep-water port on the African continent dedicated to bulk commodities handling and provided the impetus for the local coal industry to compete in the export coal market (Hill & Goodenough, 2005).

The new economic node development has been based on the abundance of the coal reserves in the country since the inception. Initial demand for the coal came from the Japanese steel industry when the Transvaal Coal Owners Association was awarded a contract to supply 27 Mt of coal to Japanese steel mills over 10 years. Initial export capacity was 12 Mt annually (RBCT, n.d.). Coal production capacity in South Africa has increased significantly since then. In 2014, 260 Mt of coal were extracted of which 69,6 Mt, worth R46,7 billion were exported and the remainder sold to the various local industries, with 53% used for electricity generation (Chamber of Mines of South Africa, n.d.; Eskom, n.d.). RBCT, today is the largest single export coal terminal in the world with the capacity to export 91 Mt per annum with an open storage of 7,8 Mt of coal and a 58 km conveyer belt system.

In addition to the positive contribution to the balance of payment and employment, coal provided 90,9% of the power generation in 2015/16 (equivalent to 114,8 Mt of coal burnt), by state-owned utility company, Eskom (Eskom, 2016). The abundance of the coal resources and over capacity of power generation in the late 1970s and 1980s (reserve margin of more than 40% at the time) enabled the one of the cheapest electricity supplies globally. As a result of the Industrial Development Corporation (IDC)’s active intervention and various incentives offered to attract capital- and energy- intensive industries, which could utilise the excess electricity, the catalyst for initial industrialisation in the region, the Alusaf (now South 32) Bayside Aluminium smelter was initiated.

The South African primary aluminium industry today consists of the Bayside and Hillside

Aluminium smelters both located in Richards Bay. Hillside is fully owned and operated by South 32 Limited while the older Bayside ceased smelting operations in FY2014 and the Bayside Casthouse part of the smelter was sold to a local Broad-Based Black Economic Empowerment (B-BBEE) consortium comprised of the major domestic aluminium semi-fabricator Hulamin and Isizinda Aluminium on 30 June 2015. The versatile metal is widely used in various industries in South Africa, ranging from packaging, building materials, electricity and automobiles, among other products due to its high strength to weight ratio, corrosion resistance, electrical conductivity and recyclability.

The Bayside smelter was established next to the port and started operation with an initial capacity of 50,000 t of primary aluminium production in 1971 and an expansion of approximately 50% capacity commissioned in 1974 totalled 75,000 t of production capacity, from which South Africa's total needs for primary aluminium metal was satisfied at the time. A Negotiated Price Agreement (NPA) on long-term electricity supply was used to share the risk of volatile aluminium prices and foreign exchange rates between US Dollar and South African Rand.

The uMhlathuze / Richards Bay area is also characterised with its rich endowments of mineral resources including ilmenite, rutile and leucoxene (used as titanium feedstocks), zircon and pig iron, which are mined as mineral sands on the coastal dune areas. The discovery of the heavy mineral deposits in Richards Bay was a consequence of another anchor project funded by the IDC for the prospecting of the area. Richards Bay Minerals (RBM), now a subsidiary of an international mining company, Rio Tinto, had started their Tisand mine in 1977. The Tisand mine has been shut down and rehabilitated and the company is currently operating the Zulti North mine. The company is also in a possession of a mining lease for the Zulti South mining area in the Southern part of the municipality. Additionally, Tronox, one of the largest producer of titanium dioxide in the world, has officially started their operation at the Fairbreeze Mine situated south of Mtunzini, which serves as a replacement of the already decommissioned Hillendale Mine just outside Ethikawini and continues supplying feedstock to the Central Processing Plant (CPC) in Empangeni.

4.1.2 Expansion in the 1990s

The South African political regime underwent a drastic change in the early 1990s. Despite the new government's decision to revise economic development policy inherited from the Apartheid regime, the aluminium industry experienced further expansion. This reflects that the artificial competitiveness created through the coal endowments and the cheap electricity had been reinforced by the government political support even after the democratisation. According to Corts and Wells (2003), it was the state-owned entity, Eskom, who initiated the discussion of building the Hillside Smelter in the midst of the lowest aluminium price at around \$1,300 while the company was even considering to shut down the Bayside Smelter altogether as it was not economically viable. A long-term price agreement to supply preferential electricity to the Hillside smelter was used to secure the investment and the tariff is proportional to the current aluminium price measured in US dollars per ton, and the rand/dollars exchange rate with a vision to absorb long-term fluctuation of aluminium prices. According to an analysis by Yelland (2013), the contract with a duration of 25 years commenced in 1995 and ends in 2020. It means that the artificially low electricity tariffs were enabled by the capital expenditures by state and taxpayers who continue to bear the costs over the years to come.

Backed by an investment of R7.2 billion, construction of the biggest smelter in the Southern Hemisphere, the Hillside Aluminium smelter for the export market started in 1993. It was the IDC who played a key role by facilitating foreign export credit finance and an R800 million loan for the project. It was one of the most significant projects of the nation as a high expectation from the first democratically elected president of South Africa, Nelson Mandela, was expressed in his speech at the opening ceremony of the Hillside smelter, saying “(the establishment of the smelter) inspires confidence in the future of South Africa (The Office of the President, 1996)”. As a result, the dependence of the local economy on this capital-intensive industry was increased in the midst of the economic liberalisation policy.

According to South 32, their smelting operation at the Hillside starts with the import of 1,400 ktpa of alumina (Al_2O_3) coming from Worsley Alumina in Perth, Australia. Other raw materials such as coke and pitch are also imported from overseas. At the smelter, alumina is

dissolved into molten synthetic cryolite in the reduction cells housed in the pot-rooms and strong electric current is induced to break the atomic bond between aluminium and oxygen. Molten aluminium precipitated at the cathode at the bottom of the electrolysis cell is periodically collected. This capital-intensive operation requires few operators on site while material handling is done by forklifts and overhead cranes. As a result, production costs comprises of more than half from imported input raw material costs and approximately a quarter are costs of electricity, supplied by Eskom. The smelting process is continuous and it requires capital costs and labour to stop the operation. Hence, reducing production volume results in essentially no savings in labour or other non-materials costs, which makes it difficult to control the amount of output. Due to its long-term investment cycle of smelter business and continuous improvement at the operation site, the Hillside still remains as one of the world's most advanced and efficient smelters, currently using the Aluminium Pechiney AP35 technology (South32, 2016). According to the South 32's annual report, the operating unit costs of the smelter in FY2016 was \$1,430 per ton of aluminium. Below is an outdated but still useful reference to an estimated cost structure of an average smelter in 1993.

Table 5. Estimated cost structure of average aluminium smelter in 1993 (\$/ metric ton) (CRU International quoted in Corts & Wells, 2003)

Electricity usage (kWh/t)	15,800
Electricity price (\$/kWh)	<u>0.02</u>
Total electricity cost	316
Alumina usage (t/t Al)	1.94
Alumina price (\$/t alumina)	<u>190</u>
Total alumina cost	369
Other raw materials	125
Plant power and fuel	10
Consumables	70
Maintenance	50

Labour	150
Freight	45
General and administrative	75
<u>Total operating costs</u>	<u>1,210</u>

The molten aluminium is cast into high-purity primary aluminium ingot for the export market and supplies a small portion of liquid metal to Isizinda Aluminium. Isizinda Aluminium currently operates only slab production part of the Casthouse under an agreement to receive molten metal directly from the Hillside Smelter. The semi-fabrication industry in South Africa has a longer history than primary aluminium production, which can be traced back to 1935, when Aluminium Limited of Canada (Alcan; now Hulamin) opened a sales office in South Africa and the first aluminium rolling mill in 1949 (Hulamin, n.d.). The established downstream aluminium industry in South Africa comprises of two major pre-fabrication companies, Hulamin in Pietermaritzburg and Wispeco Aluminium, producing rolled products, extrusion, rod, wire and castings and supplying to local industries such as automotive, packaging, construction, electrical and transport as well as for export market.

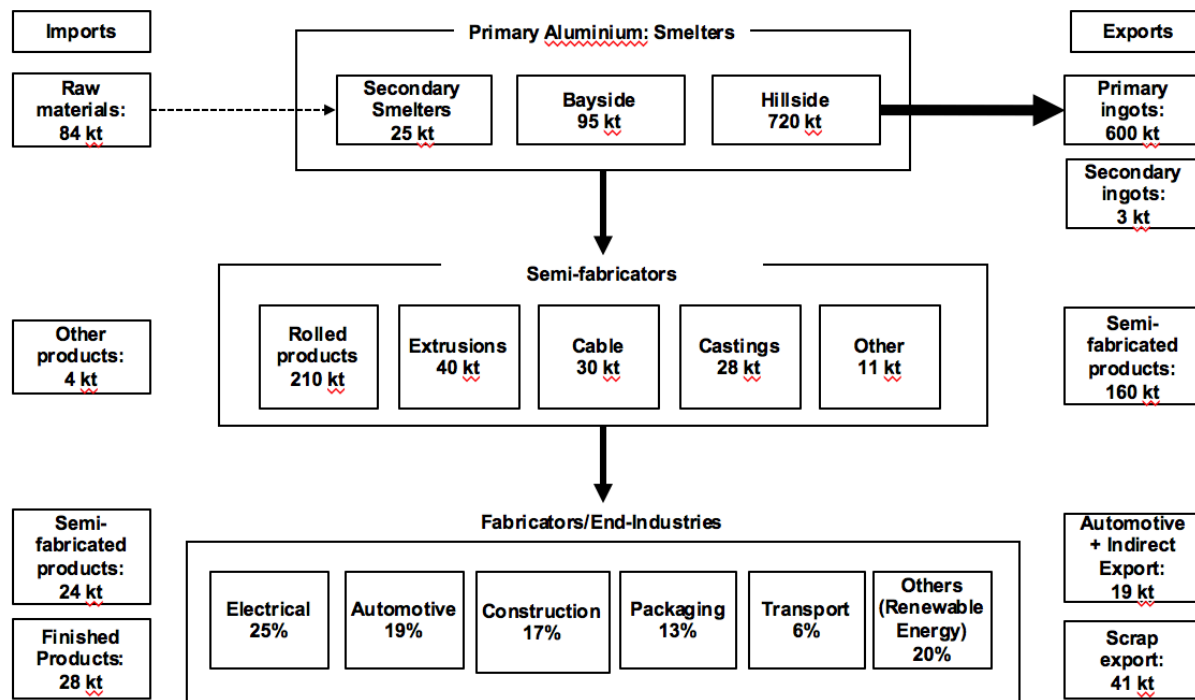


Figure 4. Detailed South African aluminium value chain (AFSA, 2013)

According to the Aluminium Federation of South Africa (AFSA), the primary aluminium metal production multiplies the value of domestic coal by 1,76 times through power generation and subsequent electricity consumption at the smelting processes in South Africa, generating positive R4,4 billion contributions to the country’s balance of payments in 2012 (R8,4 billion export of aluminium metal deducting R4 billion import of raw materials - alumina, petroleum, coke and pitch). The South African aluminium industry, the primary smelter and semi-fabricators combined, generated R21,8 billion in revenue and 6,043 employments in 2012 (AFSA, 2013). BHP Billiton Aluminium (now South 32) paid R780 million as corporate tax payment (average for 5 years), PAYE, UIF and SDL (Econometrix, 2012 cited in Mkhwanazi & Msimanga, 2013).

Although there is significant upside growth potential within the country and neighbouring countries driven by the economic growth and infrastructure development, currently more than 70% of primary aluminium is exported. This underpins calls for value addition activities; as the so-called ‘beneficiation’ policy has gained political popularity in South Africa.

Similar resource-based, energy-intensive and export-oriented industries followed the establishment of the Bayside Smelter and formed a group of globally competitive companies. Those companies are known as the ‘big 6’ of Richards Bay today; RBM, RBCT, Foskor, Ticor (now Tronox), BHP Billiton and Mondi Kraft. They are not directly connected in their processes nor competing in their products but all benefit from well-established power supply and bulk handling infrastructures. Furthermore, there is a remarkable emergence of an equipment supplier, Bell Equipment, recognised as a South African manufacturing icon, which supplies equipment and machinery to the local industry. The big 6 has contributed to the development of both commercial and residential infrastructures. According to Hill and Goodenough (2005), more than R50 billion has been invested in Richards Bay since 1976. Bulk infrastructure includes one airport and railway lines prevalent in the municipality, and the N2 highway traverses the area south to north from Durban to the Swaziland border, whilst the R34 Provincial Main Road passes west to east through another commercial area of Empangeni towards Melmoth.

As a result of the industrialisation, Richards Bay has become recognised as one of the few urban centres in the country. The Boardwalk Inkwazi Shopping Centre situated in the centre of the Richards Bay next to the Municipality office and other commercial offices has more than 160 shops in the 65,000 square metre complex and has a significant meaning to the local businesses and life style of the people. It functions not only as a major mini bus taxi rank normally congested with a number of informal traders but also as a venue for various social events like the King Cetswayo Designer Couture Competition and the Sizzle City Tourism *Indaba* (meaning important conference). Other important facilities include state-of-the-art health care centres such as the Netcare’s Bay Hospital (263 registered hospital beds) and a new John Ross Hospital worth R220 million investment currently under construction.

4.1.3 Post-electricity price surge in 2008

South African electricity prices had been low and declining for the past three decades until 2008 when Eskom was confronted with serious power shortages and urgent budgetary needs for power generation capacity building. According to a Deloitte survey, real electricity prices rose by 78% between 2008 and 2011 (Deloitte, 2012). Since then, economic sustainability of the South

African primary aluminium industry and their contribution to the socio-economic development of the country has been under question, especially after the downturn trend in the aluminium price since 2011.



Figure 5. Aluminium LME Spot Price, CIF UK Ports, US\$ per ton (IMF, 2017)

There has been increasing pressure over the long-term preferential electricity rates, especially as these have been seen to cause negative environmental impacts derived from the coal-fired electricity consumption and other harmful wastes generation. Besides, the aluminium industry has one of the lowest economic contribution per unit of energy consumed ratio. Non-ferrous metals, mostly comprised of aluminium manufacturing and gold mining, are the single largest consumers of electricity in South Africa, responsible for 25% of total consumption, but only have relatively small direct contribution to GDP at about 4% (Deloitte, 2012). The Hillside aluminium smelter consumed 1,14 GW of electricity in 2012, 2.8% of Eskom's net installed capacity, while generating 0,5% or R12 billion contribution to the South African GDP (Econometrix, 2012 cited in Yelland, 2013). Although one should not judge its rightfulness of the contract solely based on the current situation, there is little doubt that the long-term preferential contract deviates the incentive system to invest in more energy efficient technologies.

Despite the price surge, South African electricity tariffs still remain one of the lowest by

international standards. However, energy-intensive smelting businesses are vulnerable to electricity price hike because it is difficult to charge extra costs to their customers. Moreover, according to Porter (1990), a competitiveness of capital-intensive industries solely relying on cheap electricity prices will eventually be diminished as electricity prices goes up in accordance to economic growth and inflation. There is also a global commitment expressed at the COP21 in Paris to reduce carbon emission and adopt a carbon tax, which may imply a further electricity price surge in South Africa. The National Energy Regulator of South Africa (NERSA) is in a process to review an appropriateness of the long-term preferential contracts.

TATA Steel KZN ferrochrome plant established in Richards Bay in 2006, for example, halted its operation in response to the increasing electricity costs and low ferrochrome prices and subsequently sold out their operation. A green-field investment agreement to establish a 720 ktpa smelter at Coega, one of the IDZs in South Africa, by a world leading aluminium manufacturer, Alcan, was terminated after the electricity crisis (Mail & Guardian, 2009). Due to the growing input costs, the importance of the competitively priced electricity is even increasing. According to the AFSA (2013), the smelting production capacity in South Africa was decreased by 100 kt between 2008 and 2012, and more than 1,400 jobs were lost at the primary smelter and semi-fabricator level.

The South African aluminium industry is also confronted with fierce competition from emerging smelters in middle east countries such as UAE and Saudi Arabia based on a similar strategy to beneficiate locally available fossil fuel. The world largest aluminium manufacturer, Alcoa Inc., recently formed a joint venture with the Saudi Arabian Mining Company (known as Maaden) and produces 700,000 t of aluminium per annum since 2013, and the Gulf country council (GCC) region has shown rapid establishment as a global aluminium hub adding 1,290 kt between 2012 and 2014, and 2,000 kt by 2020 almost doubling its capacity with the latest technologies adopted (JOGMEC, 2015).

4.1.4 New economic landscape: IDZ

There is a large tract of land around the Richards Bay port and an expansion plan of the port,

likely to integrate it into the Richards Bay Industrial Development Zone (RBIDZ), is underway. The strategy is based on the historical export-oriented industries and beneficiation of mineral resources. It states that “the overall strategic objective of the RBIDZ is to promote competitiveness of South African enterprises through the export-led value added manufactured products and services with linkages to South Africa’s economy and natural resources (RBIDZ, n.d.)” Incentives available for the potential tenants include tax incentives, dedicated custom controlled area (CCA), allowance for infrastructure development and construction of a container handling facility. The role of the RBIDZ is mainly to obtain and manage the available lands suitable for investments and apply for environmental impact assessment (EIA) on behalf of potential investors and build necessary infrastructure including road and utilities. The RBIDZ is in a process to acquire the estimated 157 square kilometres of land encompassing the Bayside Casthouse with a view to incorporate the area into the IDZ in order to attract investment for aluminium and metals beneficiation activities. Initiatives other than metals beneficiation are in the field of marine industry development, renewable energy, agro-processing and ICT and techno-parks.

While the area is also rich in natural and archaeological resources, which are regarded as a potential to promote tourism, the tourism sector is seen rather as undeveloped. The area is situated within the Maputaland-Pondoland-Albany Biodiversity hotspot which contains 80% of the South Africa’s remaining forests and is recognised as the second richest floristic region in Africa (City of uMhlathuze, 2016). According to the South African National Biodiversity Institute, the uMhlathuze Municipal Area supports wild birdlife and many other significant flora and fauna, which includes a total of 174 Red Data species, the highest concentration in the country. The area is also inundated with a system of wetlands and natural water features such as Lakes Cubhu, Mzingazi, Nsezi and Nhlabane. Major rivers include the Mhlathuze and Nsezi. The Zululand Birding Route is rapidly gaining popularity in the area amongst local and foreign visitors and there is scope to further develop the avitourism niche, and this would provide significant economic spin-offs (Uthungulu, 2004 cited in Hill & Goodenough, 2005). Apart from the natural resources, the area is also blessed with cultural richness. A desktop survey indicated a total of 125 recorded archaeological sites, which range from the Stone Age Period to the recent historic period. However, the area is reported to have a “drive-through” and poor image, due to

the existence of the large processing plants and visual effects of emission coming from them and ‘un-sightliness’ of the large industries (Hill & Goodenough, 2005). At present, the tourism market is dominated by visits to friends and relatives (42%) and business tourism (24%) while Leisure tourism only account for 21% followed by medical/religious tourism (13%) (City of uMhlathuze, 2016).

4.2 Developmental Challenges

As reviewed in the previous section, the development path of the Richards Bay area was driven by the national decentralisation regime under the Apartheid government. After democratisation in 1994, many industry policies have undergone drastic changes to address the legacy of the unequal development patterns and unemployment issues. Local Economic Development (LED) was adopted to stimulate locally-driven, inclusive and sustainable employment opportunities. The Empangeni Arts and Crafts Centre was born out of this process, which was designed to benefit rural women in the area by providing a venue and exposure to produce and a point from which to sell their products. However, there was limited, if any, community consultation and participation prior and subsequent to the initiation of the project, hence it met with limited success that has been acknowledged by the LED committee.

The City of uMhlathuze has also put sustainable development as the top priority of their Integrated Development Plan (IDP) with their long term vision as “The Port City of uMhlathuze offering improved quality of life for all its citizens through sustainable development (City of uMhlathuze, 2016)”. Their policy objectives have been developed with consideration to the globally adopted sustainable development goals (SDGs). There is little doubt that implementing these well-depicted goals requires changing the historical unsustainable development path. Therefore, the current state of the challenges listed in the IDP in relationship to the aluminium industrial cluster is discussed in this section, focused on the socio-economic, and environmental spheres. While obvious infrastructure development in the past can be observable in the region, how the minerals cluster can contribute to sustainable development needs a review before further expansion.

4.2.1 Socio-Economic Challenges

Some of the key economic indicators of the municipality have shown improvements after industrialisation but there remain some challenges, especially social instability associated with inequality. According to the municipality's IDP, the unemployment rates have decreased from 40,6% in the 2001 census to 31% in 2011 and the youth unemployment rate dropped from 50,7% to 40,8% accordingly. Households on an income of less than R800 per month dropped from 46% down to 27,2%. However, the rate of unemployment and the current welfare dependency on grants and packages offered by the municipality is unsustainably high. A lack of public transportation system and the geographical legacy of the racially segregated living zones still impinge on the access to economic opportunities, especially for the historically disadvantaged citizens. The inequality measured in the Gini-coefficient was worsened from 0.59 in 1996 to 0.67 in 2008 (City of uMhlathuze, 2016).

Before the construction of the port and consequent developments, the population of Richards Bay had a growth rate of approximately 9% per annum which increased to 27,3% in 1980. It is clear that the development that occurred in Richards Bay since the 1970s provided many new employment opportunities in the town which drove population growth from 7,500 people in 1980 to over 50,000 today. The City of uMhlathuze has become the third largest economy in KwaZulu-Natal after Durban and Pietermaritzburg. The population at the uMhlathuze Municipality level increased at 7,7% per annum from 196,894 (1996) to 289,190 (2001). The population growth rate has declined since then and the City of uMhlathuze has recorded 334,459 people in 2011 census. Urban centres and industrial areas of the municipality are concentrated in Richards Bay and Empangeni. These urban areas are surrounded by residential towns of eSikhaleni, Ngwelezane, eNseleni, Vulindlela and Felixton as well as the Traditional Authority areas under Amakhosi Dube, Mkhwanazi, Khoza, Mbuyazi and Zungu. Although the employment rate in surrounding areas also grew at the same time, it was at a much slower rate than was experienced in Richards Bay (Stats SA, 2001).

Population influx and a lack of an urbanisation plan in the past have caused rapid urban sprawl with increased informal settlements, overcrowded public facilities, disturbed ecosystems

and negative impacts on environmental resources. The uMhlathuze municipal area is still characterised by a shortage of suitably well-located land for housing development. The total amount of estimated housing demand for the uMhlathuze Municipality can be calculated at 21,622. Besides, as a result of racially segregated settlement in the past and poorly planned infrastructure development, residential areas are still divided into the affluent urban centres like Meerensee for few people close to the port and the densely populated areas in the periphery. According to the municipality, 58% of the total population resides within Tribal areas, followed by Urban Area 39% and Farm Land 3% (City of uMhlathuze, 2016).

There is little doubt that affordable residences are needed for the workers employed in the commercial areas in the urban centre but well-located land for development are limited because large tract of lands are privately owned; some environmentally sensitive areas not suitable for development; and the lack of public infrastructures. Hence, urban densification is identified as an important developmental issue in the IDP to mitigate widespread poverty and deprivation in the neighbouring areas (City of uMhlathuze, 2016). Available public transportation is limited to mini-bus taxies operated by local entrepreneurs and some companies arrange their own transport for their employees from the city centre to the workplaces in Richards Bay. Railways are currently dedicated to only for transportation of bulk commodities, no passenger service is provided.

The general condition of basic education and healthcare of the people in the municipality has been improving. The education level in uMhlathuze is the highest in the District Municipality. Their primary education enrolment is at 91,7%, Matric 36,9% and higher education 7,3% accordingly in the previous census in 2011 (City of uMhlathuze, 2016). There is one local University, the University of Zululand. The Umfolozi College, a local public Further Education and Training (FET) college, has 6 campuses in the municipality (Central Office, Richtek, Nseleni, Esikhawini, ZCBF and Thubelihle) and provides a range of national business and engineering programmes which include the National Certificate (Vocational) and N4-N6 Diploma programmes. The Richtek Campus has a SETA accredited Trade Test Centre to offer trade tests and training for: electrician; fitter; fitter & turner; instrument mechanic; and ICDL (International Computer Drivers Licence). Despite the skills development institutions have been

established in the area, the low levels of skills development and literacy level have been still identified as a key challenge of the municipality. Besides, there has been a concerning trend of decline in the higher education enrolment (City of uMhlathuze, 2016).

Public infrastructure has been improved after the industrialisation of the area but some community members still experience limited access to basic services of water, electricity, sanitation, waste removal and social amenities. The municipality acknowledges the threats of diseases and environmental problems posed by water and sanitation backlogs. Illegal dumping is also identified as a serious issue in the region. Major medical problems in the region include hypertension, diabetes and tuberculosis. Sexually Transmitted infections remain a growing concern. According to the City of uMhulatuze, HIV/AIDS is in an epidemic state with the number of incidents increasing at an alarming rate affecting communities negatively (City of uMhlathuze, 2016). Shortage of basic health care facilities and human resources in the healthcare sector remains as a problem.

4.2.2 Environmental Challenges

The complicated geology and geomorphology of the area controls the transport and storage of water and influences the hydraulic functions of the ground water system. Furthermore, the soils are very permeable and almost all the rainfall infiltrates into the groundwater, where it is temporarily stored before being discharged into the streams, lakes and wetlands.

The minerals industry has several direct environmental impacts. For example, excavation of mineral sands by clearing topsoil and dredging causes coastal dune erosion. The aluminium smelter, although it minimises the use of water through a closed water system, impacts on water availability mainly as a coolant for casting. Fluoride-rich emission generated through the smelting operation is collected with scrubbers before emitted into air. Despite the operation under a controlled environment, the smelter is still perceived as health threats through air pollution as well as a degradation of the aesthetic value of the area, which is seen as a major obstacle for potential tourism (City of uMhlathuze, 2016). According to a respondent from the smelter, an operation with high environmental impacts, viz. dross treatment to recover

aluminium content, is currently taking place outside of Richards Bay because of the environmental sensitivity of its wetland. The smelters indirectly contribute to climate change through consumption of carbon intensive coal-fired electricity.

The low level coastal floodplain is subject to natural flooding, climate change and associated sea level rise, and may increase flood risks over time. An increasing trend in the frequency of cyclonic activity has also been observed. The most vulnerable at least 4,000 people are living in an informal settlement within the high flood risk zone between Mdlebe Ntshona Road and the Mzingwenya River. Illegal dumping of waste within streets and stormwater servitudes by the community increases the risk of overflows through blockages and create flooding of streets and properties (City of uMhlathuze, 2016).

As a result of the historical natural disasters, the municipality has formed the Disaster Management Advisory Forum with members from various sectors in the region including the head of Disaster Management Centre, representatives of line function departments in the municipality, traditional leaders, Councillor responsible for disaster management, Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs), private sector e.g. Chamber of Business, and research institutions that can provide scientific and technological advice (City of uMhlathuze, 2016). This forum is one of the few example of well represented cooperation amongst stakeholders in the region.

The heavy industries affect negatively on the already constrained water resource of the region, depending on fresh water supply primarily from the Lake Mzigazi. The KZN province was declared as a disaster area after being hit by a severe drought since October 2014. Despite the large extent of lands still underdeveloped in the region, lands suitable for farming is limited and expanding commercial lands pose threats to the food security of the people relying on subsistence farming (City of uMhlathuze, 2016).

4.3 Economic linkages to the Aluminium smelters in Richards Bay

Given the historical background and the current developmental challenges within the municipality, this research sets out to determine what human and social capital development contributions have and are being made by the two aluminium smelters in Richards Bay. This investigated through interviews with ABI (South 32), Bell Equipment, DACT, Isizinda Aluminium, local aluminium fabricators, Raizcorp, RBIDZ, South 32, uMfolozi TVET, ZCBF and ZCCI. This section is comprised of the data collected with the interviews, except the section 4.3.1. on the construction phase which is based on the data collected from literature. The detail of each interviewee is described in each section. As mentioned in the Chapter 3: Methodology, the dissertation primarily focuses on the production linkages as it is the contributions from the core businesses of the minerals industry. The activities of the smelter owners are described in section 4.3.2., followed by accounts of activities downstream (4.3.3.), upstream (4.3.4.) and side-stream (4.3.5.) thereof. Whether a company should directly invest into what the public sector is responsible for e.g. building schools and hospitals, is well-contested matter. However, it is a widely implemented practice in the minerals industry in the South African context; section 4.3.6. thus evaluates the CSI/CSR and Community development activities as a part of the financial linkages to the mineral industry.

4.3.1 Construction phase

(This section is based on the data from literature)

Aniruth and Barnes (1998) argue that the large anchor projects since the 1970s such as the Alusaf (now South 32) Aluminium Smelters had brought a significant number of employments into the construction sector. By the end of the Hillside Smelter construction project in 2004, the company had trained approximately 2,400 construction workers in various skills in conjunction with the Department of Labour. However, the positive impact of the investment on the local economy can be discounted by the fact that the supplying industry to the construction company had often come from larger cities outside of the area and they had often “enjoyed the patronage of the large industries at the expense of small local entrepreneurs (Aniruth & Barnes, 1998)”. Walker and Jourdan (2003) also reported the employment to have been temporal and that construction was followed by slumps in the number of permanent employees once the construction phase was completed.

4.3.2 Operation phase (South 32)

According to Kaiser and Waal (1977), prior to the Alusaf Bayside Aluminium, South Africa had no specific knowledge, expertise, and skills pertaining to the reduction of aluminium available and it was deeply due to the consultation from a foreign company that enabled the incorporation of the latest design concepts into the processes and techniques.

A respondent from the Human Resource Development division of South 32 answered to the interview. According to the respondent, the Hillside operation comprises of approximately 1,300 permanent employees and 900 contingent contract workers. The permanent employees range between the various skills categories: operators, artisans (maintenance), professionals (engineering, finance, etc.) and managements. Due to the unique skills required at aluminium smelting operation, the company has established in-house training and mentorship system across the spectrum of skill levels. All candidates are required to have matric in math and science, and additionally drivers licence for operators. The in-house training starts with safety induction and legal compliance courses, followed by production-related technical trainings and leadership and supervisory development trainings done in accordance for each skills category and individuals' attainment level.

Operator is regarded as an entry level job of the company and due to the company's policy to give priority to hire from the local community, currently almost all of the over 600 operator positions are filled with the local citizens of the municipality. Those entrants receive technical training courses to be able to safely handle machineries on site. The company has been contributing their employees to obtain licenses for legislated vehicles such as overhead crane and forklift. Other legislated technical trainings include understanding of the work in confined spaces and in height, first aid trainings as well as legal liability trainings. Some equipment-specific trainings are provided jointly with the company's OEM suppliers.

Artisans come with necessary skills obtained predominantly through local TVET and are trained to learn equipment specific maintenance skills on site. According to the respondent, the

company hire more than 70% out of the around 200 artisans from the local municipality. The scarce skills need to be sourced from outside of the area include high voltage electricians, predominantly sourced from the Gauteng area, where power stations are concentrated, as well as other specialised skills like instrumental mechanics and automation engineers. In order to cater for the operation- specific requirement, the company has been contributing to create a skill pool of qualified artisans combining in the field of electrical, mechanical and instrumentational engineering. Some of the highly specialised trainings are done by engineering companies. Apart from the training courses, the company has a mentorship system, of which ex-workers endorses one of the best learning opportunities in separate interviews.

Professionals are those who work as superintendents of the operation site and other supportive staff of the company. Their skills and traits normally comprise of a University degree such as in engineering, business management, IT and finance, etc. At the time of the interview, around 60% of the professionals come from the local area out of the approximately 100 employees. According to the respondent, a lot of local people wish to stay in Richards Bay due to the unique life style of the area, and that is why the company can even source more than half of the highly portable professional skills locally. Some specialised aluminium production trainings are held at institutions overseas such as at the Department of Materials Science and Engineering at the Norwegian University of Science and Technology, and University of Auckland Light Metals Research Centre.

In addition to the training programmes, there is a study assistance programme available for any employees and they can continue formal education in the fields related to their work such as engineering at TVETs and Universities fully sponsored by the company.

Apart from the trainings for their own employees, there are opportunities accessible from outside of the company. The apprenticeship programme, for example, provides opportunities for practical experiences for those who are outside of the company as well as current employees who wish to obtain new skills in order to convert themselves into other positions e.g. from operator to engineer. The programme fulfils a partial requirement of the merSETA (manufacturing, engineering and related Sector Education and Training Authority) qualification system and

conducted at the local TVET for a maximum period of 4 years. Minimum requirements for candidates are dictated by merSETA and currently, 60 apprenticeships including 25 employees are registered in the programme. Other external contributions include a 2-year graduate programme as a practical training for and potential recruitment of professional engineers. The community-based bursary fund is available for grade 11&12s and University students, and the company, at the time of the interview, supports 33 bursars who will be potentially hired by the company in the future. A learnership programme specially designed for disabled people is available and currently approximately 30 participants are registered at the centre based in Durban.

Historically, the company brought various kinds of artisans into the region for the initiation of the operation and then also raised a number of trained artisans locally, who were eventually “poached” by other capital-intensive industries in the same region in the past. According to the interviewee, such free-riding from the local industries has calmed down and is not as bad as in the past, as the other industries have developed their own skill pool. However, more recently, migration of skilled artisans and process engineers abroad took place during the aluminium price boom and emergence of new smelters in Middle East countries. It is not unusual in the industry since the reduction process of aluminium production can only be learnt at aluminium smelters.

South 32 used to have their own training centre, however it was disbanded during the aluminium price slump as it was regarded as a non-core business. The representative sees the situation unfortunate but it is costly for one company to run a training centre, though the cyclical aluminium price trend might eventually bring back the centre into life again in the future. Collective actions to raise skills pool as a community used to happen in the past, such as a training forum initiated by the Zululand Chamber of Business Foundation (ZCBF), but there is no longer such active initiatives (the detail of the training forum and the foundation is explained more in detail in [4.3.6.2. ZCBF / ZCCI](#)). The representative feels that there are many untapped opportunities for community-based collaboration, especially there are urgent needs of high quality basic education, which all the companies in the region can benefit from. Recently, the company faces more needs to provide basic education such as English literature trainings to their new employees.

The respondent understands that such collaboration does not occur so often because each company in the region has their own human resource development structure and is preoccupied with their own issues. It was also mentioned that the resource-based industries in the region are vulnerable to commodity price fluctuation and tend to be more self-interested than in collective actions. Although, the heads of the major companies in the region sometimes gather for meetings including ones at the local chamber of businesses and the KZN Growth Coalition, the cooperative programme generated from the discussion has been limited to natural disaster response. The respondent mentioned a recent example that an emerging partnership to supply semi-treated water from one company to another who does not require further treatment for their operation over the recent drought in the region.

4.3.3 Downstream

4.3.3.1 Downstream Aluminium Centre of Technology (DACT)

Alusaf (now South 32) launched the Downstream Aluminium Pilot Project (DAPP) housed in the Zululand Chamber of Business Foundation (ZCBF) in 2000 as a part of its socio-economic development programmes. Thereafter, the DACT was established as an incubation centre to further provide necessary supports for the trained entrepreneurs with its “main objective to assist potential entrepreneurs from local and emerging communities with the establishment and management of their own manufacturing enterprises from infancy through to ultimate independence (DACT, n.d.)”. Initially it was targeted to develop aluminium casting products for both local and international market.

Supporting bodies of the DACT include the DTI and SEDA Technology Programme (STP), South 32, uMhlathuze municipality, uThungulu District Municipality, RBIDZ, TVET college and CSIR. There are equipped physical spaces and a board room for meetings, and business and technical skills workshops held occasionally, and mentorships are available at the DACT’s R8 million facility in the ZCBF Community Park in Richards Bay (SEDA, n.d.). The DACT incubation programme is sector specific in metals fabrication, welding and casting. The candidates are required to be South African citizens and to have their existing businesses or ideas

in the metals fabrication industry. The successful candidates selected by the DACT committee will go through a 3-month pre-incubation phase to further assess their commitment. The selected incubatees have access to various benefits of the DACT for 3 years at subsidised rates and additional 3 years with market related rates.

The DACT employs seven staff, comprised of a centre manager, 1 business expert and 2 technical experts and 3 support staff. Thirty companies from Richards Bay and surrounding areas are listed on the DACT website as clients, however the centre has 92 clients on the list. According to the respondent, the SEDA's aim is to achieve 125 companies listed on the list. The DACT does not have a function to directly fund companies and can only assist to connect these companies with existing financial organisations in the region. With its limitation of the facilities and the experts in certain fields, technical skills workshops are arranged in cooperation with other institutions such as the University of Johannesburg Metals Casting Technology Station, merSETA, private engineering companies and local TVETs.

Telephonic interviews were conducted with 24 local entrepreneurs answering to the call, out of the 30 companies listed on the DACT website. According to their answer, most of the entrepreneurs have basic education (matric level) and basic welding and casting skills either learnt through formal schooling at TVET or through informal knowledge transfer from their relatives. The size of their companies are micro scale and the number of employees on average is 3. Their businesses are mainly in the construction industry in the vicinity such as supplying window frames, sliding doors, burglar bars and ornaments into both construction companies and individual households. However, because of the limited demand in the local market and increasing competition through imitation of the business, some of the entrepreneurs had to move to other areas and others struggle to maintain stable income.

According to the respondent from the DACT, collaborations between entrepreneurs have been limited to non-existent, although there have been a number of clustering activities organised by the DACT to get them know each other and to potentially form a consortium to apply for a tender. Possible obstacles for the cooperation mentioned by the respondent was that the entrepreneurs are afraid to work together because of low level of trust in each other and some

prefer to stay at a small scale due to their risk avoidance nature.

The DACT, as a non-profit organisation registered in terms of Section 21 of the Companies Act in 2005, has primarily focused on providing necessary supports for people in need to make their own living, and recently been tasked by the SEDA to further develop entrepreneurs who can meet industrial demands at a much larger scale in the area. Therefore, the DACT has been working with the RBIDZ to integrate the new incubation programme into the Aluminium (Metals) Hub initiative with advanced equipment to cater for the more complicated fabrication demand. This is still in the planning phase at the time of the interviews and still to happen.

4.3.3.2 Aluminium Beneficiation Initiative (ABI)

South 32 and its biggest domestic customer, Hulamin, jointly established the ABI in 2015 to supplement the DACT's initiative and further develop aluminium downstream activities especially by linking industrial demand both within the region and in other major cities in South Africa. According to a feasibility research conducted for ABI, currently 400 permanent jobs have been created in the local aluminium downstream beneficiation activities mostly in production of construction materials such as aluminium window frames, sliding doors and burglar bars (Nyandeni, n.d.). The ABI has established a website for potential candidates can register their businesses. Within 3 years, the ABI aims to identify and support 100 entrepreneurs with technical trainings and funding scheme up to the point where each of them can eventually consume at least 100 tons of domestically produced aluminium annually. Referring to a global bench mark on the number of jobs created per ton of aluminium consumption in the aluminium downstream sector; 1 ton = 3 employment, ABI expects to create 30,000 new jobs over the initial 3 years and additional 60,000 new jobs in the following 6 years (Nyandeni, n.d.).

According to the respondent from South 32, the supporting structure of the ABI is similar to that of the DACT with technical support and facilitating to available funding schemes but their targeted candidates are potential industrial suppliers and end-products manufacturers with more advanced skills. According to the ABI's website, the Small Enterprise Financial Agency (SEFA) has committed to support this initiative by setting up an Aluminium Fund to the value of

R80 million. A feasibility study of the initiative tasked to South African universities identified that no direct supply of aluminium metals to local fabricators was one of the obstacles, which lead to the establishment of Isizinda Aluminium.

4.3.3.3 Isizinda Aluminium

Isizinda Aluminium has taken over the operation of the Casthouse part of the Bayside smelter in 2014 and most of the employees at the company previously worked for South 32. The company receives production related technological supports from South 32 and Hulamin, and receive molten aluminium from the Hillside smelter, approximately 15% of their total aluminium production, to be solidified by the anchor casthouse into shapes, which are supplied to Hulamin in Pietermaritzburg for further fabrication.

The company has taken over the role as a domestic aluminium distribution centre and been working to develop local aluminium downstream fabricators in Richards Bay in close partnership with the RBIDZ. They have been discussing to develop an Aluminium (Metals) hub at the Bayside smelter. Just-in-time liquid aluminium deliveries is known to give cost advantage through reduction of heat, energy and metal losses to the downstream fabricators but its implementation is highly dependent on the types and sizes of their operation. The company also expects that some recycling of aluminium can take place within the area, as the hub can potentially create a scale of economy for aluminium consumption in the area. The development of the hub is still under discussion and planning phase. Therefore, it is still not clear what their contributions can be to human and social capital, other than taking over the previous casting operation from South 32 and continuing aluminium metal supply into the domestic downstream industry.

4.3.4 Upstream

According to BHP Billiton (now South 32), in 2012 R4.2 billion was spent on local suppliers, including a large portion for electricity from Eskom (Mkhwanazi & Msimanga, 2013). Approximately 7,000 people have benefited directly or indirectly from employment opportunities at companies associated with the smelter. It is highly visible that engineering

companies are gathered in the vicinity of the smelter and other plants in the area like Alton industrial area in the heart of Richards Bay. Currently, there are 150 companies registered on the member list of the local business chamber, Zululand Chamber of Commerce and Industry (ZCCI). According to the list, 34 companies (24%) belongs to engineering service and inputs suppliers, followed by logistics 23 (15%), construction 19 (13%), and other supporting services namely: finance 6, catering 6, property management 5, cleaning 5, labour brokers 4, legal 4, security 3 and waste management 2. In terms of human capital development, 7 companies are listed as training and business incubation providers including Raizcorp (which is fully funded by South 32).

4.3.4.1 South 32

An interview was conducted with a respondent from the Procurement, Enterprise and Supplier Development division of South 32. According to the respondent, historically, there was a time that the company focused primarily on a fewer and larger companies as their contract suppliers. This was primarily because the capital-intensive smelting operation is inevitably associated with high risk operation environment e.g. handling of hazardous materials on the one hand, and risk-averse corporate culture due to the high reputational risks on investments on the other. Besides, the multinational company has a large network of suppliers and service providers network both nationally and internationally, and tends to choose companies who have done services to them before. The larger size of the suppliers also gives cost advantage to the company by buying bulk of consumables e.g. refractory materials, fuel, lubricant etc.

However, the situation changed after the National Transformation Agenda as enacted in the B-BBEE Act and the Mining Charter first came out. Since then, the company has entered into the phase of enterprise and supplier development (ESD) in the host community, and established South 32-Hillside Aluminium Enterprise Development Village in 2013 next to the Hillside Aluminium Smelter complex in Richards Bay. This business incubation centre has been operated by a private company, Raizcorp, who provides business trainings and advises to develop local capability. According to the interviewee, the centre is open to anyone in the area (see more detail in the following section: [4.3.4.2. Raizcorp](#)). The business incubation programme is well integrated into the ESD programme of the company and those who have not satisfied the

requirement of South 32 are recommended to attend the incubation programme.

The respondent mentioned that South 32 had proactively extended opportunities for local enterprises to be able to become their suppliers by providing necessary funding and mentorship programmes both in-house and through Raizcorp and has been contributing to raise local suppliers' capability up to the level of the company's requirement. There is also a portal website, Intsika (<http://www.south32intsika.net/>), where potential local suppliers can register their businesses for the ease of the application to the tendering process. Access to internet and necessary assistance for the procedure are also available at their walk-in ESD centre at the office in Richards Bay. It was stated that South 32 can now source a fair amount of the suppliers and service providers to the Aluminium Smelter complex locally.

In response to the introduction of the amended Codes of Good Practice for B-BBEE, which came into effect on 1 May 2015, focusing more on linkages to the local economy through local procurement, the company, at a high level, had further committed themselves to increase drastically the portion of their local supplier base. They have adopted a corporate (not operational) level strategy for the local procurement of raw material, which has enabled to create aggregate demands for their entire 9 operations in the region, South Africa and Mozambique. There is dedicated personnel at the headquarter to look after sustainability issues of their supply chain and local procurement opportunities.

Although certain level of success of the past programmes, the respondent sees it another level of challenge to achieve the ambitious targets because of the current local capability gap in their skills, financial capability, understanding and culture of safety on the one side, and limited human resources of the company to look after them on the other. The company has been approaching the target by unbundling the tendering process into smaller pieces so that lower safety risk tasks can be tendered to local suppliers, and encourage main-contractor to source subcontractors locally where they can. There is also a programme planned to commence within 2-week time from the interview, which a procurement team from the regional headquarter in Johannesburg comes for business "speed-dating" with local service providers to discuss potential supplier contracts.

According to the respondent, more than 70% of specialised services such as a maintenance of equipment and machinery remain sourced outside of the region mainly done by multinational OEM companies. Another challenge mentioned is to find local female headed companies for their suppliers since the local capital-intensive industries are currently male-dominated.

4.3.4.2 Raizcorp

According to a respondent from Raizcorp, the incubation programme has been providing business skills trainings and mentorships for already existing businesses with the costs fully funded by South 32. The candidates are selected through the assessment of their commitment level. Although the incubation programme is not sector specific, the participants are predominantly in engineering jobs as the centre prioritises the companies who could potentially become suppliers to the local industries. The selected participants receive weekly lectures on business skills and co-learning sessions amongst each other for 12 months' cycle up to 3 years, however there is no obligation for the participants to continue to 2nd and 3rd years.

The registered companies have already succeeded to scale up their businesses significantly. For example, the 8 companies currently registered for the 2nd year of their programme have created 64 new jobs from 37 to 101, and generated approximately R19 million turnover, 142% increase for the past 18 months since the beginning of their programme. The incubation centre has no direct funding mechanism to entrepreneurs but they facilitate applications to funding organisations. According to the respondent, this has been an important part of the programme since the banks in the region previously had little interest in lending money to the local SMMEs and were preoccupied with dealing a few major corporations and public sector in the region.

There has been an emerging trend that ex-Hillside employees through the incubation programme become independent service providers not only to the Hillside Aluminium Smelter but also to other companies both within the Richards Bay area and other areas, and creating new employment in the greater Richards Bay area. As the spin-off companies employ and train a

greater number of people from the region, technology spill-overs impacts positively on human capital development. The respondent of Raizcorp emphasised that these successful entrepreneurs work not only as technical training providing mechanisms but also as role models to aspire and as mentorships to navigate younger generations. Some of the successful stories are shared with the local chamber of businesses as well as with citizens more broadly through the local TV, radio and printed media. The importance of the role model was confirmed with an entrepreneur, who added to the point that entrepreneurship in the region is generally lacking and people in the area tend to wait for government financial support. Besides, as the centre has become to be a central point of information about the skills supply and demand in the local industries, the centre has been playing a role to aggregate skills demands coming from the local industries and request to develop them at the local University and TVET.

It is noteworthy that companies in other sectors in Richards Bay also invest in human capital development through business incubation centre, e.g. Mondi Zimele funded by Mondi and Shanduka Black Umbrella funded by Transnet. According to the respondent from the Raizcorp, there has been no collaboration with other incubation centres by the time of the interview.

4.3.4.3 HF Engineering

HF Engineering is a company established by two former employees of South 32 in 2014. With an extensive experience as high-voltage electricians, they found a niche market to start their own business and chose early retirement. According to a respondent, it was the South 32's in-house training and mentorship programmes that helped developing their capability up to the level of an independent service provider but they initially decided not to depend on South 32 as a major customer. HF Engineering successfully received contracts to install electrical equipment from local companies like Mondi, Transnet and Engen as well as the uMhlatuzi Municipality amongst others.

The company has grown rapidly since and now employs 32 workers, including 6 of them who work at South 32 on a 3-year term contract. The company has recently formed a partnership with a local TVET college and has taken 3 electrical engineers from them for internships. The

costs of the initial 18 months of the programme is currently covered by merSETA and this partnership aims to provide practical trainings for the students' skills to meet industry's requirement. According to the respondent of the company, this partnership has been mutually beneficial as the company can potentially hire some of the interns.

4.3.4.4 LSG Group

LSG Group is another start-up company founded by an ex-Hillside employee who used to work at the Hillside Smelter for 18 years. The company provides rigging and security services to companies both within the local area and outside areas as far as Johannesburg. The company currently employs 32 people, mostly from the local region. According to a respondent, the company was awarded a rigging and security service contract to Foskor's water pump installation project.

4.3.4.5 JS Day & Night

JS Day & Night is a company started by a DACT graduate. According to a respondent, she learnt necessary skills through the DACT and her husband who works as an engineer at a local company. Since the company received funding for purchasing equipment from the SEDA, the respondent started working at her own workshop. The company currently employs 1 permanent and additional 3 contingent workers, they comprise of qualification in boiler making, argon welding and others, who recently have been retrenched from local large companies.

Although the company originally started producing aluminium casting products, there was a significant demand decline in the aluminium casting products. Hence, the company started to focus more on engineering services and manufacturing industrial products such as engineering tools, pipes and nozzles for the neighbouring plants. The company is looking for an additional funding to buy more machinery to meet higher requirement from the industry. Although they see themselves as technically competent enough for supplying to the local industries, they experience larger suppliers are often preferred due to their name value and financial capability.

4.3.5 Side stream

Accumulation of the capital industry in the region itself can be seen as a side stream development through common infrastructure development e.g. railway, port, power line, engineering skills etc. There are also some companies in service industries such as in accommodation, catering, cleaning and security; and these companies have strong job creation capacity for low skilled people. However, there is little doubt the region still needs industrialisation, which can replace the current resource-based industries and create much more inclusive and sustainable jobs in the long run. In this section, the interviews with a leading manufacturing company in South Africa, Bell Equipment, and local TVET college, uMfolozi College, are introduced for possible side stream development.

4.3.5.1 Bell Equipment

Bell equipment in Richards Bay is known as a manufacturing icon of South Africa and one of the leading exporters of capital equipment. It is a classic example of side stream initially designed to supply and to cater to technical challenges in one industry; however, expanded into other technologically similar industries (Kaplinsky & Mhlongo, 1997 cited in Walker & Jourdan, 2003). The family business started in agricultural machinery production for local cane-cutting and loading. The company has expanded to respond to the demand for heavy equipment like articulated dump trucks from the local timber, construction and mining industry. Their products are now sold internationally, predominantly in European, North American and Sub-Saharan African markets. The company also has an extensive range of OEM partnerships with major earth moving, mining, and agricultural equipment manufacturers.

According to a respondent, the company's operation at their factory in Richards Bay includes; design, fabrication of some components, assembling, and remanufacturing (refurbishment of used products). In order to cater for their specific needs, they have developed their in-house training programmes for various artisanal skills in forging, casting and welding amongst others. Therefore, even if the candidates have no basic artisanal skills but have an aptitude and basic educational background (matric in math, science and English), they can join the company and develop their skills through the in-house training programme. According to the respondent, the company has the largest number of welders in the region and their retention rates

are high due to the company's high salary standard compared to the other companies; however, more portable and demanding skills like diesel mechanics have fairly high attrition rates. Apart from the artisanal skills, Bell Equipment is one of the few companies who has R&D function which utilises professional level engineers in Richards Bay, and the company employs 70 in-house engineers coming from major cities in the country.

After the extensive feasibility study done by the company, they found that domestic fabricators are not competitive enough as their suppliers in terms of their quality, cost, and delivery (QCD) standards. As a result, all the aluminium casting components are currently imported from an Eastern European country, and a large portion of the other forged and casted metal components are imported from European countries. As the largest purchaser of manufactured semi-products in the region, the company sees themselves still too small to develop a local skills pool of manufacturing talents and component suppliers. The respondent mentioned that more rigorous policy supports for local supplier development are needed such as local procurement requirements seen in other emerging economies.

The company has been working with the local TVET to jointly develop some of the advanced skills but it has been challenging as the local demand for the skills are too small to make sizeable and sustainable training programmes. On the rise of emerging technologies like automation and mechanisation, the company expects it difficult to source skills like software and systems engineers not only from Richards Bay but also from the nation as a whole.

South Africa is known to have a small ratio of engineers per capita 1:3166, compared to other emerging economies like 1:227 for Brazil 1:130, for China 1:157 and for India (Ramdoos, 2015) The University of Zululand does not have a faculty of the most relevant subjects to the local heavy industries (mechanical, electrical and chemical engineering etc.), which can potentially contribute to lateral migrations of the technological skills pool.

4.3.5.2 uMfolozi College

Respondents from the local TVET college answered to an interview and introduced some of their activities for developing side stream and their contributions towards industrialisation as a

training institute. The college has been aware of the importance of developing new industries and currently offers relevant courses for renewable energies. The respondent sees there are opportunities for local companies not only to install and optimise energy systems but also manufacturing to some part. For example, when they installed solar panels imported from an Asian country, half of them were blown off from the roof because of the harsh climate condition and the different roof structure. Hence, they realised the needs that products must be localised to the specific conditions and demands.

Referring to their recent visit to a TVET college in Germany, who provides customised industrial equipment to the local automotive industry, the college staff realised that some practical trainings of their manufacturing related skills can be integrated as a part of joint business with the local companies. The respondent added, it would be more sustainable if the industry could take up some of the graduate as their employees at a continuous rate. However, such potential collaboration with local industries has not been fully realised, and the respondents hope some 3rd parties can facilitate to create more workable linkages. Besides, there is an issue of funding for the current joint training initiatives, which solely relies on public funding including from merSETA and National Skills Fund (NSF) at the moment, and the fluctuation in the budget prohibits to form sustainable relationships with local industries and maintain continuity of their curriculum.

4.3.6 CSI/CSR and Community development

4.3.6.1 South 32

South 32 has been aware of its challenges of creating direct jobs in the local communities and responded to it by investing into socio-economic programmes categorised as Corporate Social Investment (CSI) and Corporate Social Responsibility (CSR) activities. According to their annual reports, South 32 had spent R290 million on the Community Development programmes ranging from enterprise development supporting local entrepreneurs (69%), health (11%), education (9%), community development (6%), environment (3%) and sports & recreation (2%). Their early childhood and education programs benefitted 9,800 children per year in the uThungulu District between 2008-2012 (some of the initiatives are explained in more detail in other sections of this chapter), and the company had spent nearly R6 million over the 5 years on

the Ongoye Carbon Sink project, a community-based climate change mitigation programme to offset their carbon footprint from the operations by sponsoring 326 “Tree-peneurs” from the Mzimela Community.

According to a respondent from the Stakeholder Relationship division of South 32, the company regards healthy communities as bases of their successful operations and the community development programmes are well integrated into their own corporate human resource development as well as local enterprise and supplier development programmes. The company has been contributing to build a teacher college, schools and early child development centres in partnerships with the local governments. However, the company often faces challenges when the responsibilities of the governments e.g. management of schools, trainings of high quality teachers, are not fulfilled. According to the respondent, it makes it difficult to sustain the programmes as the company’s South African operations in general, faces constant social pressure and reputational risks from the communities surrounding their operation sites because of their highly visible existence in these areas. Besides, the general public in their operating areas normally expect immediate job and income creation, but not long-term trainings and educational programmes. In this regards, the respondent emphasised the importance of the responsibilities of the government in the long-term human capital development.

According to the respondent, the other major companies in Richards Bay also provide their own CSR programmes but there is no aligning mechanism between them. The respondent has been approaching other companies for potential collaboration but there have not been satisfying results. He says “(the situation) is unfortunate because there is a lot of common skills that are required across all the major industries that could have evolved if we have more collaborative approach.” According to the respondent, the reason for this is not clear, given these companies are not directly competing in their businesses. However, the respondent pointed out that corporate pride is one of the obstacles and he constantly faces the challenge of “who initiated the project matters to other companies”. For example, the crime prevention initiative, which can be regarded as neutral and beneficial to any kind of local businesses, started by South 32 to sponsor bicycles for patrolling the area was terminated since no other company joined the initiative as “it is South 32’s initiative”, even after a number of attempt to persuade them, and

it turned out to be too costly for a company to sustain. The respondent expects such collective actions could be more successful if a neutral organisation could take initiatives.

4.3.6.2 ZCBF / ZCCI

According to their history, the Zululand Chamber of Commerce & Industry (ZCCI) has a long history as a local chamber since 1926 (ZCCI, n.d.). The predecessor organisation, the Zululand Chamber of Businesses (ZCB) contributed towards the establishment of the Zululand Chamber of Business Foundation (ZCBF), and currently both the ZCCI and the ZCBF are located in the centre of Richards Bay but autonomous to each other. The ZCBF had played the most important facilitating roles to connect business activities and community development in the past. Their significance is still evidenced in their nationally and internationally awarded Community Park, which hosts various kinds of learning, training and science centres, functions venues, rental office spaces, financial institutes and incubation centres. Their active training forum was regarded as one of the most functional human capital development initiative from the local industries, however it is no longer operational.

From its inception, ZCBF was a successful example of the few collective action taken between the stakeholders in the region. According to their history, the Lower Umfolozi Peace Accord was initiated by the business community when “political violence threatened Zululand’s stability in the late 1980s, and it drew together political, business and community leaders. Subsequently, the networks established by the Peace Accord were used to rebuild the communities when extensive floods hit the same area in 1985 and 1987. This was achieved through the Zululand Rural Foundation (ZRF), which received assistance from the local business community. This crisis further drew attention to the region’s underlying problems of rural poverty and a lack of basic resources. The ZRF resolved to focus on the broader socio-economic problems of the region, and merged with other existing initiatives to form the ZCBF” (ZCBF, n.d.).

Since then, local businesses had entrusted their CSI into the ZCBF (ZCB) as the representative body of the local community’s interests. Most coordination efforts occurred through the ZCB who administers various forums and committees such as the Joint Development

Form (JDF), which consists of representatives from the Industrial Development Zone (IDZ), Business Women’s Association (BWA), Black Management Forum (BMF), the Uthungulu District Municipality and the uMhlathuze Municipality. Business Against Crime was a partnership facilitated by the Chamber between the police and the business community as a crime prevention initiative.

The ZCBF also facilitated the Amangwe Village, a holistic healthcare and welfare centre established through local business partnership between Mondi, BHP Billiton, Richards Bay Minerals, Richards Bay Coal Terminal, the United Nations Children’s Fund (Unicef), and the Nelson Mandela Children’s Fund. The Village is made up of three core categories of intervention: the Ethembeni Care Centre, Orphans and Vulnerable Children services, and outreach education and training initiatives. Working relationships exist with the Africa Centre for Population Studies, Department of Health, Welfare and Education; Lifeline Zululand; and the KZN Wildlands Trust.

During the latter half of the 2000s, however, companies have started to set up their own CSI/CSR projects and their financial contribution to the ZCBF had dropped significantly. People in the industry see the movement as “it was unfortunate, but each company wanted to be seen as better than others”. As a result, while the ZCCI remains as a local business chamber affiliated with SACCI (South African Chamber of Commerce & Industry), the ZCBF has a limited capability other than managing their legacy such as the Community Park. Since then, collective actions for the benefit of community development are difficult to implement in these days and voluntary collaboration between businesses in Richards Bay are limited in the case of emergency such as high crime rates and natural disasters.

4.4 Analysis

Table 6. Table of summary

	Human Capital	Social Capital
Construction phase	<ul style="list-style-type: none"> • Training for approximately 2,400 construction workers in 	<ul style="list-style-type: none"> • Subsidiaries of large companies developed in an

	<p>various skills in conjunction with the Department of Labour</p> <ul style="list-style-type: none"> • Impact of construction phase was short-term 	<p>expense of small local entrepreneurs</p>
Operation phase	<ul style="list-style-type: none"> • Approximately 1,300 permanent employees and 900 contingent contract workers • Well established in-house training and mentorship across spectrums of skills • Potential underinvestment due to free riders of skilled workers 	<ul style="list-style-type: none"> • Local TVET is a sufficient provider of basic skills but not advanced skills • No significant cooperation with other companies for training and skills development after the termination of the ZCBF initiative
- Downstream	<ul style="list-style-type: none"> • Available skills are limited to basic artisanal skills • Small and already saturated local household market • No significant industrial activities 	<ul style="list-style-type: none"> • No significant cooperation amongst SMMEs e.g. division of labour, joint market research, R&D activities • Public funding for skills development is available to support local entrepreneurs • Aluminium smelter is committed to supply aluminium molten metal
- Upstream	<ul style="list-style-type: none"> • Specialised skills provider emerged from ex-Hillside workers • Skills development through enterprise and supplier (ESD) development programme is accessible to local businesses 	<ul style="list-style-type: none"> • Aluminium smelter is committed to local ESD through preferred procurement • SMMEs provides OJT jointly with TVET • Business incubator functions as a promotor of information sharing, specialisation and division of labour
- Side stream	<ul style="list-style-type: none"> • Linkages to local economy other than historical accumulation of the capital-intensive companies are limited to service industries e.g. security, catering, accommodation 	<ul style="list-style-type: none"> • No significant cooperation with other companies for R&D and skills development • Local university does not have an engineering faculty
- CSI/ CSR Community Development	<ul style="list-style-type: none"> • Investment into basic education and healthcare is still regarded as important contribution due to insufficient public services 	<ul style="list-style-type: none"> • No significant cooperation with other companies for training and skills development after the termination of the ZCBF initiative

4.4.1 Analysis: Human capital contributions

Through the interviews with the stakeholders surrounding the local minerals industry in Richards Bay, it is evident that the aluminium smelter and the industrial cluster; upstream, downstream and side-stream, have contributed to the human capital development in the area through various channels. Originally, the company's in-house training started as a business requirement in order to cater for their high standard technological and safety requirements for their operation and the company brought skilled artisans from outside of the area into their operation and gradually developed a local skills pool through technological transfer. The skills development initiative has been further expanded in response to the National Transformation Agenda as enacted in the B-BBEE Act and the Mining Charter. Since then, the company had committed to source necessary skills more from the local areas not only as their employees but also as their suppliers by mentoring and coaching local enterprises and proactively seeking linkages to the local economy.

The successful experience of the ex-employees of the company, who are now working as independent service providers to the aluminium smelter as well as other companies, is proving that the combination of work experience of the owners and the quality of the training of their employees can build on the human capital available in the local communities. Some of the ex-Hillside employees emphasised that practical experiences can only be obtained through on the job trainings and mentorships. Given that the number of people who can join the aluminium smelter is limited, the company has proactively been providing the opportunities to outside of their company through various initiatives such as apprenticeship, graduate programme, bursary fund, and other investment into basic education and healthcare.

There is little doubt that the company, as one of the few large private sector employers in the area, has been providing scarce opportunities for graduates from local TVETs and the university to gain practical experience. However, some challenges related to the human capital development mechanism were observed in the course of the interviews. Firstly, due to their vulnerability to the commodity prices, investments into human capital development, especially when the skills are not directly relevant to their operations, fluctuate and create uncertainty of the

consistency. This includes potential closure of training initiatives and unavailability of employment opportunities for the participants after the training. The company constantly faces reputational risks and it is likely for them to invest low but rather consistent amount into human capital development. Secondly, free-riding activities to poach trained artisans and engineers from other companies can potentially minimize investment into human capital development. Thirdly, some of the highly specialised skills are too costly to develop locally and the company rather outsources from service providers elsewhere. Lastly, the mineral company faces constant pressure over immediate job creation from the local community. Hence, a commitment to long-term human capital development may not be understood and welcomed by host communities in some cases.

In this case, the company regards the human capital development programmes as a part of their successful businesses and the linkages to the local economy are fundamentally important for the programmes to be sustainable and effective. In this sense, investing into basic education and healthcare, while important, should be seen as primarily a government responsibility. The converse of such an argument is that the company resources should be allocated more onto technological spill-overs and potential promotion of industrialisation. Due to the highly specialised nature of the aluminium smelting business, many job opportunities have been missed to outside of the area. Despite some of the skills remain economically not viable to raise locally, it was suggested that other skills can be developed if there were collective actions with local industries. As more suppliers and service providers can be sourced locally, more human capital development opportunities can be available locally, which creates a virtuous cycle. Therefore, joint initiatives to raise human capital can potentially benefit not only the competitiveness of the company but also the region as a whole. This requires long-term commitment from various stakeholders including government and good social capital of the society. This point will be discussed in the following section.

4.4.2 Analysis: Social capital contributions

Surrounding the capital-intensive big six companies in Richards Bay, industrial cluster formation as a result of local suppliers' agglomeration has occurred to some extent in the areas like Alton

industrial area. However, it was observed that the potential further cluster development had been inhibited by the ‘enclave’ nature of the smelter and the branches of other larger companies set up in Richards Bay coming from outside of the region in expense of local supplier development.

It had been the case since the beginning of the construction of the smelter, that the branches of the large firms from bigger cities had their preferred contractors, which affected negatively for local entrepreneurs to seize the opportunities. The respondent from the capital-intensive company explained some reasons why larger contractors, normally from outside of the local communities had been preferred in the past; 1) skills gap between high standard of the company’s requirement and the capabilities of the local small companies 2) switching costs from existing suppliers 3) economies of scale to buy commodities in bulk and 4) highly specialised supply only available elsewhere.

However, it was evident that the local content requirement as enacted in the B-BBEE Act and the Mining Charter had impacted to change the company’s behavior in a direction towards local enterprise and supplier development. This change coincided with the company’s business needs to mitigate the cost implications of sourcing services from afar, and it initiated a positive trend for human and social capital development in the community. However, there remain a number of challenges for the company to develop highly specialised skills and services to the smelter in the vicinity, even though the company at a high level has committed to developing local suppliers. If the target is too high, it can potentially incentivise the company to either relocate themselves or find a loophole e.g. using too big to fail logic to negotiate with the government.

Hence, the high target can be accomplished with partnerships with other stakeholders; especially government commitment to invest more into human capital development and R&D capability development in support to the company is important. However, through a number of interviews, it was clear that there had been a lack of cooperation not only between the company and the public sector but also within other private companies. Furthermore, a number of interviewed stakeholders confirmed that the historical facilitative role of the local business

chamber had been reduced drastically since the late 2000s and individual companies had been operating in their own islands since then.

The current lack of collective action between various stakeholders can be attributable to a low level of social capital and the situation has potentially undermined investment opportunities into human capital development by each company. For example, South 32 experienced that their trained employees were poached by other companies in the area. Besides, according to the respondent of South 32, other major companies in the area have been skeptical about joining what they term a ‘South 32 branded programme’. This led to the demise of a crime prevention project and a training centre initiative by South 32, which were eventually terminated due to the lack of buy-in from other companies.

Although further studies are needed to investigate what have been obstacles for inter-organisational cooperation, some possible explanations for the lack of social capital were highlighted in the interviews, including corporate pride and a vulnerable mineral-based industry with the associated selfish behavior “what best for our company, not community as a whole”. This study only focuses on the aluminium smelter but it was suggested that other capital-intensive industries may be similarly vulnerable to commodity price fluctuations as well as being ‘enclaved’ with highly specialised skills set required for their operation. This situation needs intervention as some emerging technology potentially make the operations more capital-intensive and technology-intensive, which can only be sourced elsewhere without proactive approach.

It is still too early to judge the success but there is little doubt that the South 32’s business incubation programme in Richards Bay has been providing an opportunity for local businesses to link themselves into the capital-intensive industry in the region and thus to further the formation of an industrial cluster. The emerging trend of the enterprises of the ex-South 32 workers receiving tenders in the area has been showing that technical skills can be sourced locally. These entrepreneurs have also been employing local citizens to a larger extent and provided human capital development opportunities jointly with local TVET colleges. Besides, the successful entrepreneurs have become role models and aspirations to the local communities, a refreshing

alternative to what one of the entrepreneur termed as a “waiting for government financial supports mentality”.

The close relationship between the participants of the incubation programme can also potentially mitigate lower level of cooperation and division of labour amongst local enterprises. It stands to reason that clustering in the upstream industry could be further expanded with the commitment from the government and from the other capital-intensive companies in the area to develop their supplier base locally. Contrastingly, such a clustering seems not to be included into the downstream development of the DACT initiative. This might confirm the findings of Hausmann et al. (2008); industrial development in downstream linkages based on a physical proximity of input raw material is not a natural progression.

It is noteworthy that many stakeholders expressed their high expectations on the proposed IDZ development as it can potentially play a facilitation role to link between local businesses, training institutes, funding agencies, and local governments. To what extent the RBIDZ has been building social capital through its formative years is an interesting question, but one outside the scope of this dissertation.

5 Conclusions and Recommendations

This dissertation set out to investigate the historical contributions of a minerals industry cluster to sustainable development. It did so by investigating the case of the aluminium industry in Richards Bay, focusing on human and social capital development contributions, and structuring its analysis according to economic linkage theory.

This chapter presents conclusions as to the contribution of the minerals industry cluster to sustainable development in Richards Bay and the city of uMhulathuze, by answering the three research questions developed in chapter 3. It proceeds to discuss some of the challenges for sustainable development in the study area, and to present recommendations for policy and for further study.

5.1 Conclusions

1. Can a minerals industry cluster contribute to the development of human and social capital as preconditions for sustainable development?

As seen in chapter 4, the aluminium industrial cluster in Richards Bay has been contributing to human capital development and to technological advancement. However, these benefits have been largely ‘enclaved’ within the company and a few large contractors, and economic linkages to the broader society have not been created at significant scale in the vicinity. As a result, side stream development has been limited to the capital-intensive industries so called “big six” in Richards Bay, which coevolved by sharing energy and bulk handling infrastructure since the beginning of the industrialisation in the region.

This can be partly explained by a lack of social capital e.g. division of labour, trust, ease of transaction, etc. The racially segregated development pattern in the region had left residents with huge disparities and a trust deficit. There are many untapped opportunities for economic cooperation and industrial cluster formation mentioned by interviewees and what seems to be

lacking is a facilitating role by the stakeholders in order to mitigate the historical trust deficit and create a cooperative environment.

2. Are industrial policy supports effective means to promote economic linkages from/to an extractive sector?

In contrast to the high expectations of beneficiation policy, significant downstream activities have not taken place in the proximity of the smelter. While the local primary aluminium sector enjoys cheap electricity costs, there is little incentive to sell the metal to the domestic markets at a price lower than international price.

The interviewees from the minerals industry mentioned that local content requirement policies are key factors for promoting economic linkages to local businesses in the upstream industry. The business incubation programme which emerged from the South 32's CSR investment has contributed to create a number of jobs. However, for these jobs to be sustainable, there needs to be competitive industrial cluster formation both within and beyond the minerals industry. Hence, longer-term investment into further development of human capital and research capabilities are needed. These cannot be realised within a private company and government commitment is important as seen in the experiences of many countries. There is limited lateral migration of technology to other manufacturing sector players, except in the case of Bell Equipment, which contributes to the scarce engineering skills in the region.

As seen in the literature review section, linkage theory primarily informs policy interventions to promote collective actions. Hence, supporting upstream supplier development should not be seen as antagonistic to downstream beneficiation but rather promotive of industrialisation through competitive cluster development. Having both capable suppliers and demanding customers and consumers, complement each other by increasing domestic demand for innovative products and value added minerals.

The other countries' success provides evidence of the important role of R&D, education and promotion of innovation. The Finnish government funding scheme tied to "projects that are

performed in collaboration with other companies, research institutions, and/ or universities” (Dahlman et al., 2006) is a good example of promoting social capital development.

3. Are stakeholder engagements effective in promoting a “dialogue of values” (Ratner, 2004) for sustainable development in the area where the cluster is located?

Lack of communication and misalignment of developmental strategies has already caused waste of resources as seen in the failure of the LED initiative in the past. Local government can cooperate in identifying skills gaps and proactively developing the local skills pool. The importance of partnership is emphasised in SDGs as well and it can create new platforms for communication. Whether the local economy can successfully raise those skills and give competitive advantages to the companies depends on collective action amongst stakeholders.

As seen in some examples of CSR programmes, the problem is certainly not a lack of projects but rather the lack of alignment between them. The ZCBF had played an important facilitative role in the past, especially on regional developmental issues by creating a discussion and networking forum. This forum provided an opportunity for stakeholders to address and fund projects in their common interest. In so doing they avoid duplication of efforts and conserve local resources. More importantly though, the initiative helps to build and maintain strong relationships between all stakeholders which has resulted in the unique situation where the private sector can play a strong part in the socio-economic development of the area. However, the ZCBF has lost influence over time and there is a lack of coordination between business incubators, training and financial institutions.

The recent trend of automation and mechanisation requires new sets of skills and interviewed companies already experience difficulty to source these urgently needed skills in the vicinity. The challenge is not a lack of one or even of several needed factors or elements (capital, education, etc.) that must be combined with other elements to produce economic development, but with the deficiency in the combining process itself. Identifying skills gaps and addressing it needs to happen in a partnership with local companies and to be incorporated into their tendering process to leverage their purchasing power to create local demand of these skills. However, it

was expressed that a partnership works best if facilitated by a third party because the corporate pride of big companies is seen as obstacle to collective action.

5.2 Recommendations

5.2.1 For industry, government and society in Richards Bay

As explained in the conclusion, in order to link the minerals industry to local economy, which is otherwise ‘enclaved’, facilitative efforts to promote partnerships between stakeholders need to happen. Although it needs further study, it is recommended that the world-class companies operating in Richards Bay, other than the aluminium smelters studied in this research, provide various kinds of human capital development through their in-house training and CSR programmes. A lack of coordination and selfish behavior of each company described as “what is best for our company, not community as a whole” have inhibited to development of skills and technological spill-overs to side-stream development.

It was expressed by a number of interviewees that a third party like the RBIDZ should intervene and initiate such discussions as social distrust amongst stakeholders has already been an obstacle for partnerships.

5.2.2 For industrial policy nationally

The industrial policy to promote the export-oriented and capital-intensive industrialisation in Richards Bay in the past and to retrofit an extension of domestic minerals value chain into the downstream have not mitigated high inequality and unemployment issues in a sustainable manner in the region. According to the representatives of the industry, a lack and mismatch of skills are preventing the creation of linkages to the local economy and many job opportunities are taken by large companies from elsewhere. A more consultative and transparent approach with stakeholders is needed.

The local content requirement policies have changed the companies’ procurement

policies and CSR activities to develop human capital in the vicinity. Further study to quantify the effectiveness for such a policy intervention is recommended in the next section.

5.2.3 For further study

5.2.3.1 Human capital development

Due to the limited data available for this research, quantitative data analysis of the local content requirement policies and their relevance to human capital development was not included in this study. Thus, it is recommended that further studies analyse a regional input-output table across various industries in Richards Bay and chronological shift in the list of local content suppliers as a result of such intervention. Such a study should distinguish mere importers of inputs previously acquired directly by the companies which may involve little contribution to the local economy (Kaplan et al., 2011) from others. Such study is also beneficial for the local industries to elaborate and jointly develop skills which they have common interests.

5.2.3.2 Social capital development

This study only focuses on the aluminium industry but it was suggested that other capital-intensive industries in Richards Bay may be similarly vulnerable to commodity price fluctuations as well as being ‘enclaved’ with highly specialised skill sets required for their operations. Through the course of the interviews, some possible explanations for the lack of social capital were highlighted, including corporate pride and a vulnerable mineral-based industry with associated self-interested behavior.

The lack of collective action amongst the industries in Richards Bay restricted economic linkages creation into the local economy in the past. Interventions to promote collective actions become increasingly important as some emerging technology potentially make the operations more capital- and technology-intensive, and the necessary skills can only be sourced elsewhere without proactive approach. Therefore, further studies are needed to investigate what have been obstacles for the inter-organisational cooperation and what can promote social capital

development in Richards Bay. There is no single uniform definition or measurement of social capital development, which makes it difficult to directly apply international experiences. However, a similar assessment for the governance of collective action in the South African garment and textile industry done by Morris and Levy (2016) provides useful insights and it is suggested that a set of eight principles developed by Ostrom (2005) is applicable for this kind of studies.

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