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# The South African Economic History *Annual*

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## Highlights:

A new economic history laboratory at Stellenbosch  
African multinationals in history  
What explains South Africa's migrant labour system?  
Africa's first special economic zones



## EDITORIAL

**H**istory – and the scholars who study it – has never been more relevant than in 2015. University campuses around the country witnessed large-scale protests against institutional racism, escalating fees and outsourcing. Rhodes fell. Verwoerd was moved. A new generation is questioning the past and its legacies in uncomfortable ways.

This is a good crisis for South African historians in general and economic historians in particular. Our interpretations of the past are in demand and, more importantly, influential. Students who only a year ago could care little about colonial symbolism and black consciousness now have a ready appetite for their own history.

This has brought historians and their theories and facts of the recent past into the public spotlight. This fourth issue of the South African Economic History Annual demonstrates this scholarship in action: Edward Kerby discusses the lessons from apartheid spatial policies, while Ben Prinsloo investigates South Africa's nuclear programme.

But the 2015 protests should also come as a warning to scholars: we must stay relevant to our audience, which means that our research questions must adjust to the demands of the time. The 2015 protests will influence the study of history as much as the students' understanding of history fuelled the protests.

Johan Fourie



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## NEWS & EVENTS

### EHDR expands

From 2016, *Economic History of Developing Regions*, the journal published by Taylor & Francis under the auspices of the Economic History Society of Southern Africa will increase the number of issues from two to three annually. Says Leigh Gardner, editor: "The rapid increase in the number of article downloads and citations convinced us to expand our number of issues". In addition the increase in issues, Taylor & Francis has also offered a book prize for the best paper published annually in the journal.



## WEHC2015 in Kyoto: precise, profound and popular

Grietjie Verhoef, UJ

The global economic history community invited the South African economic historians into the International Economic History Association as a member in 2006. We joined the IEHA with the firm conviction that Economic History in Africa and South Africa could only benefit from membership of the international association. Visits by the then Secretary General Jan Luiten van Zanden to South Africa in 2007 and the entire Executive Committee of the IEHA in 2009, allowed the community of economic and business historians in South Africa to showcase our enthusiasm and determination to serve the disciplines through research and conference participation. In 2012 the Economic History Society of South Africa won the bid to host the WEHC2012 in South Africa – and we hosted a cold and wet event with warm hearts and a community of happy new wine consuming friends. The WEHC2012 set the agenda for the explosion of research on African economic history. As the African Economic History Network expanded its activities, the research focus on Africa moved forward at a healthy speed. These development supported

economic and business historians on Africa and other developing regions in performing an important role at the last WEHC2015 in Kyoto, Japan. From Stellenbosch to Kyoto the number of sessions on African economic history, or comparative work on African economic developments and other developing regions, quadrupled.

The WEHC2015 in Kyoto performed a similar catalyst function for Asian and Oceania economic history as the WEHC2012 did for African economic history. With a record number of 1158 delegates to Kyoto's magnificent Convention Centre, the WEHC2015 was organized with Japanese precision and flair. Colourful conference bags and memorabilia were noticed across the city as delegates converged on the spacious and comfortable conference centre – fully equipped with excellent air conditioning! The opening address by Professor Osamu Saito, Professor Emeritus Hitotsubashi University, on diversity and interdependence in development, wove global demographic trends together in a similar way as the WEHC2015 brought economic historians together. It was an event profoundly impressive and socially relaxed. Five days of deliberations and excellent research papers were balanced by entertaining social

events. The WEHC2015 was opened officially by Professor Patrick O'Brien, followed by the sake-barrel bashing ceremony. Prima sake, good food and good company set the congress off to a pleasant start. Throughout the week delegates met in seminar rooms, small conference rooms and large auditoria, but the large community of delegates has ample space to meet and discuss arguments and comments, while enjoying the cuisine from Kyoto.

The most rewarding aspect of the WEHC2015 was the large number of South African participants (eight) and the honour to Johan Fourie, from the University of Stellenbosch, who was the winner of the dissertation prize for his PhD thesis in the category of the early modern period. From Stellenbosch in 2012 the South African community of economic and business historians have taken their position amongst the global best. Congratulations to Johan and may that inspire the next generation of scholars to follow the trail to Massachusetts in 2018. The next WEHC2018 will be at MIT, inviting us all again under the theme "Waves of Globalization" to engage in helping society to understand our development and build a better future on the firm foundation of fact and insight.



## New laboratory for the study of Africa's economic past launched at Stellenbosch University

Johan Fourie, SU

**R**ecognising the need for a centre of African economic history research based in Africa, the Department of Economics at Stellenbosch University established the Laboratory for the Economics of Africa's Past in May 2015. LEAP is an interdisciplinary initiative based in the Economics Department which includes members from Stellenbosch University's Sociology, Agricultural Economics and History departments.

The study of African economic history is overdue for revival. During the past 50 years, much has been said and written about underdevelopment and poverty in Africa, but little about the historical roots of the problems. Economists are now taking on this task and, with the aid of new information and techniques, starting to find answers to a fundamental question of our day: Why is Africa lagging behind?

This research programme, however, continues to be driven by scholars at Western institutions, firstly because African economic historians have

been slow to adopt the new techniques that have spurred the global revival in economic history research, and secondly because Africa has produced too little economic history research to offer a viable alternative to Western ideas and paradigms.

To stimulate interest in economic history and expand the pool of active researchers in the field, the Depart-



**LABORATORY FOR  
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ment of Economics at Stellenbosch has introduced a postgraduate course in economic history. Staff members of the Department have been at the forefront of efforts to coordinate economic history research in southern Africa and forge links with scholars in other African countries.

The initiative to establish a strong footprint of African economic his-

tory at Stellenbosch University has been recognised by national and international peers. In 2008, Stellenbosch University won the bid to host the triennial World Economic History Congress (WEHC) in July 2012. The choice of Stellenbosch University reflected the international community's belief that African economic history is moving to the top of the research agenda and that Stellenbosch can spearhead this movement.

The founding of LEAP in 2015 was the logical next step in establishing Stellenbosch University as the premier African economic history research unit on the continent.

LEAP will make it possible to forge links with other African institutions, build research capacity and expand research output, facilitate scholarly networking and invest in data gathering and dissemination.

It will enable – for the first time on African soil – a deeper investigation into the economic history of our continent and a more nuanced understanding of its past, present and future challenges and opportunities.





Princeton economic historian Professor Leonard Wantchekon presents closing address at Wageningen

## Wageningen hosts African economic history meetings

Johan Fourie, SU

Wageningen University in the Netherlands was the host of the Fifth African Economic History meetings from 30-31 October. The African Economic History Workshop, which was an initiative of Gareth Austin at the London School of Economics nearly a decade ago, has now grown into a conference-format event, with parallel sessions and a keynote speaker. More than 100 papers were submitted of which 70 were included in the final programme. This reflects the strong and growing interest in African economic history.

Given his role in the initial creation of the workshops, professor Gareth Austin of the Graduate Institute of Geneva, was the first invited keynote. He discussed the topic of a possible African Green Revolution, and how land-extensiveness and intensification in African economic history could be understood.

Professor Ken Giller of Wageningen University was the second keynote speaker, discussing farm size and pro-

ductivity in the African context.

Professor Leonard Wantchekon from Princeton University was the final keynote speaker, discussing how economic history can contribute to un-

derstanding political change in Africa.

The next meeting will be held at Sussex University from 21-22 October 2016. It was also agreed that the 2017 event will be held in South Africa.



Stellenbosch University PhD student Abel Gwaindepi presents his work on the Cape Colony's fiscal history at the African Economic History meetings at Wageningen University on 30 October.

# The limited success of apartheid's special economic zones: lessons for today

Edward Kerby, LSE

Contrary to popular belief, Special Economic Zones were first adopted in South Africa, two decades before they were popularised by the enormous success of those in Shenzhen China, where our smartphones and tablets are currently assembled. Special economic zones are intended to increase export trade and drive unskilled employment. The apartheid state sought similar spatial policies to anchor Africans in the former homelands with lucrative incentives, tax breaks and infrastructure. Known as the Regional Industrial Development Programme (RIDP), sixty-seven RIDP zones were established between 1955 and 1992. Some were located near major cities such as Roselyn west of Pretoria. However, the vast majority were in isolated rural settings like Phuthaditjhaba, the former capital of QwaQwa, a south Sotho homeland on the slopes of the Drakensberg mountains (figure 1).

By promoting the relocation of industrial plants to the homeland and border areas, the RIDP tried to separate black people and disperse industrial activity, thus maintaining the economic and political status quo. From the outset, these rural industrial zones were contentious. Houghton (1956) first questioned the rationale of Grand Apartheid's idealism versus the economic reality of isolated industrial zones. The government persevered, appointing the Tomlinson Commission, creating a framework for regional industrial policy that would come to shape the apartheid incentive hierarchy between private capital and homeland industrialisation.

State induced growth poles, the forerunners to special economic zones, were familiar in western economic

dogma. For example, Dewar, et al al (1986, pg. 363) explained that "there are few nations in the world in which the state has not attempted to manipulate the spatial pattern of settlement to one or other political or economic end."

However, Bell (1986, pg. 276) add-

South Africa's history. The sheer scale of the project to industrialise the homelands offers contemporary lessons by confronting the country's economic history. Notwithstanding isolated studies published in the 1980's (see Bell, 1987 or Dewar et al 1984) or later revisionist neo-liberal critiques



Figure 1: RIDP zone at QwaQwa showing standardised factories were built in a uniform layout within close proximity to large urbanising homeland townships (1978). Source: Free State Development Corporation, QwaQwa Archive, Phuthadajhaba, South Africa.

ed the key caveat, noting how "few countries had manipulated industrial spatial locations with such intensity to bring about racial separation on a regional basis as the South African state." With apartheid's immanent demise, Addleson et al (1985, pg. 37) concluded that "industrial decentralisation policies may have had serious economic consequences [...] but may nevertheless have a continued role to play in the ongoing political development of the country."

Although racist and divisive, the RIDP was a remarkable period in

(see Hart, 1996, 1998, Phalatse, 2000 or Luiz & Waal, 1997) little is known about the impact of decentralisation or the industrial zones which employed hundred of thousands of rural Africans.

Confronting this is difficult, and often unpopular and thus the recent history of apartheid has been neglected. Posel (2011, pg. 319) explained that "the historiography of apartheid has tended to be rather more insular and inward looking in the past, particularly in the thick of the anti-apartheid struggle, when the specificities of the



South African experience dominated both the analytical and the political agenda of debate.”

However, the German philosopher Georg Hegel noted the cyclical nature of history and emphasised the corollary, that man must learn from the past. Yet the “archives of Bantustan rule” have not been fully utilised, offering scholars of economic history, business history and development economics a number of opportunities to uncover the truths which have shaped South African society. Exploiting new sources, my PhD examines the current models of spatial development through a historical lens. Exhibited as three phases, it constructed a new periodisation of state-led industrial incentives (figure 2). This is the first to quantify the changes in investment and labour intensive employment between the different time periods and decentralisation policies which are briefly summarised:

Phase one has been dubbed ‘Grand Apartheid’, which runs from 1952 until 1969. The results showed how the proposed master plan for decentralisation (i.e. the Tomlinson Commission) differed from those implemented by the apartheid state. Major investment and business partnerships between white and black groups never materialised. The lack of private investment continued into the second phase which has been described as ‘Benevolence and Growth’.

Ending in 1979, the period was discernible by more pragmatic policies during the upward industrial and mining output. Fixed capital investment for special economic zones on the periphery was preferred over political reform. The government instead implemented coercive legislation to “push” industries to decentralise, limiting manufacturing firms from expanding their operations in the industrial core.

When industries did decentralise, large-scale infrastructure spending, rather than industrial decentralisation incentives were the motivating factor. Phase three (1980 – 1992) has

been labelled ‘Desperation’, and sees a renewed sense of urgency, providing greater autonomy to the homeland development corporations. State subsidies and spending escalated as the RIDP was increasingly seen as the only solution to reduce African influx to the cities.

In a process Bell (1986) called “spontaneous decentralisation”, improved infrastructure, changing labour preferences and international competi-

Africa’s economic geography today however the costs and historical outcomes from special economic zones remain questionable.

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Figure 2: Three phases of the decentralisation programmes transposed over per capita GDP in 2000 Rands and Madison Dollars (1990 Int. GK\$).

Source: SA Reserve Bank, The Madison Project, and Seekings and Nattrass (2008)

tion “pulled” industries to the zones. Interestingly, for the first time, the programme attracted labour intensive foreign direct investment. An inflow of Taiwanese firms created internal and external economies of scale, manufacturing a vast range of products from car radios to plastic flowers, in a vibrant production diaspora which still exists.

Although this research demonstrates that the policies of decentralisation had limited success, the current democratic government has elected to target regional development programmes similar to those of the apartheid RIDP.

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# The rise and challenges of African multinationals

Grietjie Verhoef, UJ

**M**ultinational corporations have commenced foreign direct investment (FDI) activities since the 1960s by moving operations to resource-rich, low-cost labour and capital markets (Wilkins, 1970; 1974; 1988; Jones, 1994; 2005). The first wave of outward foreign direct investment (OFDI) during the 1960s and 1970s was motivated by efficiency and market-seeking factors.

This wave was dominated by firms from Asia and Latin America. A second wave of OFDI followed in the 1980s, led by strategic asset-seeking enterprises from Hong Kong, Taiwan, Singapore and South Korea (Dunning et al., 1996; UNCTAD, 2005b: 3s). Since the 1990s China, Brazil, India, Russia (the so-called BRIC countries) Malaysia, Turkey and South Africa are among the countries expected to add significantly to OFDI growth (UNCTAD, 2005c: 4). The emergence of EMTNCs (Emerging Market Transnational Corporations) makes up a growing proportion of outward FDI and they acquire an increasing share in foreign affiliates from developed markets conducting business in their regions.

Since the launch of the New Partnership for African Development (NEPAD) in the early 1990s (Luiz, 2007; Grobbelaar, 2008) and the acceptance of the Lagos Plan for regional economic integration in Africa, the actual economic integration of regional economies was less than impressive. OFDI by African economies was delayed as governments struggled to transform their economies. The strongest drive towards globalization came from South African businesses that sought to enter the world markets after many years of sanctions and isolation which ended in 1990 as the country prepared for its first democratic election in 1994. OFDI from Africa commenced from low levels of US\$659 million OFDI in 1990

compared to Asia OFDI which already stood at US\$11 024.3 million in 1990. African OFDI showed stronger growth off the low base than the rest of the world: world OFDI grew by 8.36 percent, Africa by 14.2 percent and Asia by 16.6 percent between 1990 and 2013 (WIR, 2014, Web Annex Table 2). An analysis of the composition of African OFDI since 1990 shows a doubling of outward stock as a percentage of gross domestic product. OFDI stock in Africa rose from 4.8 percent of GDP in 1990 to 8.6 percent in 2013, but in North Africa the ratio only rose beyond 2 percent during the late 2000s to reach 4.4 percent in 2013.

South African businesses have dominated the cross-border M&As throughout the period. Only in 2008 were North African M&As higher than South African M&As. No M&A activity was recorded of significance in southern Africa, except for Mauritius, where business sustained M&A activity throughout the period. Moroccan companies became more involved in M&A since 2009. In West Africa Nigerian companies were active in expanding their operations, but Ghanaian companies did not engage in such M&A of any significance. Egyptian companies were relatively active between 2007 and 2010, but the only sustained activity was that of South African companies. The level of cross-border M&As of African businesses was nevertheless significantly lower than that of companies in Asia and South-East Asia. The M&A activity in that region increased from US\$98 606m in 2007 to US\$107 915m by 2013, which surpasses the African achievement significantly (WIR, 2014: 214).

The domination of South African conglomerates is further substantiated by the ranking of South African, and African, companies on the list of the world's top 100 non-financial TNCs, ranked by foreign assets in 2013. Only two African corporations are listed on the 2012 ranking list - they are Anglo

American Corporation Plc (ranked 43rd in terms of foreign assets, with a TNI of 2), which currently holds a primary listing on the London Stock Exchange, and is no longer assigned to South Africa as its home economy. The other company is SABMiller Plc (ranked 55 in terms of foreign assets, with a TNI of 7), which has the same domicile (United Kingdom) after acquiring its primary listing in London, although the company originated in South Africa.

There are no African companies ranked under the world's top 100 non-financial TNCs (WIR, 2014: web table 28). Both AAC and SABMiller maintained their ranking among the world's top 100 corporations since 2008 (UNCTAD, 2009; Verhoef, 2011), but with substantially reduced TNIs. African companies are better represented on the list of the top 100 non-financial TNCs from developing and transitional economies, ranked also by foreign assets, in 2012. There are eight South African companies, one from Egypt and one from Algeria.

The world ranking of some of these South African corporations is changing consistently. In 2008 Sasol was the highest ranked South African conglomerate on the top 100 ranked list of non-financial corporations - at the 22nd position, with a TNI of 31.6 percent (UNCTAD, 2009:231). In 2012 the company failed to make the ranking of the top 100 non-financial corporations in the world, but increased its TNI significantly to 74 percent. New corporations entered the top 100 non-banking companies in developing countries since five years ago and this list keeps changing. When the largest companies in Africa in 2014 are compared to the top 100 rankings of UNCTAD, South African companies made up 71 percent of the top 50 companies. Based on market capitalization in 2014 the largest African company is BHP Billiton, a mining and metals company, followed by SAB Miller, then Sasol, Naspers (the media



Ranked by Foreign Assets	Ranked by TNI*	Corporation	Home economy	Industry
31	31	MTN Group Ltd	South Africa	Telecommunications
43	27	Steinhoff International Holdings	South Africa	Other consumer (furniture and home ware)
49	25	Gold Fields Ltd	South Africa	Metal and mining products
51	72	<u>Sonatrach</u>	Algeria	Petroleum
53	74	SASOL Limited	South Africa	Chemicals
63	35	Naspers Limited	South Africa	Other consumer services (Media)
67	34	<u>Orascom</u> Construction Industries SAE	Egypt	Construction
83	41	Med-Clinic Corp Ltd	South Africa	Other consumer goods (health care)
97	60	<u>Netcare</u> Ltd	South Africa	Other consumer goods (health care)
98	33	Sappi Ltd	South Africa	Wood and paper products

conglomerate) and MTN. The Africa Business Magazine listed under the top ten African companies by market capitalization, nine South African and one Nigerian company in 2014. The top non-South African conglomerate is the Dangote cement group of Nigeria, with a market capitalization of US\$22,7 billion ([www.africabusiness-magazine.com/sector-reports/africa-top-250-companies](http://www.africabusiness-magazine.com/sector-reports/africa-top-250-companies)). These are the private conglomerates, but the largest company on the continent, are still SOE's.

The African Business Review ranked Sonatrach an Algerian petroleum company, as the largest with a turnover of US\$58.7 billion, followed by Sonangol, an Angolan petroleum SOE with US\$22.2 billion turnover. The third largest company in Africa by turnover is Sasol, with a turnover of US\$18.3 billion, followed by the MTN Group at US\$17.2 billion ([www.theafricareport.com/top-500-companies-in-africa-2013](http://www.theafricareport.com/top-500-companies-in-africa-2013); [www.africanbusinessreview.co.za](http://www.africanbusinessreview.co.za)). Twenty-six percent of the top fifty conglomerates in Africa conduct their business in finance and insurance, 22 percent in consumer goods and retailing, 14 percent in mining, 12 percent in media and telecoms, one percent each in diversified enterprises, health care and construction respectively, and 3 percent in manufacturing. When considering the 'globalisation' of African business OFDI

does not only refer to OFDI outside the African continent, but also OFDI outside the African home market into neighbouring countries or into more distant regions in Africa: the African continent is home to 56 countries and comprises a land mass of 30 221 532 km<sup>2</sup>.

African conglomerates have diversified business activities and explored the opportunities outside the home market, primarily in the immediate neighbouring markets, as suggested in the Uppsala model of internationalisation. Expansion into developed country markets remains limited to the South African corporations owning advanced proprietary knowledge, technology and strategic management capabilities.

In contrast to the internationalisation of the Asian Tigers described by Matthews, the internationalisation strategies from the African periphery were motivated primarily by market, asset and efficiency-seeking strategies and less by resource seeking motives. The observation of the internationalisation of the leading corporations that have diversified operations significantly to gain revenue from operations outside the home country, as discussed in this paper, the following are the dominant trends.

Internationalisation of the first movers was motivated by market and asset-seeking considerations. The long pe-

riod of international isolation resulted in 'pent-up' capacity at South African firms. The size of the domestic market is small - GDP growth has slumped from 5 percent to below 2 percent the last few years and is not likely to improve any time soon as a result of domestic political constraints. Market-seeking strategies offered access to the new fast growing markets in Africa, with competitive labour resources.

The second trend is that market and asset-seeking initiatives were driven by the competitive advantage of FSAs, found in proprietary knowledge and managerial capabilities. The proprietary knowledge of the locally developed technologies, such as the world leading CTL and GTL technology developed by Sasol, or the mining technology of the mining conglomerates AAC and Gold Fields, or the mobile telephone technology MTN injected into the African and Middle East markets.

The expansion of the health care companies Netcare and MediClinic, are also representative of advanced health care technology as a vehicle for internationalisation. These technologies provided a strategic tool to access new markets and simultaneously address the growing constraints in the domestic market.

Technological advantages were underpinned by strategic managerial capabilities. The managerial capabilities

of South African corporations constitute a vital element of the successful globalisation of their operations. Strategic leadership and, dynamic capabilities in change management placed them in an advantageous position with respect to expansion into global and neighbouring developing markets. The diversified conglomerates of pre-1990 South Africa were multi-division firms, managed by professional managers and not only family members (as is still the case in most of the emerging African conglomerates in other African countries such as Uganda, Tanzania, Ethiopia and Kenya). These competitive advantages were enhanced through the international orientation of South African management. Local managers are well travelled, have extensive business network links outside the country, possess ability to manage operations under conditions of political instability and social turmoil – as persisted in South Africa during the 1980s and 1990s – and take and manage risk in such markets (Ibeh, 2012; Bakunda, 2004).

On the back of the trends identified, it is to be expected that efficiency-seeking motives will in future become a stronger consideration for South African firms. The emerging diversified corporations from African countries will join those ranks as soon as professional management replaces or supplements family control and acquires a strong international orientation and develop alliances or networks outside the home country.

As the bulk of private enterprise in Africa still falls within the category of SMEs (up to 40 percent of Africa's GDP is still contributed by informal economic activity – Marsden, 1990; McDade and Spring, 2005), African enterprises are growing in size and capabilities to challenge competitors on the basis of cost and resource advantages. The strongest private African corporations expanding across African home borders are the Simba Group, the Dangote Group and the Orascom Group.

This was a keynote address at the ABH Annual Conference, 3-4 July.

# Wine production in South Africa

Tom Keywood, SU, and  
Mandy van der Merwe, SU

South Africa has become a formidable participant in the international wine market by establishing itself as a frontrunner in “New World” wines; “New World” despite having a history spanning in excess of 300 years. This paper presents, to our knowledge, the first ever data series for wine production of this length. It runs from 1659 – the year that the first ever South African wine was bottled – to 2014 and depicts some of the major events to have affected the South African wine industry over this time frame.

This series is used to describe the major events that occurred throughout the history of South Africa's wine industry, complemented by Breakpoint Chow statistics to detect significant events in the wine production timeline and Recursive Graphics to show the resilience of production despite changes in purchasing power, proxied by GDP per capita.

## Data

The production series was used to compile Figure 1, below, expressed in level kilolitres. Period-specific graphs positioned throughout the text are also expressed in level kilolitre terms and are used to aid descriptions of significant events in the timeline. However, being non-stationary, level graphs understate variation in the series for earlier years, providing the rationale for using log series in order to conduct the statistical procedures that follow.

A variety of sources were used in constructing this dataset can be found in Table 1. These include a copy of Jan van Riebeeck's personal diary which was translated into English from Dutch and accessed at the South African National Archives in Cape Town. Janse van Rensburg's 1954 book then outlines a history of South Africa's wine industry and Van Duin & Ross's 1987 book provides details about the

composition of the entire economy of the Cape Colony and prosperity of its citizens during the 18th century. These three sources all provide data for both wine production and vine plantations, while various other sources are used to augment the production data series.

The additional sources, which provide data on wine production alone, include van Zyl's 1975 paper which outlines South Africa's wine industry between 1795 and 1860, the Cape Colony and South African Union Blue Books, as well as the GWM (Global Wine Markets) and SAWIS (South African Wine Industry Information & Systems NPC) databases.

These sources, as well as the years for which they were used are listed in Table 1 while Table 2 describes the conversions used to transform the diverse units of wine volume measurements that were used – such as leaguers, mengel, imperial gallons and pipes – into kilolitres.

Figure 2 shows the relationship between wine production and per capita GDP on a log scale, thereby better depicting relative movements in the two series and enhancing comparability. Real GDP per capita is used as a proxy for purchasing power and therefore the potential demand for wine.

These series appear largely unrelated as confirmed by the dynamic conditional correlation expressed in Figure 3 which deviates significantly over time. This measure was obtained by regressing wine production on per capita GDP recursively – controlling only for a constant and time trend – and plotting the coefficient for GDP per capita against time. The logs of both variables were used, implying that the graph should be interpreted as the percentage point response associated with a one percentage point increase in per capita GDP for any year in the timeline. Unfortunately, as recursive estimation requires complete series, exponential interpolation was necessary in order to account for missing data, potentially attenuating the standard errors and inflating the co-



efficient. The coefficients themselves are not of much interest as various endogeneity concerns limit their accuracy, but they represent an unstable relationship and thereby emphasise the result that purchasing power and wine production are largely unrelated. Intuitively, this makes sense as prices would have allowed for the market for wine to clear following disturbances in foreign demand and domestic supply. Additionally, as corkage and glass bottling were already common practices by the 1600s – with corks being used to seal ceramic jugs since antiquity – even wine in the 17th century Cape Colony could be stored for years, allowing for consumption to be smoothed intertemporally following both demand and supply shocks (Mortensen & Marks, 2002:3).

#### The Evolution of the Cape wine industry

A number of events that have been cited as important throughout the literature regarding the development of the Cape wine industry are discussed in this section. To determine their statistical significance, Chow Breakpoint tests have been run on the production series.

These tests show that new tariffs on wine brought into Cape Town (1743), the abolition of slavery (1838), the introduction of British import tariffs (1840), the Corden-Chevalier Treaty (1861), the Phylloxera aphid infestation (1886) and the beginning of Apartheid (1948) were associated with significant impacts on wine production. When exponential interpolation was imposed on the series then the beginning of World War I was found to be significant as well. Surprisingly, Apartheid's end (1994) and the global financial crisis (2008) did not reveal significant impacts to wine production, though exports may have been affected. Again, this is potentially explained by the relative efficiency of goods pricing in more modern times and increased access to foreign markets through international trade.

The Dutch East India Company or Vereenigde Oost-Indische Compagnie's (VOC's) original mandate for the

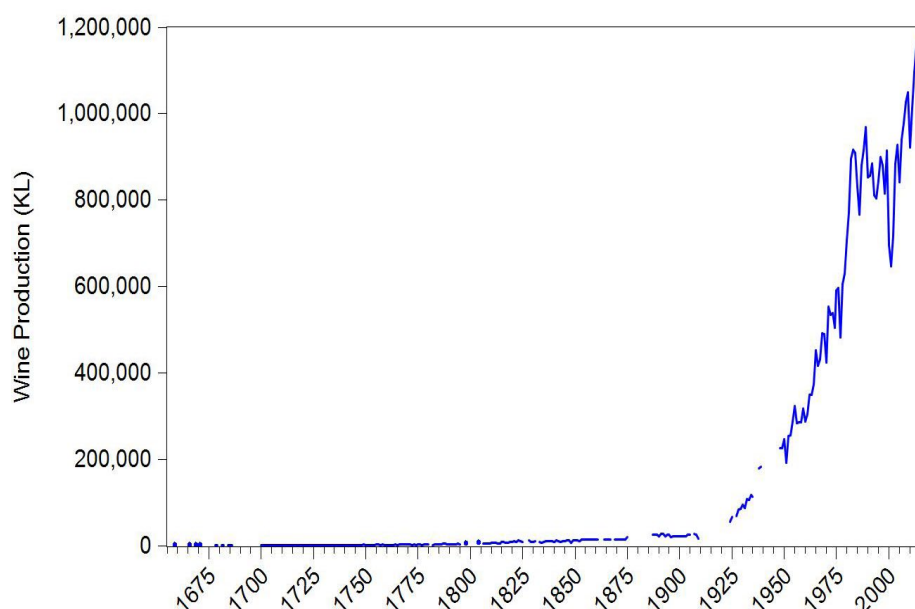


Figure 1: Wine production, 1659-2014

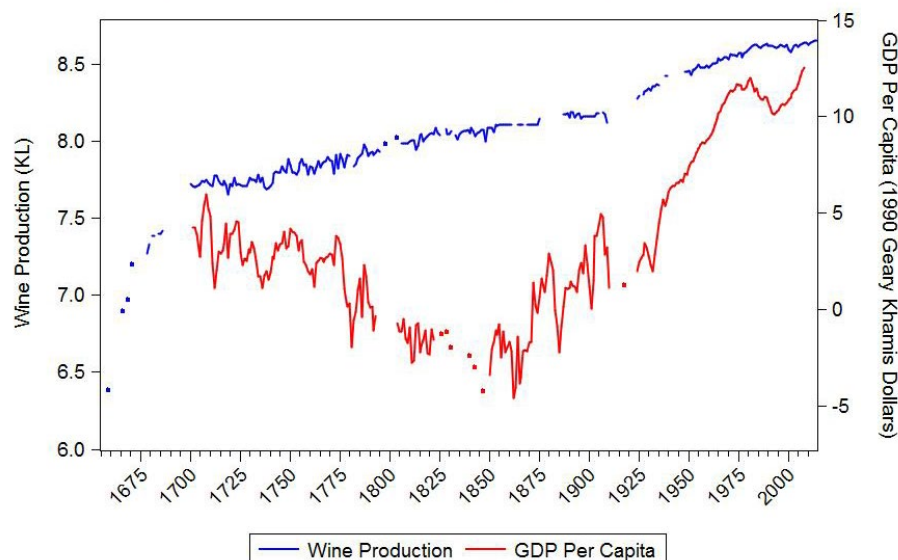


Figure 2: Wine production, 1659-2014

Cape Colony was to supply passing ships with fresh produce, implying that wine production was never an intentional endeavour (Jooste, 1973:3).

In this early period, a number of key players can be attributed to having established the wine industry in the Cape (Figure 4) – Jan van Riebeeck, Simon van der Stel, the Vryburgers and the French Huguenots.

Jan van Riebeeck, the first Commander of the Cape, noted suitable conditions not only for agriculture, but for viticulture in particular, and planted the first vines on 22 July 1655. In February 1659, the Colony had its maiden harvest and was able to produce wine for the first time. These

wines included both Muskadel and Steendruif varieties – most likely out of France (Van Zyl, 1975:7) – producing 12 mangel in total (14.52 litres; Janse van Rensburg, 1930:4).

Due to inhibited food production and the inability to barter for meat with the pastoral Khoikhoi, the VOC were advised to release nine men from their contracts to farm independently and formed the foundation of the Vryburgers (Estreicher, 2014:509). Although convincing these men to take on wine farming was initially a tenuous task, by 1660, the number of vines planted in the Cape began to rival those of wheat (Janse van Rensburg, 1930:9). By 1695, the revenue

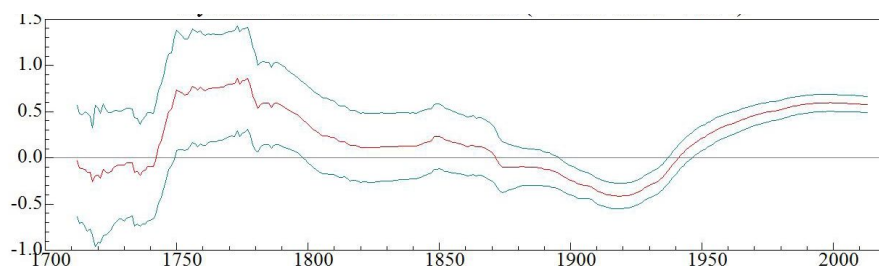


Figure 3: Dynamic Conditional Correlation ( $\pm 2SD$ : 1700 - 2014)

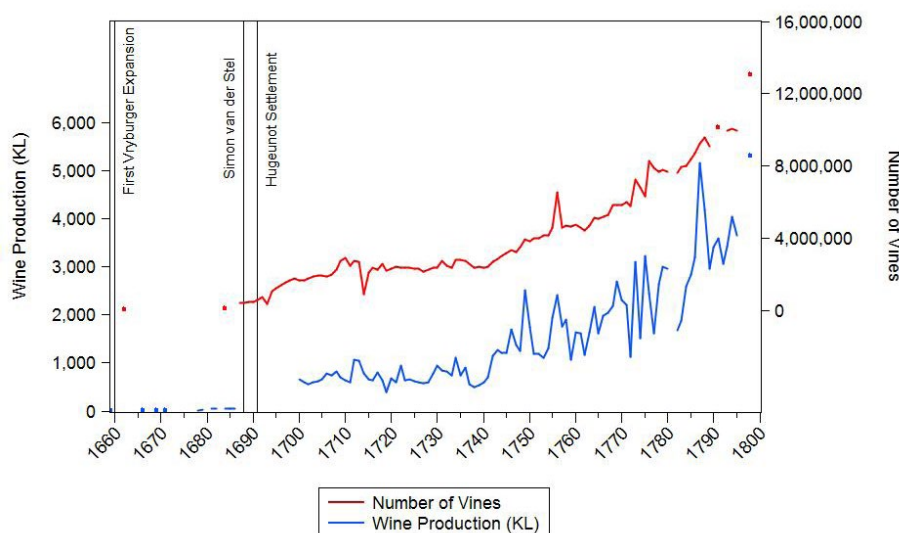


Figure 4: Wine Production (1655-1800)

derived from these vines was able to compensate for the losses made from the struggling wheat farming industry and later the wine farmers were able to produce more wine than that of the Company – though the Company's wine, based in Constantia, was of substantially higher quality (Janse van Rensburg, 1930:16). This is a known truth of Cape wine in the early period.

Much of the groundwork for wine production in the Cape had already been laid by the time Simon van der Stel arrived (Estreicher, 2014:509). As he had previously been involved in wine production in the Netherlands (Estreicher, 2014:509), he naturally intended for the Cape to promote viticulture within its economy. Thus, production expanded into the Stellenbosch and Drakenstein regions where intensive viticulture and agriculture took place.

The French Huguenots were another group that played a vital role in the Cape wine industry. The majority of the Huguenots arrived in 1688 and 1689 and although they only numbered a little over a hundred individu-

als (Fourie and von Fintel, 2014:935), they had a substantial impact on the European population who numbered approximately 1000 at that stage (Estreicher, 2014:511). The VOC was particularly interested in these individuals as they brought with them relatively advanced knowledge pertaining to viticultural practices. In order to better utilise this knowledge, Simon van der Stel granted land, long term loans and farming equipment to the French immigrants in addition to grants to the Vryburgers (Janse van Rensburg, 1930:28).

It is often assumed that the Cape Colony consisted of an impoverished society post-European settlement in that settlers did not bring large stocks of wealth with them from Europe (Fourie, 2011:2). Rather, it was one of the most prosperous regions in the world (Fourie, 2011:2). Given that the wine market was limited to the local Colony and passing ships, widespread opinion is that farmers experienced large overproductions and were not able to sell all of their produce, potentially inducing solvency risk. If there

was overproduction in the market, many farmers would cease production and decrease overall output until it was again profitable for the few remaining in the market. In the Cape, however, the number of wheat and wine farmers increased steadily, indicating scope for profit (Rijksuniversiteit te Leiden, 1978:49).

The local market for wine was small and irregular due to it being considered a luxury. Rijksuniversiteit te Leiden (1978:48) estimates that 96% of wine production, on average, was sent to the Cape annually to be marketed, showing that despite the inability to escape the tax on wine (implemented in 1743), it was still transported there due to limited external market demand.

As the amount of wine exported to Europe decreased over the century (Rijksuniversiteit te Leiden, 1978:50), the rise of the *pachten* or the wine franchises played an important role. This entailed the Company auctioning the rights to sell alcohol in the Cape which made up a large proportion of its income. Logically, the amount individuals willing to pay for these licences were dependent on their expectation of alcohol consumption in the future. To control the quality of wine sold and not flood the market with poor quality produce, from 1765 it was forbidden to bring wine into the Cape between February and August each year (Rijksuniversiteit te Leiden, 1978:51). Wine producers were thus accustomed to predicting how much to supply to the market in subsequent periods and how much they would need to invest to ensure they met consumption demand.

A signal as to the level of affluence within the wine industry is the willingness of farmers to invest in new vines. This provides an indication of the wine farmers' expectations of long-term future markets, given the long periods they would need to wait for return as well as the risks they would need to endure (Rijksuniversiteit te Leiden, 1978:45).

Growth in the wine industry stagnated during the 19th century, potentially



due to the continued poor quality of much of the wine (excluding that of Constantia) by international standards. The 19th century was a period of substantial change, influence and tribulation in the Cape, all of which had effects on the supply of wine (figure 5). Treaties and agreements between France, England and the Netherlands were seen at the beginning of the century, followed by the abolition of the slave trade – upon which farmers so heavily relied – and the discovery of diamonds and gold which saw a large influx of immigrants.

The Cape, then under British rule, enforced stricter quality standards for wine production and through wine exhibitions hosted by the British, raised the level of competition – and consequently, the quality of wine – between local wine farmers (Estreicher, 2014:520). A further implication was the expansion of the wine market to include foreign consumers. Between 1808 and 1824, the production of wine doubled due to British imports (Ross, 1993:132). Better quality wine, especially from Constantia, was exported while the lower quality, common wine remained for local consumption (Estreicher, 2014:520). The growth in exports was, however, virtually obliterated by the end of the century, likely due to rumours and an eventual tariff agreement between Britain and France (Ross, 1993:138).

The agreement between France and Britain eventually took place under the Corden-Chevalier Treaty in 1861 (Ponte and Ewert, 2009:1639), making French wines considerably cheaper to import for the British as the treaty reduced the tariffs on manufactured goods to not more than 30% (Estreicher, 2014:525). With French wine being of superior quality and both easier and cheaper to ship, the import of French wine to Britain rose, while that of Cape wine fell substantially.

Given that farmers were facing production and labour shortages after the abolition of the slave trade, as well as shrinking export markets, wine production fell after 1838 (Figure 5). Toward the middle of the century,

further disaster hit the wine industry with the arrival of odium and Phylloxera – a powdery mildew and aphid infestation respectively (Estreicher, 2014:525 and Van Zyl, 1975:19). Given the devastating effects of these, many wine farms either went bankrupt during this period or transformed into fruit farms.

There are a number of events in this period which are worth mentioning for historical completeness, which may have an indirect influence on wine production. An important development for the wine industry was the establishment of the Koöperatieve Wijnbouwers Vereniging (KWV). Founded in 1918 to regulate the industry (Ponte & Ewert, 2009:1639), it led to improved coordination between

farmers and other parties, controlling sales and stabilizing processes thereby reducing wine surpluses, enforcing quotas which regulated the planting rights of new vineyards and production methods, and opening new markets for export of South African wine (Estreicher, 2014:527 and Ponte and Ewert, 2009:1639). In order to make surplus wine productive, the KWV encouraged farmers to distil brandy and produce fortified wine which allowed a successful export market for Cape brandies to emerge (McCusker, 2006:814). By 1924, the reach of the KWV was so extensive that 95% of wine makers in South Africa were members (Estreicher, 2014:528). By the 1940's, the KWV pushed for technological innovations in terms of

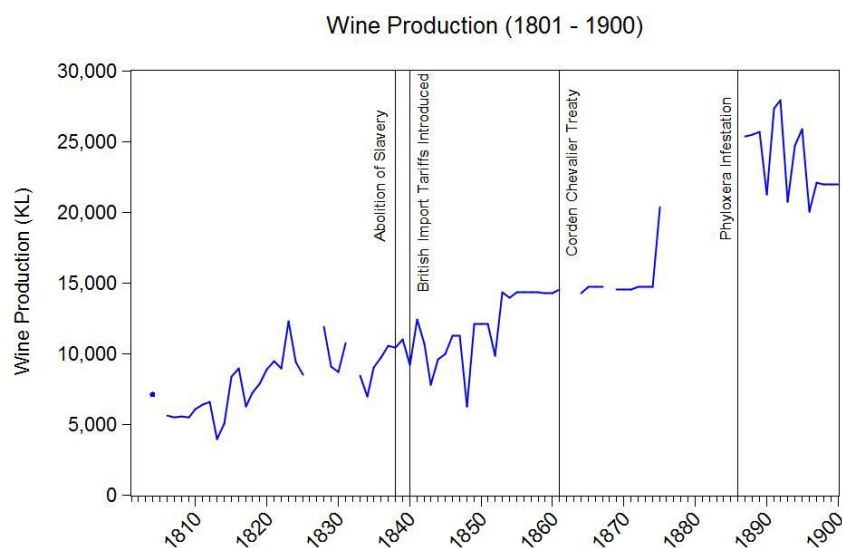


Figure 5: Wine Production (1800-1900)

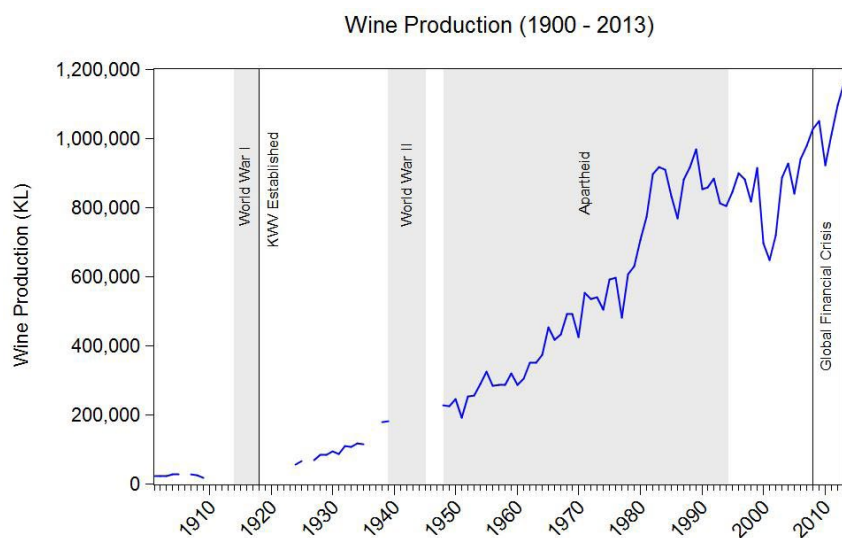


Figure 6 Wine Production (1900-2014)

making better quality wine and using improved viticulture techniques and technologies.

As the century progressed, the effect of sanctions influenced the export market under Apartheid. When international sanctions against South Africa were lifted, South African wine exports received a significant boost. The lifting of sanctions further meant that the industry was faced with a relatively unknown set of demands from the international market regarding quality, styles, processes and logistics – all of which were different from what the local market was accustomed to (Ponte and Ewert, 2009:1638).

As a result, South African wine entered an era of increased quality and special attention was paid to quality rather than quantity throughout the industry in order to compete internationally. In 1990, only 30% of grapes harvested were used as wine inputs which – with productivity, quality and marketing improvements – rose to 70% by 2003 (Estreicher, 2014:530).

## Conclusion

Our new data series has allowed insight into the history of South Africa's wine sector and its evolution from a single vineyard under Jan van Riebeeck to a thriving industry as one of the chief "New World" wine producers. With the aid of Breakpoint Chow statistics, certain key events in this timeline were highlighted and the resilience of wine production to changes in purchasing power was identified

(a) 1743			
F-statistic	194.7026	Prob. F(2,352)	0.0000***
(b) 1838			
F-statistic	48.2746	Prob. F(2,352)	0.0000***
(c) 1840			
F-statistic	47.1739	Prob. F(2,352)	0.0000***
(d) 1861			
F-statistic	32.0644	Prob. F(2,352)	0.0000***
(e) 1886			
F-statistic	19.4735	Prob. F(2,352)	0.0000***
(f) 1914			
F-statistic	3.0010	Prob. F(2,352)	0.0510*
(g) 1918			
F-statistic	1.3669	Prob. F(2,352)	0.2562
(h) 1948			
F-statistic	0.3326	Prob. F(2,352)	0.7172
(i) 1994			
F-statistic	0.7140	Prob. F(2,352)	0.4904
(j) 2008			
F-statistic	0.2731	Prob. F(2,352)	0.7612

\*\*\* - 1% significance, \*\* - 5% significance, \* - 10% significance

through Recursive Graphics. It is hoped that this new series will inspire further research into features of South African wine history and potentially offer new insights stemming from the collection of new data such as price or labour market series.

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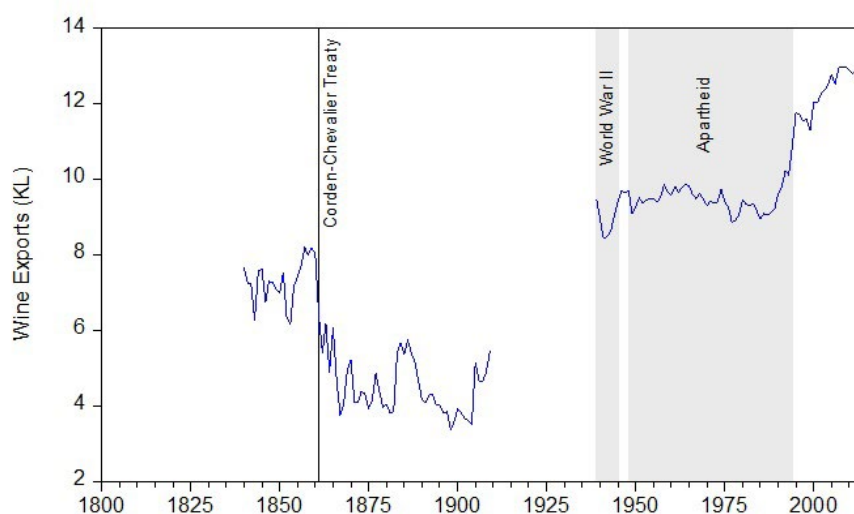


Figure 7: Wine exports



# The origins of migrant labour in South Africa: towards an alternative explanation

Heleen Hofmeyr, SU

**L**abour migration, whereby workers move away from their places of residence for work, is a relatively common phenomenon in most developing regions. This is largely due to the limited employment opportunities available in rural areas of developing countries. Individuals living in such areas typically migrate to urban areas, where there are more developed economies and therefore better employment opportunities, in search of work. From an economist's perspective, the relatively high prevalence of labour migration in the developing world can therefore be explained as a simple demand-and-supply of labour story.

Labour migration is also common in South Africa. What is interesting about the South African case, however, is that labour migration most often occurs on a temporary basis. That is, instead of permanently relocating to urban areas in search for work, migrants tend to maintain membership in their household of origin, and intend to return to these households at some point in time (Posel, 2010: 129). Rational choice economic theory, whereby individuals make decisions in order to maximise their utility, does not provide an explanation for this phenomenon, since the costs of temporary migrant labour tend to outweigh the benefits to the individual worker. This has led scholars to look

at history to explain the popularity of temporary labour migration among black households in modern-day South Africa. Two episodes in history are often posited at the centre of explanations of modern-day migrant labour, namely the mineral revolution of the late 19th century, and the creation of independent 'homelands' through apartheid legislation around the mid twentieth century. This paper offers an alternative explanation to these two theories by suggesting that a different episode in history, namely the Mfecane, constitutes the true origins of migrant labour in South Africa. This is based on insights from institutional economics which suggest that the persistence of migrant labour well beyond the abolition of official laws that necessitated this practice is not consistent with explanations that explain either the mineral revolution or the creation of homelands as the origin of modern-day migrant labour.

The paper proceeds as follows. Section 2 introduces institutional theory about the origins of informal institutions which casts doubt on the mining revolution or the creation of the homelands as the origins of migrant labour in South Africa. Section 3 uses the ethnic composition of mineworkers in the late 19th century to show that some ethnic groups flocked to the mines in greater numbers than others. This data is used to argue that migrant labour was already an existing institution among the Pedi, Tswana

and Tsonga groups prior to the mineral revolution. Explanations for why these three groups specifically developed migrant labour as an informal institution prior to the mineral revolution are offered in Section 4. It is thus made evident that migrant labour in South Africa is a particularly persistent institution due to its origins as an informal institution which developed semi spontaneously as a result of the Mfecane, rather than a reactive informal institution which developed only in response to the formal institutions of mining compounds or apartheid legislation. Section 5 concludes.

## Migrant labour as reactive formal institution

The two prevailing theories of the origins of migrant labour in South Africa, namely those which see migrant labour resulting from the mining revolution and/or apartheid legislation respectively essentially explain migrant labour as a reactive informal institution. As explained by Helmke & Levitsky (2003: 17), these are informal institutions which result purely in response to formal institutions. Helmke & Levitsky (2003: 17) make an important distinction between the latter and spontaneous informal institutions: reactive informal institutions, they argue, are established in direct response to the incentives created by formal rules, for example legislative or judicial rules. Reactive informal institutions are established in order to "fill the gaps" in, or mitigate the effects of,

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or substitute for, or subvert the formal rules (Helmke & Levitsky, 2003: 17). In essence, reactive informal institutions only exist in order to aid the accomplishment of the goal of the formal institution (Helmke & Levitsky, 2003: 17). Explanations of migrant labour as originating in the mineral revolution or apartheid legislation subscribe to this notion of reactive informal institutions since they see migrant labour as coming about purely in order to accomplish the goals of existing formal institutions. In the case of the mineral revolution, mineworkers were forced to leave their families for large parts of the year since they were not allowed to bring their wives and children to the single-sex compounds occupied by hundreds of thousands of black men. Migrant labour as an informal institution therefore came about in order to adhere to these formal rules made by mine owners. Similarly, black people participated in migrant labour during apartheid purely as a response to the formal rules put in place by the oppressive National Party government. The creation of homelands, in particular, is considered a major cause of current patterns of migrant labour. This is due to two reasons: firstly, the homelands were located in extremely rural parts of the country where the main productive activity was subsistence farming. As a result, there were very few formal employment prospects in these areas. Secondly, the enforcement of 'pass laws' allowed people to leave the homelands strictly for employment purposes only, and only for a limited amount of time (Richmond, 2010: 2). Thus adults working in other parts of the country could not bring their families with them, and in this way they were forced to reside away from their families and close to their place of employment for a large part of the year. As in the case of the mineral revolution, migrant labour during apartheid came about purely as a way of adhering to the formal laws at the time.

The problem with both these explanations of migrant labour as a reactive informal institution lies in the persis-

tence of this particular institution. According to Helmke & Levitsky (2003: 20), reactive informal institutions should be particularly susceptible to formal institutional change. Helmke & Levitsky (2003: 20) argue, "Because [informal institutions] emerge in direct response to incentives created by formal institutional structures, a change in either the rules themselves or the enforcement of the rules will directly affect the costs and benefits of continuing to adhere to the informal rules. In these cases, informal institutional change may be quite rapid." The fact that the informal institution of migrant labour remains popular in South Africa 21 years after the abolition of any laws that could force people to participate in this practice casts doubt on the above explanations of migrant labour as a reactive informal institution. If migrant labour really were a reactive informal institution, in other words it had originated either during the mineral revolution or apartheid, we would expect to see the popularity of migrant labour decline as time passes. As Helmke & Levitsky explain, if formal institutions cause the development of the informal institution in question, one would expect to see informal institutions disappear once the relevant formal institution changes. This has not been the case with migrant labour in South Africa. The abolition of apartheid laws has not been accompanied by the expected decline in the popularity of migrant labour. Thus an alternative explanation, one that sees migrant labour as coming about spontaneously, rather than reactively, is required.

#### **Migrant labour as spontaneous informal institution**

In contrast to reactive informal institutions, spontaneous informal institutions are created in response to incentives that are unrelated to the formal rules (Helmke & Levitsky, 2003: 17). Custom laws or kinship-based rules therefore fall within this category, since they seldom come about in order to serve existing formal institutions such as official laws (Helmke & Levitsky, 2003: 17). If migrant labour

in South Africa emerged as a spontaneous informal institution, therefore, it would have come about as a cultural norm or custom which cannot be directly linked to any formal institutions. Here we must be careful not to condemn migrant labour in South Africa to that category of phenomena which are taken simply as historically given due to the fact that it may have originated as a cultural norm. Even though explanations of the origins of spontaneous informal institutions are less obvious than those of reactive informal institutions given that the former cannot be directly linked to formal institutions which are often documented explicitly, such an explanation must be sought if we are to provide a satisfactory account of the origins of migrant labour in South Africa. A satisfactory account such as this would require both a theory and empirical evidence in support of this theory. The remainder of this paper constitutes an attempt at such an explanation.

#### **Mfecane as alternative explanation**

Stichter (1985: 19) presents evidence of the existence of migrant labour as a cultural norm before the discovery of diamonds in 1867. Based on written accounts of missionaries, Stichter (1985) argues that the Tsonga, Pedi and Sotho in particular migrated to and from the Cape Colony temporarily as early as the beginning of the 19th century in order to work there for large parts of the year. She argues that they did so without any legislation forcing them to participate in such patterns of labour migration. In institutional economics terms, therefore, the Tsonga, Pedi and Sotho developed this informal institution spontaneously, and not as a response to any existing formal institutions. Interestingly, these three groups were unique in their decision to work as migrant labourers; not even the Xhosa, who were geographically much closer to the Cape Colony, offered their labour in exchange for wages prior to the mineral revolution (Stichter, 1985: 27).

Stichter (1985) provides an interesting account of the reasons behind



the decision of the Tsonga, Pedi and Sotho to participate in temporary labour migration in the beginning of 19th century when other groups did not. One common feature of all three these groups is that their traditional means of survival were severely disrupted by the Mfecane conflicts that plagued southern Africa for the period 1815-1840. There are two reasons for this. Firstly, these three groups occupied geographical regions that were most under threat of attack by Mzilikazi, a Matabele king who ordered widespread raids and killings as he expanded his reign into the northern parts of the country. The Pedi, Tsonga and Sotho therefore faced the largest threat from Mzilikazi's army, causing near-constant battles between these groups (Stichter, 1985: 29).

The second reason for the major disruption in the livelihoods of the Pedi, Tsonga and Sotho during this period leads from the first in that Mzilikazi's expansion into the northern parts of South Africa caused not only constant warfare that resulted in losses of thousands of Pedi, Tsonga and Sotho, but also forced the Pedi, Tsonga and Sotho to abandon their homesteads at regular intervals in order to escape from Mzilikazi's army (Stichter, 1985: 35). Stichter (1985: 35) explains that this nomadic lifestyle was particularly disruptive to these three groups since they traditionally depended largely on subsistence crops for survival. Whereas other groups could take their cattle with them when running from attacking forces, the Pedi, Tsonga and Sotho had few cattle by comparison, and therefore struggled to survive as nomads who could not stay in one place long enough to develop a subsistence economy.

These major disruptions in the traditional ways of life of these groups created the need for them to find alternative ways of survival. Not only did these groups need to protect themselves against attacking armies, but they also needed to find ways of feeding themselves which did not involve crop farming. It is this dilemma that led all three these groups to offer their

labour to the British in the Cape Colony in exchange for wages (Stichter, 1985: 18). In particular, it was the young men from these tribes who travelled in excess of 1000 kilometres by foot in order to earn wages in the Colony. Their newfound wage income would save the Pedi, Tsonga and Sotho from the threat to their survival posed by the Mfecane in general and Mzilikazi's advancing forces in particular. Not only could they use their wages to purchase cattle from neighbouring tribes, which solved their food scarcity problem, but they could also purchase guns from the British. Stichter (1985: 36) provides convincing evidence that it was in fact the need for arms which largely drove the Pedi, Tsonga and Sotho to the Cape Colony: she reports that most young men worked in the Colony for about two years at a time, which was about as long as it took to earn enough money to buy a gun. Migrant labour therefore provided a way for the Pedi, Tsonga and Sotho to defend themselves in the conflict that raged in their regions around the period 1815-1840. This proved to be essential to their survival, thus permanently cementing migrant labour into the cultures of the Pedi, Tsonga and Sotho people.

The disruption in the livelihoods of the Pedi, Tsonga and Sotho and their need to protect themselves from constant conflict therefore provides an intuitively appealing theory of why migrant labour developed spontaneously as an informal institution prior to the mineral revolution in South Africa. In addition, this explanation matches the description of how spontaneous informal institutions come about, as argued by Helmke & Levitsky (2003: 18). These authors explain that because spontaneous informal institutions are generally created in a context where power and resources are unevenly distributed, explanations for their origins are "likely to involve conflict and coercion, rather than pure coordination" (Helmke & Levitsky, 2003: 18). According to this view of spontaneous informal institutions, the conflict of the Mfecane constitutes

a very fitting explanation of the origin of migrant labour as such an institution.

Although intuitively appealing, this explanation of the origins of migrant labour in South Africa is not very sound empirically, given that Stichter's (1985) accounts are based solely on missionary accounts produced at the time. While certainly useful as a means to access history, these accounts remain anecdotal and therefore remain somewhat lacking in empirical soundness. Fortunately, empirical evidence exists which matches these missionary accounts. It is to this evidence which I now turn.

#### Ethnic composition of mineworkers

The fact that it was strictly Pedi, Tsonga and Sotho young men that participated in migrant labour before the mineral revolution in South Africa means that this episode in history can be studied as a natural experiment. This is because the groups that did not participate in migrant labour prior to the mineral revolution, such as the Xhosa, Zulu, Tswana and Swazi, can be considered as counterfactuals to the Pedi, Tsonga and Sotho. That is, the groups that did not participate in migrant labour during this period can be studied as a control group, the existence of which allows us to derive important information about the groups that did participate. Specifically, this essay is concerned with investigating whether the Pedi, Sotho and Tsonga had already established migrant labour as an informal institution prior to the mineral revolution which began in 1867.

This hypothesis will be tested by considering the decisions of men from various ethnic groups to work as migrant labourers on South Africa's first mines at the beginning of the mineral revolution. If young men from the Pedi, Tsonga and Sotho groups initially flocked to the mines in greater numbers than men from other groups, this could indicate that Pedi, Tsonga and Sotho men did so largely because migrant labour was already part of these groups' cultural norms at the time of the discovery of diamonds and

gold. This, in turn, could indicate that Stichter's (1985) account of the origins of migrant labour as a means of surviving the conflicts of the Mfecane is empirically verifiable using data other than the anecdotal accounts of missionaries.

Data on the proportions of men from different ethnic groups who worked at the mines as migrant labourers is available from Wilson (1972: 4). He collected information from the Chamber of Mines regarding the

Ethnic group	Proportion of mineworkers
Pedi	23.4%
Zulu	1%
Swazi	0%
Xhosa	0%
Sotho	11.1%
Tswana	3.9%
Tsonga	60.2%
Groups north of Beit Bridge	0.5%

Table 1: This ethnic composition is the result of using geographic areas as proxies for ethnic groups in the following way: Transvaal = Pedi; Natal and Zululand = Zulu; Swaziland = Swazi; Cape = Xhosa; Lesotho = Sotho; Orange Free State = Sotho; Botswana = Tswana; Mozambique = Tsonga.  
Source: Adapted from Wilson (1972: 4)

ethnic composition of workers at all mines in the period 1896-1898. Wilson's (1972: 4) estimates are reported in Table 1 below. His data has been altered since he reports on the geographical origins of migrant workers instead of the various ethnic groups to which they belonged. For clarity, these geographical origins are used as a proxy for ethnic groups. Although naturally imperfect, geographical regions constitute a good proxy for ethnic groups in late 19th-century South Africa, when ethnic groups tended to uniformly occupy specific geographic

regions (Wilson, 1972: 7).

A striking pattern emerges from this data. The three ethnic groups that Stichter (1985) identifies as participating in migrant labour prior to the mineral revolution, namely the Pedi, Tsonga and Sotho, clearly dominate the ethnic composition of black Chamber of Mines employees in the period 1896-1898, representing 23.4%, 60.2% and 11.1% of this workforce respectively. Not only do these three groups make up the largest proportions of this workforce, but they do so by remarkably large amounts: the nearest competitor to the Sotho's 11.1% representation, the smallest of the three top groups, is the Tswana with a mere 3.9% representation. The Tsonga's representation is especially striking at 60.2%. It is possible that this extremely large number is a misrepresentation of the Tsonga's prevalence as mineworkers in South Africa since being from Mozambique is used as a proxy for being Tsonga in this table. This percentage may therefore overestimate the prevalence of Tsonga men at the mines.

While it is certainly true that this proxy is an imperfect estimate, it may nonetheless be a useful indication of the proportion of Tsonga men working in the mines. This is because substantial evidence exists that the overwhelming majority of Mozambican men who came to work in South African mines came from the southernmost part of Mozambique, which is the region that remains dominated by the Tsonga to this day (Peberdy, Crush & Msibi, 2004: 11). Moreover, even if some of the Mozambican mineworkers reported as Tsonga in this table were from other ethnic groups, the fact that the majority of this 60.2% were Tsonga means the Tsonga remains the largest ethnic group working in the mines at the time.

The evidence presented in Table 1 clearly supports the hypothesis that the three groups Stichter (1985) identifies as participating in migrant labour prior to the mineral revolution in South Africa were more likely to migrate to the mines at the begin-

ning of the revolution. Of course, this correlation between participation in migrant labour prior to the mineral revolution and high participation at the time of the discovery of diamonds and gold in no way implies causation between these two variables. Ordinarily, one would make use of ordinary least squares regression analysis to control for a number of characteristics that might be driving this positive association, in order to isolate the effect of participation in migrant labour prior to the mineral revolution. Unfortunately data on individual black mineworkers at this time is severely lacking. In the absence of such data, the positive association we observe is, although imperfect, the best evidence we have that established norms of participating in migrant labour drove Pedi, Tsonga and Sotho young men to the mines in larger numbers than other ethnic groups for whom participation in migrant labour was not yet an established social norm.

The implications of this finding for explaining modern-day patterns of migrant labour are huge, for it provides a potential explanation for the continued popularity of migrant labour in modern-day South Africa, despite the abolition of apartheid laws forcing this form of labour more than 20 years ago. The account provided by Stichter (1985), which seems to be verified by Wilson's (1972) estimates, explains migrant labour as originating as a spontaneous informal institution among the Pedi, Sotho and Tsonga. Given that spontaneous informal institutions are less responsive to changes in formal institutions than reactive informal institutions (Helmke & Levitsky, 2003: 20), the fact that migrant labour originated as the former may provide some explanation for why this form of labour remains popular in modern-day South Africa.

#### Conclusion

This essay has presented an explanation for migrant labour in South Africa as a spontaneous informal institution. This explanation constitutes an alternative to existing theories which see migrant labour as a direct



response to formal institutions, that is a reactive informal institution.

Using accounts of migrant labour among the Pedi, Sotho and Tswana during the Mfecane and evidence of these three groups flocking to the mines in higher proportions than other ethnic groups in southern Africa, this essay has presented the possibility that migrant labour originated as a response to the conflicts and interrupted livelihoods caused by the Mfecane, rather than as a response to the formal institutions of mining compounds and apartheid legislation. This explanation is consistent with fact that migrant labour remains a popular choice in modern-day South Africa, since spontaneous informal institutions are less responsive to changes in formal institutions than reactive informal institutions are.

The fact that many South Africans continue to participate in migrant labour despite the absence of any formal institutions which force this form of work thus lends some support to the notion that migrant labour originated as spontaneous informal institution. This first attempt at an alternative explanation of the origins of migrant labour has illustrated the potential insight to be gained from institutional economics in providing explanations for cultural norms which are often accepted as simply historically given. Further investigation into the exact mechanisms which caused migrant labour to persist as an institution despite changing economic and political landscapes in South Africa is therefore likely to be a worthy cause.

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# The origins of nuclear waste in SA

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A common conversation in the debate about nuclear power concerns the management of waste. Over the past two decades, much of this concern has revolved around the fact that South Africa has had no policy regarding the management of nuclear waste. This paper seeks to explore the subject of nuclear waste management in South Africa, drawing on an historical perspective on the anti-nuclear argument. Within the constraints of the relative scarcity of papers on this topic, a number of points will be brought together to form a case study, providing a broad overview of the topic. There are, to my best knowledge, no secondary sources on the South African nuclear waste sector that take an historical, or historiographical perspective. This paper thus speaks to this absence, in providing an historical perspective and account of the nuclear sector in South Africa from its origins to the present. The paper is divided into three sections, namely, South African nuclear waste in an historical perspective, the technicalities and institutional arrangement of the radioactive waste sector to date, and a case study. This case study will support the argument that the cost of nuclear waste outweighs the benefit of nuclear energy as a source of electrical power. The paper will argue, on the basis of the information that is available, that the state of the nuclear waste sector of South Africa is cause for concern. The financial cost of the nuclear waste sector cannot at this point be determined due to NECSA not releasing such information to the author, despite the access to this information being a constitutionally guarded right. The risks and mismanagement of the nuclear waste sector are appropriate ammunition in the anti-nuclear debate.

## South African nuclear waste in an historical perspective

In 1945, South Africa first began investigations into the production and

distribution of uranium. In the seventy years since then, South Africa has developed a nuclear energy sector that contributes only 5% of South Africa's total electricity output. Currently, there is sparse information on South Africa's nuclear waste sector, with little to no academically published research. There are however, a number of papers that criticise the nuclear industry, and a common criticism is around the management of nuclear waste, despite there being no reliable secondary source focused on waste management specifically. In discussing the history and development of the nuclear fuel industry, a number of scholars have argued that this industry was developed primarily as a political strategy by the Apartheid government. Examples are the anti-nuclear arguments of Fig, as well as the arguments by Marquard who pointed out the political affiliations of the nuclear industry (Fig, 2008; Marquard 2006). Both authors were writing in the mid 2000s. They were therefore writing in the context of a ten year old democracy, and their anti-Apartheid approaches are therefore very evident. This is relevant because they are approaching the argument from the position that South Africa had been suffering from a heavily oppressive regime, and sectors and industries now need to ensure that they accommodate to the transformative needs of post-apartheid South African society. In other words, the nuclear sector needs to be aware of its political, social, economic, and environmental impacts.

The nuclear industry began in the 1940s when the USA and the UK requested South Africa to collaborate on investigations into the prospective use of nuclear technology, specifically regarding military usage and applications (Auf der Heyde, 1993:3). South Africa's contribution was to inspect the uranium deposits it had at its disposal. Following the success of this enquiry into the availability of uranium deposits, South Africa was then contracted to supply all its uranium

to the Western powers for the Manhattan atomic bomb project. In 1952, the first full scale uranium extraction plant was opened and cooperation between South Africa and the Western powers strengthened.

However, South Africa was doing more than simply selling a resource. Jan Smuts, Prime Minister of South Africa at the time, realised the potential of a nuclear industry in South Africa – it could place South Africa at the forefront of technological development in the world (Marquard, 2006:209). This was “technological nationalism”, as David Fig would later critically describe it (Fig, 2008:190). Thus, when the South African government began negotiation with the Allies, Smuts ensured that South Africa’s resource advantage, its access to uranium deposits, was to be used as leverage – South Africa’s uranium would be sold exclusively to the West for weapon purposes in exchange for the importation of nuclear technology and expertise into South Africa (Auf der Heyde, 1993:3).

This move catalysed and catapulted South Africa’s nuclear sector into growth. By 1948, the Atomic Energy Board was established in South Africa, with the aim of governing the development of the nuclear sector, thus signalling the development of an indigenous nuclear sector (Auf der Heyde, 1993:37). In 1957, the International Atomic Energy Agency (IAEA) was founded, which was an international nuclear monitoring group, and South Africa was elected the African representative by the board of the IAEA, which consisted of 54 countries ranging from the United States, the Russian Federation, Cuba, Afghanistan, and others (Fischer, 1997:30). This election demonstrates the power and influence in the world that South Africa held, thanks to its nuclear industry. Until the late 1960s, South Africa continued to supply uranium to the West. However, following an altering of their agreement in 1958, which allowed South Africa control of surplus uranium, South Africa began to research and develop its own nu-

clear sector. Twenty years later, a nuclear waste management programme was put into place. In 1965, America provided South Africa with SAFARI I, a nuclear reactor for research purposes, furthering development of South Africa’s nuclear industry. Once the Nuclear Fuels Corporation was established in South Africa in 1967, South Africa’s nuclear industry was effectively self-reliant and independent. Moreover, all the initial stages, they claimed, in the nuclear fuel chain were now indigenous. International importation of technologies meant that South Africa was now capable of extracting, converting, and enriching uranium, and soon, weaponisation and fuel fabrication (Auf der Heyde, 1993:1). However, waste was not considered a fundamental chain in the cycle and no record of financial waste quantities exists prior to 1988.

Running concurrently with the development of a nuclear sector in South Africa was the development of the Apartheid regime. In 1948, the Nationalist Party had come to power, and by the mid-1960s the legal infrastructure of Apartheid had largely been established. The South African government was aware of the developing international protest against its regime and, in response, plans were put in place to ensure a strategic place in global markets as well as self-sufficiency, should sanctions become a reality (Auf der Heyde, 1993:7). An article published in 1964 in the New York Times discusses the United Nations forming a committee to investigate “imposition of economic sanctions if South Africa refuses, as in the past, to abjure the policy of Apartheid” (Hamilton, 1964). Accordingly, in 1976, due to anti-Apartheid pressure following the Soweto uprising, and the belief that South Africa was attempting to conduct nuclear weapons testing in the Kalahari, South Africa was stripped of its seat on the International Atomic Energy Agency (Auf der Heyde, 1993:38). The South African government, in defiance of international pressure, began construction of the Y-plant, which was to de-

velop weapons-grade uranium; as well as the Z-plant, which was to develop fuel grade uranium; and also Koeberg, which was to be the first nuclear fuel generator in South Africa (Marquard, 2006:224). It was only at this point that the Vaalputs programme, which would manage waste, would come into existence, arguably thanks to the development of nuclear weapons.

The development of nuclear weapons in South Africa was relatively covert. While the IAEA did have knowledge of Weapons of Mass Destruction (WMD) testing, South Africa’s weapons labs were undercover, with one in Pretoria, for instance, disguised as a Car Fitment centre (Auf der Heyde, 1993:8). Pressure from America and the UK to dismantle the weapons was not substantial, but given the context, this was not un-expected – the Cold War was in full swing, and the Apartheid government was at war with Communist-friendly resistance movements. To the USA, South Africa having nuclear weapons, along with an anti-Communist agenda, presented more of a potential benefit than a potential threat.

That being said, when the US Nuclear Non-Proliferation Act was passed in 1977, South Africa faced nuclear sanctions that prevented it from importing nuclear fuel. This resulted in further investment in the Y-plant, and consequently, in 1979, Highly Enriched Uranium (HEU), the key ingredient in nuclear weapons, was first produced in South Africa, with the intention of using it for nuclear weaponry (Auf der Heyde, 1993:37). Such an innovation in South Africa demonstrated the country’s capabilities. Undeniably, South Africa now had the potential for a prominent nuclear sector, both for fuel and militarisation. The ANC recognised the significance of this development, and it sabotaged the Koeberg power station in 1982. Four bombs were used, with no reported injuries or casualties, and the attack delayed construction of the nuclear power plant for a year. In a press release that year, the ANC claimed that the act was “a salute to our fallen he-

roes" (Lelyveld, 1982). It can be concluded that the sabotage was not carried out based primarily on a fear of nuclear weaponry, but rather because the ANC recognised the strategic importance of a nuclear power station in South Africa, and sabotaging such a strategic point would undermine the infrastructures of Apartheid. The Botha administration then restructured the AEB into the Atomic Energy Corporation (AEC). The AEC inherited the AEB's licencing power, making it a self-governing entity that had the power to licence nuclear entities. Yet this new entity was to act as a corporation, with some private interest and notably, the majority of its members were part of the secret AWB affiliated society the Broederbond (Marquard, 2006:214).

Despite this restructuring, the nuclear sector had by now reached its peak in South Africa, as had the Apartheid regime. The consequences of its nuclear weapons programme had been an increased international resistance to Apartheid policies, and South Africa losing its seat on the IAEA. Entities like the ANC had recognised the nationalist government's strategy of using nuclear power as a tool for self-sufficiency and militarisation, and was accordingly beginning to sabotage this strategy. It is at this point that it becomes clear that the nuclear sector in South Africa was a product of Apartheid and it was, as FW de Klerk said:

... yet another major expense which we would never have undertaken had it not been for our growing isolation and sense of confrontation with the international community. Ultimately, it was yet another cost of Apartheid and of sanctions. (Marquard, 2006:214).

This highlights why the nuclear sector's growth began to slow down with the end of Apartheid. When De Klerk came to power in 1989, the Apartheid-driven nuclear sector came to an abrupt halt. One of his administration's first acts was to publicly dismantle the nuclear weapons. The unilateral decision of a country to dismantle its nuclear weapons was unprecedented,

and the act is, to this day, celebrated by some, as one of South Africa's finest achievements (De Villiers, Jardine et al., 1993:2015). However, the act was not unilateral, as is apparent in an investigation into the context surrounding the act. With the collapse of the Berlin Wall, and the increase in international sanctions, Apartheid was under threat and the Apartheid government would not readily grant both presidential power and nuclear weaponry to the political entity it had been fighting for so many decades (Fig, 2008:187). The weapons were thus dismantled, due to both internal and external pressures. In 1990 the Y-Plant, which was producing HEU, was shut down, and the following year, South Africa signed the non-proliferation treaty. South Africa was then re-inducted onto the IAEA. It is important to note here that the new democratic South Africa inherited the nuclear fuel systems, and not nuclear weapons. Nuclear weapons research had been burnt and destroyed when the weapons were dismantled, for the reasons discussed above (Fig, 2008:187).

The infrastructure the nuclear sector left included both benefits and loss. The benefits included the Western Cape inheriting Koeberg, which contributes to 40% of the Western Cape's total energy (Eskom, 2014), as well as South Africa retaining some of the most noted nuclear physicists in the world. Yet the burdens of irrational tenders and a nuclear sector financially dependant on the state also remain. Additionally, the burden of a growing store of high-level waste within the Koeberg centre remained, as will be discussed.

In the year that the ANC took power, the nuclear fuel industry was costing the state R300 million per year while it was only generating an annual income of R90 million (Auf der Heyde, 1993:2). The nuclear fuel industry was thus running at a deficit of R210 million at the beginning of the democratic era in South Africa. Additionally, in the thirty years that nuclear fuel had been viable in South Africa,

the industry had amassed a contribution of at least R30 billion from the state (Marquard, 2006:196). Since then, the South African government has continued to invest large amounts into the development of its nuclear sector: 10% of the Ministry for Energy's budget is currently dedicated to nuclear research and development (World Nuclear News, 2014), and South Africa is in talks for the building of a nuclear plant to the value of \$100 billion (Business Day, 2015). In spite of all of this, nuclear energy contributes a maximum of 5.9% – all from Koeberg – to the total supply of South Africa's electricity. The plant is constantly shutting down due to trips, glitches, sabotage and loose bolts – which get replaced by expensive imports, according to Fig (Fig, 2008:193). The Koeberg systems are offline 20% of the time, according to Eskom (Eskom, 2014).

The picture that emerges is that nuclear fuel in South Africa is not a substantial sector of the economy. It drains large amounts of state capital and returns very little. Combined with the growing burden of nuclear waste, the need for the sector in the country is debatable (Fig, 2005). What is clear, however, is that the nuclear sector in South Africa was one built for political strategy and largely to aid the Apartheid regime. Following the dismantling of Apartheid, the sector continues to operate, but amidst growing concerns. Debates on this sector vary, from the left-wing, anti-nuclear position held by Fig, to the pro-nuclear side held by Auf der Heyde. The argument against nuclear power rests on the fact that the consequences of nuclear energy mishaps are dire. The argument for nuclear energy counters this by pointing out that when the nuclear industry is conducted correctly, mistakes, and the consequences of these mistakes, will not occur, which is theoretically correct (Was, 2015). This counter argument is problematic, in that it undermines the concept of risk by arguing that consequences will not occur in an ideal scenario. Risk occurs in a scenario that is not ideal, and



one therefore has to argue about the consequences of risk within a scenario that is not ideal. The fact that there is a risk of dire consequences in the event of mismanagement needs to be addressed. However, as for a cost versus benefit argument, the history of the indigenous nuclear industry reveals that the costs of nuclear energy have outweighed the benefits. The state of the nuclear waste industry bolsters this point.

#### The technicalities and institutional arrangement of the radioactive waste sector

What follows is an outline of the general framework regarding the legislative functioning of the sector. It also provides a brief summary of the technicalities of nuclear waste management, such as the division of different types of nuclear waste, as this is fundamental for one to understand the problems with the industry. Finally, it concludes with a brief summary of the nuclear waste industry's activities and history. Together, these will make clear the challenges in the nuclear waste sector, and the role waste plays within the greater nuclear energy sector of South Africa. While much of this information relates to a contemporary context, its importance lies in its contribution to the historical debate on the nuclear industry, in that it highlights issues that have arisen over the past two decades.

The National Radioactive Waste Disposal Institute Act of 2008 is the primary piece of legislation dealing with the management of nuclear waste. This Act derived from a drive to have a formal policy passed, dealing with nuclear waste management (World Nuclear News, 2014). Centrally, the Act was meant to have founded the National Radioactive Waste Disposal Institute. The Institute is to be tasked with a number of different tasks but simply put, it should become the general manager of nuclear waste. However, despite the Act now being several years old, the institute does not yet exist and the Nuclear Energy Corporation of South Africa (NECSA), a parastatal of South Africa, continues

to manage nuclear waste, as it has done since it was still the Atomic Energy Board in the early 1940s (NESCA annual report, 2014:28). Operationally, NECSA manages nuclear waste through one of its subsidiaries, an organization called Nuclear Liabilities Management. This group oversees all the aspects of the nuclear waste management sector, from managing Vaalputs to coordinating the sale of decontaminated scrap material (NESCA annual report, 2014:28).

It is now necessary to explain briefly the technicalities of nuclear waste. Radioactive waste is classified into four categories: very low level waste, low level waste, intermediate level waste, and high level waste (Bodansky, 2004: Ch9&10). The level refers to the degree of radiation, with low being least harmful and high being most harmful. Very low level waste constitutes items that are not considered harmful to the public or environment. This is mostly debris from construction or maintenance of nuclear industrial sites, and as such is disposed with domestic refuse. This form of waste will therefore not be investigated, as it does need to form part of the nuclear waste industry - it can be treated the same as non-radioactive waste. Low level waste consists of paper, rags, tools, clothing, filters and so on, which might contain small amounts of radiation that will exist for short periods of time. This is the most common form of waste, and makes up 90% of all waste derived from the nuclear industry. Its radioactivity, however, only makes up 1% of the total radioactivity of nuclear waste. It is therefore suitable for what is known as "shallow burial", which involves being incinerated or compressed, placed into sealed containers, and buried, generally only a few metres underground. Intermediate level waste is comprised mainly of chemicals from the nuclear reaction process such as resins, chemical sludges and contaminated materials from reactor decommissioning. This type of waste may require shielding when handled, and makes up approximately 4% of the total radioactivity of all waste.

Non-solids are generally solidified in concrete for disposal. This is the most radioactive form of waste that can be buried at South Africa's waste disposal site Vaalputs, and it will remain toxic for a long period of time. Finally, high-level waste constitutes the items used within the fission process - the process whereby nuclear energy is created. This waste is highly radioactive and gives off a lot of heat and as such requires both cooling and shielding. It is currently stored on site, such as at Koeberg in cooling containers, and can remain radioactive for what some estimate at hundreds of thousands of years (NESCA annual report, 2014:29). Currently no plans exist for a final and long-term management of high level waste.

The history of the nuclear waste industry begins relatively recently, compared to the Nuclear procurement and development industry. As discussed above, the first investigations into nuclear energy took place in the 1940s but the disposal of nuclear waste only became a focus in South Africa in the late 1970s (NESCA Overview of Repository Program at Vaalputs South Africa). The programme to select a nuclear waste site commenced in 1978 but it was not until 1983 that three farms were purchased, which would make up the Vaalputs property, and by 1986 the first loads of waste were delivered (Vaalputs The National Radioactive Waste Disposal Facility). Currently, Vaalputs is South Africa's only nuclear waste site where low-level waste and intermediate level waste are stored.

An explanation for the length of time taken to select an appropriate site can be found in the wide range of conditions that had to be met. Selection criteria for a nuclear waste site were population density, mineral potential, seismic hazard probability (the risk of earthquakes), agricultural production, rainfall and groundwater recharge, surface and groundwater hydrology, growth potential, and political boundaries (NESCA Overview of Repository Program at Vaalputs South Africa). The Vaalputs area had

a population density of <1 person per km<sup>2</sup>, its mineral ground was made up of clay, granite and sand, the only agricultural practices close by were sheep farming, it was a highly dry area with a small ecosystem, and the closest town was a drive of roughly an hour (NESCA Overview of Repository Program at Vaalputs South Africa). It was therefore deemed a suitable venue for a nuclear waste site expected to be an off-limits zone for centuries. An estimated 500 concrete, and 1,500 metal drums were expected to be delivered per annum, with the drums consisting of a range of items, from used gloves to construction items. The zone was estimated at having a total potential capacity of roughly 500,000 metal drums, and 60,000 concrete drums. According to these figures, the site could be used for just over 300 years, assuming that waste deliveries did not increase. According to NECSA's annual report from 2014, currently 56,205 drums (of both concrete and metal) are stored at Vaalputs – averaging a total of 2,000 drums a year – meaning their estimates up until now have been correct (NESCA annual report, 2014).

The only noticeable growth in drum delivery can be seen in a comparison of the periods pre-1994 and post-1994 (NESCA Overview of Repository Program at Vaalputs South Africa). Pre-1994, an average of 300 metal drums were delivered a year with a minimum of 100 in 1987 and a maximum of 800 in 1994. In 1988, 1,800 drums were delivered, which is the highest amount out of any year, but this is a drastic outlier. Most likely, this was due to the fact that FW De Klerk had decommissioned nuclear weapons that year, and undoubtedly there was a large amount of weaponry waste to be disposed of. Post-1994, the mean has been 1,100 metal drums delivered annually, with a maximum of 1,200, and a minimum of 200. The minimum was most likely caused by South Africa's nuclear license being suspended for not following regulatory procedures, and nuclear activity was briefly halted. As it stands, the site will continue to operate, as planned, unless other ex-

ternalities present themselves, such as a new set of nuclear reactors and an increased input of waste. High level waste is stored on-site at Koeberg for cooling, and very low level waste is decontaminated and sold. The latter generates income averaging between 1 and 2 million ZAR a year.

Through this discussion of the technicalities and institutional arrangement of the radioactive waste sector, a number of points become clear: Firstly, the industry is not one which is overly competent, as can be drawn from the fact that the Institute founded in 2008, intended to be the sole, and independent manager of nuclear waste, has yet to be properly established. It has also become clear through the discussion so far that no plan currently exists regarding the management of high-level nuclear waste, despite it being the most harmful and long-term form of waste. Thirdly, the Vaalputs process has gone according to plan since its inception in the early 1980s. Due to the expected expansion of the nuclear sector in the next ten years, however, the area may not have sufficient capacity for waste, and further plans need to be made to accommodate this increase. These points therefore provide a new historical perspective on the nuclear waste sector by demonstrating the problems associated with the sector, some of which have been noticeable for twenty years, and the unconstructive way in which Government and the relevant parastatals have addressed these issues.

#### A case study of nuclear waste management

Regarding the long-term management of nuclear waste, South Africa does not have any concrete plan. For instance, when it comes to high-level waste, The Radioactive Waste Management Policy and Strategy for The Republic of South Africa (2005) states:

The storage on these sites is finite and the practice of storing used fuel on a reactor site is not sustainable indefinitely. Government shall ensure that investigations are conducted within set timeframes to consider the various options for safe management

of used fuel and high level radioactive wastes in South Africa (The Radioactive Waste Management Policy and Strategy for The Republic of South Africa, 2005).

In this policy, four potential options to deal with waste are provided. The first is long-term above-ground storage on an off-site facility licensed for this purpose. The only way that this would work is if “more appropriate technologies are developed in future” (The Radioactive Waste Management Policy and Strategy for The Republic of South Africa (2005)). In other words, the first plan is one based on a potential development of technology, which is an inherently risky strategy because of its imprecision. One could make the argument that it has been included simply to add bulk to a relatively empty policy.

The second proposed option is that of reprocessing, conditioning and recycling. Some countries, such as Canada, have the technologies to reprocess high-level waste into nuclear energy. South Africa has the possibility to either import these technologies with the aim of reprocessing waste within its borders, or to export the waste for reprocessing. This does, however, raise concerns pertaining to proliferation. Radioactive waste can be used to create a “dirty atom bomb”, “a device that uses radiological or chemical materials along with conventional explosive . . . as a means of causing fear [by terrorist groups]” (Philips & Sharkov, 2014). Additionally, reprocessing comes at a massive cost, one that the Department of Energy claims “could mitigate against reprocessing in South Africa” (The Radioactive Waste Management Policy and Strategy for The Republic of South Africa, 2005). In 2003, the estimated cost of nuclear waste reprocessing worked out to \$1,000 per kilogram of heavy metal. This would increase the cost of electricity by roughly 80% (Bunn, van der Zwaan et al., 2003). This increase occurs because the waste is not reprocessed into uranium. Rather, the waste is generally processed into plutonium oxide or MOX fuel (mixed-oxide ura-

nium-plutonium) (Ramana, 2013). Simply, the cost of converting this fuel into energy is more expensive than the cost of the entire uranium enriching process – from mining to conversion to energy (Ramana, 2013). The cost of purchasing a reprocessing plant can also be extremely heavy. Japan's reprocessing plant, to take one example, cost the state \$20 billion in 1993, one of the most expensive single industrial facilities in history (Ramana, 2013). This plan is therefore not financially viable in South Africa. Again, the plan seems to be adding bulk to the 2005 report. One can draw the conclusion that because environmental activist groups were pressuring the state to develop pro-environment policies, and to produce a policy managing nuclear waste, the policy was injected with these clearly unrealistic and unfeasible "plans".

The third plan is deep geological disposal. Essentially, this is the only viable plan. In Finland, Sweden and France, the first such repositories are expected to become operational in the next decade (IAEA, 'Overview of Disposal Options' 2013). The theory behind this method is that the waste is buried deep enough underground where it can reside for hundreds of thousands of years, without providing a potential hazard for future generations. This proposal seems the most promising. However, the policy suggesting this as a potential solution was published in 2005. Ten years later, South Africa still has no concrete plan as to how to deal with its high-level waste, and it continues to be stored on site.

In 2011, NECSA presented a Solid Radioactive Waste Management Plan. In this document, it was argued that an endpoint for all categories of waste must be found. The endpoint for intermediate-level waste was that a greater confinement trench at Vaalputs be created. Low-level waste's endpoint was storage in a near-surface disposal facility at Vaalputs. High-level waste, however, has "no endpoint as yet" (Radioactive Waste Management Policy and Strategy for the Republic of South Africa, 2005). Effectively, these

endpoints have not been developed since Vaalputs was first conceptualised in 1978; the disposal concepts for intermediate, low level, and very low level waste have all remained virtually the same (NECSA, Overview of Repository Program at Vaalputs South Africa). The Radioactive Waste Management Policy of 2005 states: "All conclusions on investigations shall be subject to public scrutiny" (Radioactive Waste Management Policy And Strategy For The Republic of South Africa, 2005). However as of yet there have been no studies or reviews commissioned to subject high level waste to scrutiny. In 2011, six years after the aforementioned policy, the Waste Management Plan stated that management of disposal of high-level waste was being developed on a national level. Due to the unavailability of any information to the contrary, it can be suggested that the statement regarding "development on a national level" is a way of avoiding the reality that no plan currently exists.

In the Nuclear Energy Policy of 2008, the Department of Minerals and Energy provides a 17-year plan to develop South Africa's nuclear energy sector. In it, the years 2016 to 2025 are aimed at the development and operation of new power plants, an expansion which South Africa seems to be on track with. Yet at no point is there mention of a policy to deal with high level waste. In fact, NECSA was briefed by the IAEA to develop a report on Deep Geological Disposal, the most realistic method to handle high level nuclear waste in South Africa, and NECSA's report has been used by other countries to investigate and develop their own deep geological disposal repositories. In spite of the success of NECSA's study report, South Africa continues to rely on its limited on-site facilities to store high-level waste, rather than beginning its own depositories and despite taking on an expansion of the nuclear industry worth \$100 billion. The state needs to develop a plan, rather than a "plan to plan", that will sustainably deal with high-level nuclear waste in

a way that will not burden generations to follow. It is clear that some of the possible plans suggested in the Waste Policy are not viable; long-term above ground storage on an off-site facility licensed for this purpose is a plan based on technologies that do not exist and the reprocessing plan is overly costly. NECSA has developed a study on Deep Geological Disposal, and accordingly needs to institute a pragmatic approach to developing its own repositories. The history of the management of high-level waste in South Africa is therefore one of an absence of development. From day one, high-level waste has been stored on-site, and 30 years later, it continues to be stored on-site. If South Africa continues on this path, high-level waste will provide a very serious problem to the future population and environment of the country.

The expansion of waste storage at Vaalputs has been at a rate that was projected, with an average of 2000 drums per annum. One of the criteria for selecting Vaalputs was the fact that it had low rainfall. Towards the end of the 1980s average rainfall around the Vaalputs area was about 20.2mm (Dent, Lynch & Schulze, 1989). The average over the past ten years has been 20.8mm (World Weather Online, 2015). This has therefore not provided any significant change. The agricultural industry also has not developed much over the past 30 years in the surrounding area of Vaalputs, and earthquakes have not become a risk. Population density remains less than one person per square kilometre, though settlements just outside the border of the Vaalputs area have begun to develop, likely for the labourers at Vaalputs (STATSSA, 2015). None of the other criteria have changed significantly. The Vaalputs area therefore meets its own criteria in being appropriate to the task of waste storage. While the external context of the Vaalputs area has not changed over the past few decades, however, the internal context may lead to a problem. Currently Vaalput's nuclear waste storage capacity is sitting at 10%. As



was found earlier, it could continue to operate at its current rate for another 300 years. However, with new nuclear expansion on its way, this will change drastically.

Despite the history of Vaalputs indicating that it can continue to operate for a very long time, this is likely to change due to the new nuclear deal. The sustainability of Vaalputs is therefore not as promising as it may seem, and an expansion, or finding of a new nuclear site, will at some point in the future have to occur.

In the annual reports of NECSA, it is stated that it has been making in excess of a million ZAR a year on the sale of decontaminated scrap materials since 2001. What exactly this consists of is unclear. Despite this author's numerous efforts to gain access to reports on these sales, NECSA remained uncooperative.

However, in 2014, the environmental activist group Earthlife Africa lodged an application with the Gauteng High Court to halt smelting operations (Paton, 2014). While this application was based on a technicality, it provides some insight into the industry. Essentially, the process of decontamination involves radioactive material (such as waste), being smelted with scrap metals, which are subsequently sold off. The theory behind this decontamination process is that it loses radioactivity, and can thus be sold as scrap metal. However, Earthlife insists that the decontamination is not effective enough. Their application concerned a smelter intended for the exclusive decontamination of a specific 14 000 tons of contaminated material; some of it being parts from decommissioned nuclear weapons from Apartheid's arsenal. Whether it was only the 14 000 tons of scrap which was not decontaminated sufficiently, or whether all waste is not decontaminated sufficiently has yet to be determined. Through the sale of decontaminated materials, relative to the GDP of 350 billion ZAR, South Africa has been making a small amount every year at least as far back as 2001, this waste being unrelated to the 14 000 tons (Worldbank, 2015). In 2001, 1.1

million ZAR was earned from the sale of decontaminated scrap materials; in 2010, the figure was 2.3 million ZAR; and last year it was 1.5 million ZAR. While this is a negligible contribution to South Africa's total GDP, it is still a sizeable amount of capital being made out of a relatively unknown industry.

The most common form of scrap material that gets decontaminated is a form of aluminium, according to the NECSA annual report from 2006 (NECSA annual report, 2006). On average, Nuclear Liabilities Management clears 99% of decontaminated material (NECSA annual report, 2014). What this means is that 99% of its materials are declared free of harmful levels of radioactivity, and can accordingly be sold as standard scrap metal; which any person could essentially buy. However with little oversight and legislative operating requirements, the validity of these declarations is questionable. If NECSA fails to adequately clear the decontamination of the materials, the sold materials could find themselves being used as materials for shack building, construction, or commercial activity, all of which have serious health implications for both the people in and around these materials, and the surrounding environment. Human health issues arising from radiation poisoning can include "nausea, vomiting, fatigue, and a lowered white blood cell count. . . Death can result from infection, dehydration, or low white blood cell count". Further research and investigation is therefore required into a record of sales and procedures regarding the sale of decontaminated materials by Nuclear Liabilities.

To summarise the case study, the following has been found: There currently exists no plan for the long-term management of nuclear waste, despite this waste being the most toxic and dangerous form of waste. The way in which it has been dealt with is comparable to leaving dirty dishes in a sink. Vaalputs, according to its history, should operate for another 300 years. The nuclear expansion program set to develop in the next few years, how-

ever, provides a challenge to this estimate, and plans for a new disposal site for the management of low-level and intermediate-level waste will need to be made in the future. Lastly, the sale of decontaminated scrap materials provides a particular risk in South Africa. Due to the fact that there are no independent overseeing bodies that are ensuring the decontamination of materials is sufficient enough for the materials to be considered non-toxic, the sale of these materials has the potential to cause serious health-risks for persons within the environment of these materials. The three points above therefore criticise the nuclear waste industry over the past two decades.

The fact that this criticism can be levied against the nuclear waste sector supports the arguments by authors such as Fig, who claim that nuclear energy is not a viable option for South Africa. As has been the case historically, the costs of nuclear energy continue to outweigh the benefits. In the past, the sector was predominantly founded as a tool of Apartheid and Nationalist ideologies, without sufficient thought and planning towards the management of nuclear waste. This error on the part of the Apartheid government has been repeated by the present government in that no sufficient plans and processes have been put in place to improve, and in some cases sufficiently to deal with, the management of nuclear waste. This paper is therefore a contribution to the anti-nuclear side of the debate regarding the appropriateness of nuclear energy in South Africa. As it stands, the history of nuclear waste management indicates that South Africa is unable to deal with the consequences of nuclear energy development. The government therefore needs to invest a large amount of resources into developing a sufficient and viable plan soon, if it hopes to successfully complete the expansion of the nuclear sector in the country.

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## In memoriam: Robert Shell

Robert Carl-Heinz Shell died on February 3, 2015. The following is an excerpt from an obituary by the Department of Historical Studies at UCT:

The Department was deeply saddened by news of the death of Robert Shell. Robert towered above us in many ways – literally, since he was one of the tallest students the Department has ever known – but also in the pioneering nature of his historical scholarship.

As an Honours student in the Department in the early 1970s, Robert identified the importance of Islam in the early colonial Cape Colony under Dutch East India Company rule and the role that Asian slaves played in its growth. This became the main theme of his life's work.

He completed his doctorate at Rochester in the US under the supervision of leading historians of slavery in the

Americas and subsequently obtained a post at Princeton. In the 1970s the study of slavery in the Americas was being revolutionized by the application of statistical and quantitative methods, and Robert became fully conversant with what then were new techniques of computer analysis.

The book that resulted from this, *Children of Bondage*, was a landmark study of Cape slavery. It is brimming with data that took years to collect and analyse at a time when computer technology was much less developed than it is today. Robert's conclusions that Cape slaves played a central role in the development of the colony, deeply influencing not only its economy but also settler family structures, urban and rural architecture, language and culture made a major impact on both Cape history and slave studies more widely, and the book remains a standard work for students and scholars.

Robert returned to South Africa

in the late 1980s and used his demographic and quantitative expertise to set up a research project at Rhodes University examining the nature and causes of the spread of HIV/AIDS that was beginning to ravage the country and about which very little was known. His findings were not welcomed by the authorities who were in a state of denial about the epidemic. Unafraid of speaking his mind, his criticism of the way in which his research was handled led to his departure from Grahamstown and he moved to a specially created Chair of Historical Demography in the Statistics Department at UWC.

Back in Cape Town, Robert continued to be an active historian and teacher. He was particularly committed to digital technology and worked tirelessly to assemble resources on the Company Slave Lodge in CD-ROM format for wide availability. He lived to see his lifelong work on Cape slavery have a major impact not only on scholars and students but also on the general public.



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