

# **SOUTH AFRICA IN THE INTERNATIONAL ARMS TRADE NETWORK (ATN) DURING ANC RULE (1994-PRESENT): A NETWORK ANALYSIS**

**Burgert A Senekal<sup>1</sup>, Jan-Ad Stemmet<sup>2</sup> and Karlien Stemmet<sup>3</sup>**

## ***Abstract***

*Network theory has become a key theoretical framework with which to study complex systems, and a large number of studies have investigated the structure of the World Trade Network (WTN) within this paradigm. This article follows Åkerman and Larsson-Seim (2014) in investigating South Africa's position in the international Arms Trade Network (ATN) from 1994 to the present within the framework of network theory and by using data provided by the Stockholm International Peace Research Institute (SIPRI). Using centrality measures such as degree, betweenness, closeness, and in- and out-degree, the article shows that South Africa is a relatively important role player in this trade network, and specifically as an arms exporter. It is also discussed how South Africa's position changed under the leadership of consecutive presidents, and it is shown that the country became more active during the presidencies of Thabo Mbeki and Jacob Zuma than it was under Nelson Mandela.*

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**Keywords:** Arms trade; complex networks; trade networks; Social Network Analysis; SNA.

**Slutelwoorde:** Wapenhandel; komplekse netwerke; handelsnetwerke; Social Network Analysis; SNA.

## **1. INTRODUCTION**

South Africa is a respected role player in the arms industry, with clients ranging from the United Nations to the United States. South African designed and produced weaponry have been used in peacekeeping and counterinsurgency operations worldwide, including in the most recent war in Iraq, where the Private Military Company Blackwater used South African Mamba mine-protected vehicles for convoy movement in the face of increasing insurgent attacks that utilized Improvised Explosive Devices (IEDs). The country is also a regional leader. Wezeman (2011:12), for instance, writes, “The South African arms industry is by far the largest and most technologically advanced in sub-Saharan Africa”. In Africa, the African Union in particular has relied heavily on South African armoured vehicles in peacekeeping operations.

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1 Research Fellow, Unit for Language Facilitation and Empowerment, University of the Free State. E-mail: senekalba@ufs.ac.za

2 Senior Lecturer, Department of History, University of the Free State. E-mail: stemmetj@ufs.ac.za

3 Lecturer, Department of Economics, University of the Free State. E-mail: kitchk@ufs.ac.za

The success of the South African arms industry in the post-Cold War arms market is largely a result of initiatives taken by the former National Party government to establish a self-sufficient industry in the face of the UN arms embargoes and the growing threat of Soviet and Cuban military intervention in Southern Africa. Henk (2004:13) argues,

“The quest for security made South Africa one of the handful of states in the developing world willing to bear the economic burden of developing not only a massive conventional arms industry but also nuclear weapons and a space programme (the latter two being dismantled in the early 1990s). Still, South Africa’s recent history bequeathed it an armaments industry like no other in Africa.”

Of course, the South African arms industry had to adapt to the vastly different context in which trade occurred after 1994. On the one hand, the domestic demand for weaponry decreased significantly after the South African Defence Force (SADF) withdrew from Angola and Namibia in 1989, but on the other hand, the export market opened up after the embargoes were lifted in May 1994. Botha (2003:2) writes,

“In 1989 FW de Klerk succeeded PW Botha as president. Shortly thereafter, the Soviet Union collapsed, closing the chapter on superpower rivalry. This affected countries in Southern Africa, which had been drawn into the competition between the dominant powers. A settlement was reached in Namibia, whose transition to democracy followed in 1990. There was no longer a clear need for South Africa to maintain a strong military force. Instead the government faced the urgent task of balancing the budget after years of apartheid-era profligacy. It was the defence budget that suffered most [...]. By 1994, the industry was much smaller and had lost significant capacity and capability. However it had reshaped into a tougher, more cost effective and consequently more competitive actor in the international arms scene.”

History provides a necessary context for any complex system, and in the case of the arms trade, events set in motion by the National Party in 1968 by establishing Armscor continue to have an effect on South Africa’s contemporary arms industry. It is therefore against the backdrop of the Cold War and the National Party regime that this study explores how the industry created by the NP government engaged with the global arms industry under the new ANC government since 1994.

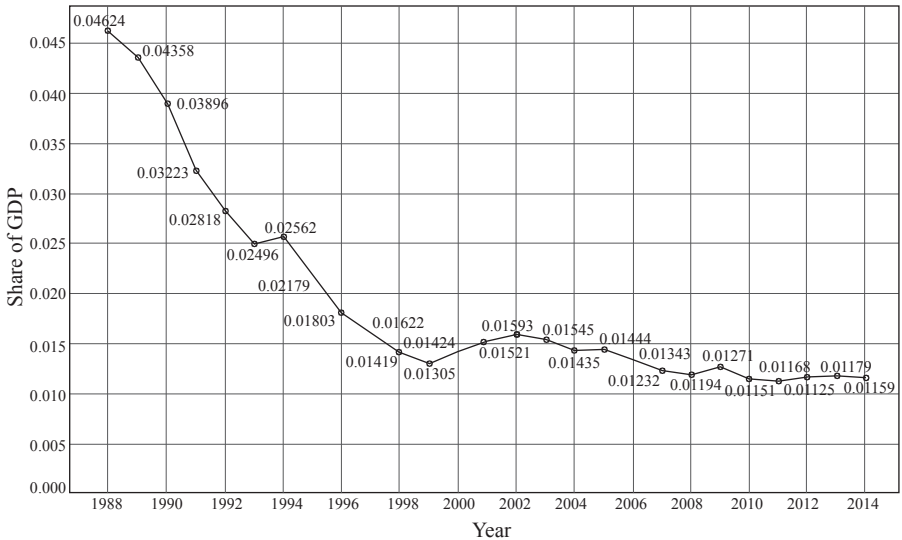
This article follows Åkerman and Larsson-Seim (2014) in studying South Africa’s position in the international Arms Trade Network (ATN) from 1994-2014, using network theory. Like Åkerman and Larsson-Seim, we use data on the international arms trade as provided by the Stockholm International Peace Research Institute (SIPRI), which is “the richest dataset available on arms trade” (Åkerman and Larsson-Seim 2014:537). The dataset includes major conventional weapons systems, but not small arms or less-lethal, chemical, biological or nuclear weapons. The authors focus on South Africa’s changing trade relations and position in this industry since 1994, but draw comparisons with earlier periods whenever

applicable. In following studies of the World Trade Network (WTN), such as Fagiolo, Schiavo and Reyes (2008; 2009; 2010), Schiavo, Reyes and Fagiolo (2010), De Benedictis and Tajoli (2011), Squartini, Fagiolo and Garlaschelli (2011), Fagiolo, Squartini and Garlaschelli (2013) and Vicarelli *et al.* (2013), this article focuses on trade relations on a global scale rather than the dynamics of the local industry. While the WTN has been studied extensively, the ATN has not, and Åkerman and Larsson-Seim (2014:537) claim that theirs is the first published paper on the ATN. However, unlike in these studies (including the study by Åkerman and Larsson-Seim), the focus in this article is not on the macrolevel topological properties of the trade network but rather on how South Africa has tied in with the international ATN.

## **2. SHORT BACKGROUND TO THE SOUTH AFRICAN ARMS INDUSTRY AFTER APARTHEID**

The end of the Cold War saw a major worldwide reduction in military spending. Singer (2002:193) writes that the total number of personnel employed by the world's armies was reduced by six million in the 1990s. The US military shrunk from 2,1 million in 1989 to 1,4 million in 2005, the Soviet Union/Russia downsized from an army of 5 227 000 in 1987 to 977 000 in 2001, and by 2005 the UK had an army that was at its smallest since the Battle of Waterloo (Schreier and Caparini 2005:4). The end of the Cold War affected South Africa as it did other countries around the globe, but the simultaneous ending of South Africa's war in Angola and the withdrawal of Cuban forces resulted in even larger defence budget cuts than experienced in many other countries. The South African defence budget was cut by 40% between 1989–1994, while procurement expenditure declined by 60% from R5,5 billion to R2,2 billion at 1990 prices (Botha 2003:2). These reductions are even more pronounced when considered as a percentage of South Africa's manufacturing output, as Henk (2004:14) writes, "Arms production as a percentage of South Africa's manufacturing output shrunk from a high of 6,6% in 1989 to 4,5% by 1994". Yet even more vivid is a comparison of South Africa's military expenditure as a percentage of Gross Domestic Product (GDP), with data provided by SIPRI:

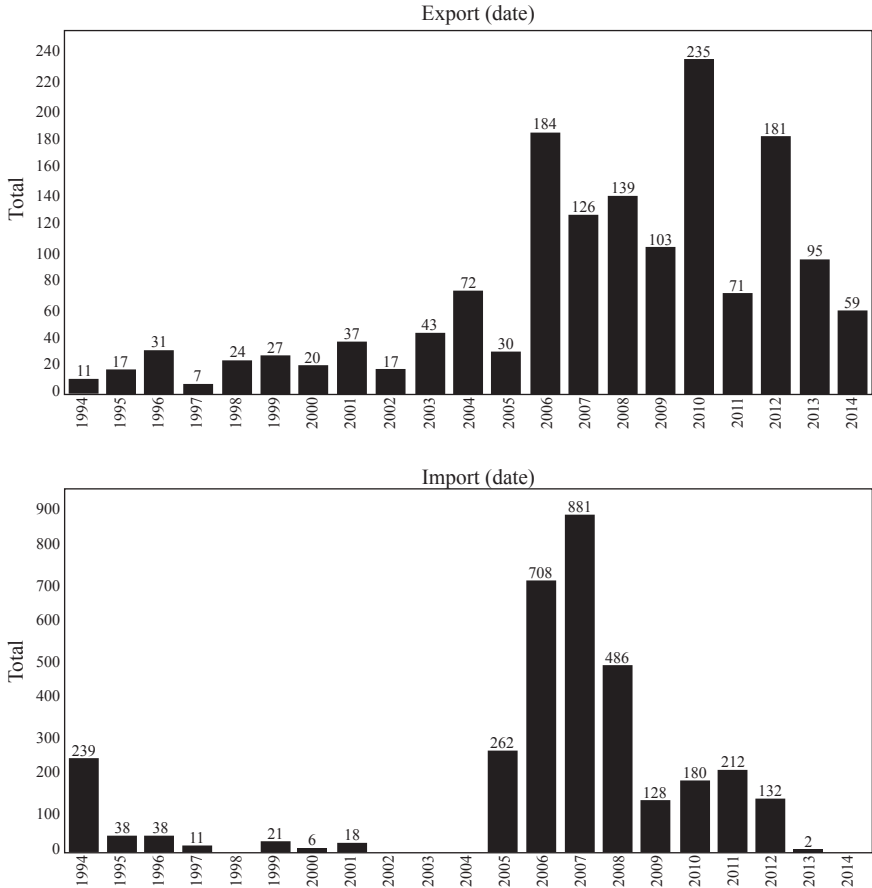
**Figure 1. South Africa’s military expenditure as a percentage of GDP, 1988-2014 (data by SIPRI)**



This vast reduction prompted a major restructuring of the local arms industry, with local arms manufacturers looking increasingly towards the export market, subcontracting projects, and looking at ways in which to enter the civilian market. While the South African arms industry was realigning itself, the UN Security Council Resolution 919 terminated the arms embargo in May 1994, following the successful completion of South Africa’s first multiracial election (Stockholm International Peace Research Institute 2012). In 1994, arms exports represented 1% of South Africa’s exports. However, as Henk (2004:15) observes, even at this time of uncertainty there was some hope for the future of the industry.

“Despite the trauma, not all the news for the arms industry in the early 1990s was unfavourable. To the surprise of many in South Africa and elsewhere, newly elected South African President Nelson Mandela publicly defended the country’s arms industry and promoted its products on his overseas trips.”

In the twenty years since the arms embargoes were lifted, this glimmer of hope would lead to a successful global repositioning of the South African arms industry. When looking at South Africa’s arms imports and exports, the significant increase after 2006 can clearly be seen (Figures are SIPRI Trend Indicator Values (TIVs) expressed in US\$ million at constant 1990 prices):

**Figure 2. South African arms imports and exports, 1994-2014 (Data by SIPRI)**

As can be seen in these graphs, the arms industry established under the NP was thoroughly appropriated by the new ANC government. Globally South Africa ranked as the 19<sup>th</sup> largest importer of major arms for the period 2005–2009 (Wezeman 2011:2). During this period, a total of 34,5 billion rand (US\$5 billion) worth of military equipment was also exported. Of the total, 1,7 billion rand (US\$241 million) or 4,9% was accounted for by exports to sub-Saharan African countries, while 40% of South African arms exports were to the US (Wezeman 2011:4-5).

These increases in exports are the result of more aggressive overseas marketing by South African companies. Already by 2003, Botha (2003:8) observed, “some companies such as Eloptra (Denel), Grintekewation, and Fuchs (Reunert)

export virtually their total output. Many companies such as Alvis-OMC, Grintron (Grintek) and RDI (Reunert) do more than 50% of their business abroad”. This shift from the domestic to the export market is precisely the result of the abovementioned changing political circumstances, and as Henk (2004:14) writes, the realignment of the local arms industry was largely successful,

“[...] after a decade of majority rule, the industry not only had survived the political transition, it had established a respected position as a key government partner. South Africa had become a global actor in the international arms market, having carved out significant high-technology niches where its products compete effectively.”

The local arms industry was of course accompanied by various controversies, including corruption, of which the Tony Yengeni and Shabir Shaik convictions are probably the most notorious. On 24 October 2011, President Jacob Zuma announced that allegations of corruption would be investigated by the Commission of Inquiry into allegations of fraud, corruption, impropriety, or irregularity in the Strategic Defence Procurement Packages (SDPP), headed by Judge Seriti. This Commission of Inquiry is still on-going. Exports to African countries, in particular where conflicts are still on-going, have also been controversial, as Wezeman (2011: 10) writes,

“There have been several documented cases of the use of South African supplied arms in human rights abuses in the period 2000–2009. Mamba armoured personnel carriers supplied by a South African company in 2003 were used in September 2009 by Guinean police forces when forcefully dispersing a gathering of people related to those killed during anti-government demonstrations. Armoured vehicles supplied from South Africa were also used in the violent suppression of demonstrations in Uganda in 2006.”

On the other hand, South African weaponry has also been used extensively in peacekeeping operations, for instance by the UN and African Union. Whether used to support or undermine human rights, the South African arms industry has continued to impact Africa, as it did during the Cold War.

### **3. SOUTH AFRICA IN THE ATN SINCE 1994**

Since the publication of Watts and Strogatz (1998) and Barabási and Albert (1999), network theory has become one of the key theoretical paradigms with which to study complex systems. International trade is of course a complex system, and some network studies on international trade relations were listed in the introduction of this article. Those studies are primarily concerned with investigating the macrolevel topological properties of international trade networks, including facets such as average path length ( $L$ ), transitivity or clustering ( $C$ ), modularity ( $Q$ ), core/periphery structures and others in order to come to a better understanding of the structure of the entire system (these and other macrolevel topological properties of

networks or graphs are discussed in depth in e.g. Caldarelli (2013), Estrada (2012) and Newman (2010)). In addition to such macrolevel studies, one can also conduct a microlevel (node-level) analysis of a network, where the focus falls on how the individual entity relates to all others in the network. In a microlevel analysis, measures of centrality such as those formalised by Freeman (1979) can be used to gauge the importance of an entity (also referred to as a *node* or *vertex*, denoted by  $n$ ) based on its ties (also referred to as *edges* or in the case of a directed network, *arcs*, and denoted by  $m$ ) to some or all other vertices in a network. The current article seeks to investigate South Africa's role in the ATN and hence conducts a node-level analysis using Freeman's centrality measures.<sup>4</sup>

Degree centrality ( $C_D$ ) is the simplest measure of centrality and measures the number of edges incident on a node. As such, it is a *local* measure in the sense that it only takes a node's immediate context into account, and is usually a measure of how actively a node is involved in the network. In a directed network (also called a *digraph*), the direction of ties is also indicated, which means that in- and out-degree can also be distinguished. In-degree then refers to the number of ties pointing to a node, while out-degree indicates the number of degrees pointing from a node to other nodes. Since the dataset analysed here indicates supplier and recipient, the network constructed is properly described as a digraph with arcs pointing from supplier to recipient, as was done in Åkerman and Larsson-Seim (2014:543). Like Åkerman and Larsson-Seim, we also are primarily interested in the occurrence of trade rather than the volume of trade, and therefore we also do not weight edges by trade volume.

Betweenness centrality ( $C_B$ ) takes all edges in the network into account and is a *global* measure. Betweenness centrality measures to what extent short paths run through a node, and is usually seen as the measure that identifies the most important nodes in a network.

Closeness centrality ( $C_C$ ) also uses the concept of short paths by measuring to what extent a node can reach any other node, on average, within a short path and, as such, is also a global measure. Because nodes in the core of a network can reach any other node on average within a short path, closeness centrality also indicates which nodes can be found at the core of a network (for a more detailed discussion of the mathematical calculations underpinning these centrality measures, see e.g. Prell (2012:97-109); Estrada (2012:121-146) and Newman (2010:168-193)). What precisely these centrality measures mean in terms of the ATN is discussed below.

In the case of the ATN, vertices represent countries and their trade relations are represented as arcs. When represented as a network, 212 countries with 1 760

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4 Åkerman and Larsson-Seim (2014:546) also compute these centrality measures, but do not provide a detailed list of their results.

ties belong to the network of arms transactions that took place in the ATN between 1994 and 2014, with an average ( $\langle k \rangle$ ) of around eight ties per country:

Period	n	m	$\langle k \rangle$
1948-1994	228	1 602	7,026
1994-2014	212	1 760	8,302

The number of countries taking part in the ATN has therefore decreased slightly since 1994, but the higher average degree shows that the countries that do still form part of the ATN trade with a higher number of other countries, on average. These figures of course differ in the periods where South Africa stood under different leadership, namely 1995-1999<sup>5</sup> under Nelson Mandela, 2000-2008 under Thabo Mbeki, and 2009-2014 under Jacob Zuma. The following table provides the above figures for each of these periods:

Period	n	m	$\langle k \rangle$
1995-1999	159	677	4,258
2000-2008	178	1 068	6,0
2009-2014	175	885	5,057

South Africa’s position in the global arms trade network can be calculated using Freeman’s (1979) degree-, betweenness- and closeness centralities. The following table provides these scores of the 30 highest-scoring countries on all three of these centrality measures for the entire period:

**Table 1. Centralities of countries in the ATN 1994-2014**

Country	$C_D$	Country	$C_B$	Country	$C_C$
United States	151	United States	1.0000	United States	1.0000
France	117	Russia	0.5283	France	0.8951
Germany	104	Unknown country	0.5263	Italy	0.8869
Italy	104	France	0.4101	w	0.8869
Russia	98	Ukraine	0.3101	Russia	0.8631
United Kingdom	93	South Africa	0.3033	Canada	0.8309
Canada	88	Italy	0.2589	Israel	0.8239
Israel	76	Germany	0.2584	United Kingdom	0.8169

5 A president’s term in office was rounded off as necessitated by the calculations.



Country	$C_D$	Country	$C_B$	Country	$C_C$
Netherlands	76	Israel	0.2345	Ukraine	0.8146
Ukraine	75	China	0.2070	South Africa	0.8101
South Africa	73	Canada	0.2061	Spain	0.7838
Spain	69	United Kingdom	0.1980	Czech Republic	0.7775
China	65	Netherlands	0.1650	Netherlands	0.7713
Sweden	65	Australia	0.1076	Unknown country	0.7612
Czech Republic	62	Bulgaria	0.0987	China	0.7612
Unknown country	57	India	0.0984	Brazil	0.7572
Brazil	49	Czech Republic	0.0963	Sweden	0.7572
Switzerland	48	Spain	0.0906	Switzerland	0.7360
Norway	45	Turkey	0.0845	India	0.7305
Poland	45	Brazil	0.0724	Jordan	0.7268
Austria	41	Slovakia	0.0646	Singapore	0.7232
Turkey	40	Norway	0.0630	Poland	0.7232
Finland	39	Singapore	0.0554	Turkey	0.7196
Australia	34	Iran	0.0517	Indonesia	0.7178
Indonesia	34	Georgia	0.0516	Bulgaria	0.7143
Belgium	33	Eritrea	0.0502	Finland	0.7108
Bulgaria	33	Ireland	0.0483	Norway	0.7090
India	32	Sweden	0.0428	United Arab Emirates	0.7073
United Arab Emirates	31	Poland	0.0401	Peru	0.7073
Denmark	30	Egypt	0.0389	Malaysia	0.7039

This table indicates that the US has the highest degree centrality, which means it has the highest number of trading partners in the ATN, France the second highest, etc. Note South Africa's 11<sup>th</sup> position in terms of degree centrality: South Africa has a very high number of trading partners (73) when taking the country's relatively small economy into account – countries with much larger economies, such as Sweden and Norway, have fewer trading partners. Countries with a high degree centrality often dominate trade networks; In De Benedictis and Tajoli's (2011) study, the UK had the highest degree in the entire World Trade Network (WTN) in 1980, while the US had the highest degree in 2000. However, unlike in the ATN, South Africa does not feature high on degree centrality in the WTN, which illustrates what an important role the arms trade plays in South Africa's trade relations.

Betweenness centrality in this case means that these countries serve to provide cohesion to the network by creating short paths between other countries,

and because betweenness centrality often identifies the most important nodes in a network, it is noteworthy that the US and Russia are at the top of the list: these are of course the former and current superpower(s), and two of the largest economies in the world, as well as two of the major role players in the ATN. The US was ranked third on betweenness centrality in the WTN in 1960, seventh in 1980, and first in 2000 (along with Germany), while the UK was ranked second in terms of betweenness centrality in 1960, first in 1980, and third in 2000 (De Benedictis and Tajoli 2011:1434). In the WTN, South Africa again does not play a significant role when its position is measured using betweenness centrality, and hence its 6<sup>th</sup> position in the ATN is highly significant as it shows again what an important role the arms trade plays in connecting South Africa to global trade networks.

When considering closeness centrality, the US is again at the top of the list, which indicates that it is positioned at the very core of the network (as it was during the Cold War), along with France, Italy, Germany and Russia. Note again South Africa's relative high position, placing it in the top ten, while South Africa had a lower position during the Cold War (South Africa had the 17<sup>th</sup> highest closeness centrality during the Cold War). Taken together, these three measures of centrality show that the US is at the core of the ATN, with Russia, Germany, France, and Israel following closely behind, and South Africa is clearly a major player as well (in terms of connections).

South Africa's relative central position in the arms trade network is determined by its connections: connections with other well-connected countries elevate a country's position in terms of the above measures (except degree centrality, which only measures direct connections). Both the US and South Africa have traded with the following countries in this period: Mali, the Netherlands, Norway, Oman, Peru, Saudi Arabia, Senegal, Spain, Sweden, Switzerland, Thailand, United Arab Emirates, United Kingdom, and Yemen. South Africa has a similar trade partner overlap with Russia, Israel, Germany, France, Italy, and other highly central role players in the weapons industry. South Africa's trade partner overlap with Russia include Algeria, Angola, Azerbaijan, Brazil, Burkina Faso, Colombia, Djibouti, Ecuador, Finland, Germany, Ghana, Guinea, India, Indonesia, Iraq, Israel, Italy, Jordan, Kenya, Malaysia, Peru, Rwanda, Senegal, Thailand, Uganda, United Arab Emirates, the UK, the UN, the US, and Yemen. Note also that the above relationships are directed: Israel, Germany, and Italy sell weapons *to* Russia, while the rest of the countries (including the US and UK), purchase weapons *from* Russia. In this sense, there is a major difference between Russia and South Africa's trade relations: Russia is mostly *selling*, while South Africa has a higher number of partners it purchases from.

Because this nuance in the degree centralities of countries is also important to take into consideration, Table 2 provides the in- and out-degrees of the top 30 countries from 1994-2014:

**Table 2. The in- and out-degrees of the top 30 countries, 1994-2014**

Country	In-Degree	Country	Out-Degree
Indonesia	27	United States	126
United States	25	France	105
Iraq	24	Germany	94
Malaysia	24	Italy	93
Pakistan	22	Russia	92
Thailand	22	Canada	74
Brazil	21	United Kingdom	72
United Kingdom	21	Ukraine	72
Peru	21	Israel	70
India	20	South Africa	62
Jordan	20	Netherlands	60
Uruguay	20	China	57
United Arab Emirates	20	Spain	54
Algeria	19	Sweden	49
Ecuador	19	Czech Republic	46
Mexico	19	Unknown country	43
Oman	19	Switzerland	40
Chile	19	Norway	34
Angola	18	Austria	30
Colombia	18	Brazil	28
Poland	17	Poland	28
Nigeria	17	Finland	25
Saudi Arabia	17	Bulgaria	25
Venezuela	17	Turkey	24
Chad	17	Belarus	24
Sweden	16	Australia	22
Netherlands	16	Belgium	19
Bangladesh	16	Slovakia	19
Czech Republic	16	Denmark	18
Egypt	16	Singapore	14

Note that South Africa does not feature in the top 30 list of the countries with the highest in-degrees, but is 10<sup>th</sup> on the list of countries with the highest out-degree. This means that South Africa is an important role player in terms of *exports*, but not imports: its high closeness and betweenness centrality scores are due to its exports rather than imports.

Many of the Cold War alliances of the ANC have been lost since 1994. The ANC government did not trade with the Ukraine, North Korea, or Vietnam, while South Africa's weapons trade with Namibia was limited to 24 G-2 guns sold in 1998. Despite the close connections between the ANC and the South West Africa People's Organization (SWAPO), and despite North Vietnam's help to the ANC during the so-called freedom struggle (see e.g. Giliomee 2012:392), virtually no weapons trade came of any of these relations. Ties with Tanzania, where Umkhonto we Sizwe (MK) training camps had also been located, is limited to five CASSPIR APCs sold to Tanzania in 2008, while Angola's willingness to provide training camps to MK during the 1980s (see e.g. Central Intelligence Agency 1979:11-13), did not lead to major arms trade relations either: six CASSPIR APCs were ordered by Angola in 1994, and another 45 in 2013. While the ANC had bases in Mozambique during the freedom struggle, and Nelson Mandela even married the widow of Samora Machel (Mozambique's president during the Cold War (1975-1986)), trade with Mozambique is similarly limited to a total of 21 CASSPIR APCs sold to Mozambique in 2000 and 2003.

Also absent in South Africa's weapons trade network is Zimbabwe. In this period, Zimbabwe traded with Bulgaria, China, the Czech Republic, France, Italy, Libya, Russia, Slovakia, and the Ukraine, but not with South Africa. Two of the other pariah states, North Korea and Iran, never traded with South Africa directly, but France and Germany both supplied Iran and South Africa, and North Korea and South Africa both supplied Yemen (incidentally, Russia supplied both Iran and North Korea).

#### **4. SOUTH AFRICA'S CHANGING TRADE RELATIONS UNDER DIFFERENT PRESIDENTS**

South Africa's trading partners have, however, changed under different presidents. Under Nelson Mandela (1995-1999), South Africa traded with the following 25 countries: Algeria, Cameroon, Canada, Chile, Colombia, Republic of the Congo, Côte d'Ivoire, France, Germany, Ghana, India, Israel, Italy, Namibia, Peru, Rwanda, Sierra Leone, Swaziland, Sweden, Switzerland, Uganda, United Arab Emirates, the UK, UN and the US. One of the few struggle legacies that can be seen in this list is ANC ties to Sweden. Olaf Palme, the Swedish Prime Minister (1969-1976 and 1982-1986), was highly sympathetic to the ANC's cause, and South Africa's

weapons trade with Sweden started in 1998 when South Africa sold six Mamba APCs to Sweden. In 1999, Sweden sold nine JAS-39C Gripen fighters to South Africa, with another 17 in 2000. Since then, South Africa has sold 370 RG-32 Scout Armoured Personnel Vehicles (APVs) to Sweden, and indeed the second highest value of imports came from Sweden.

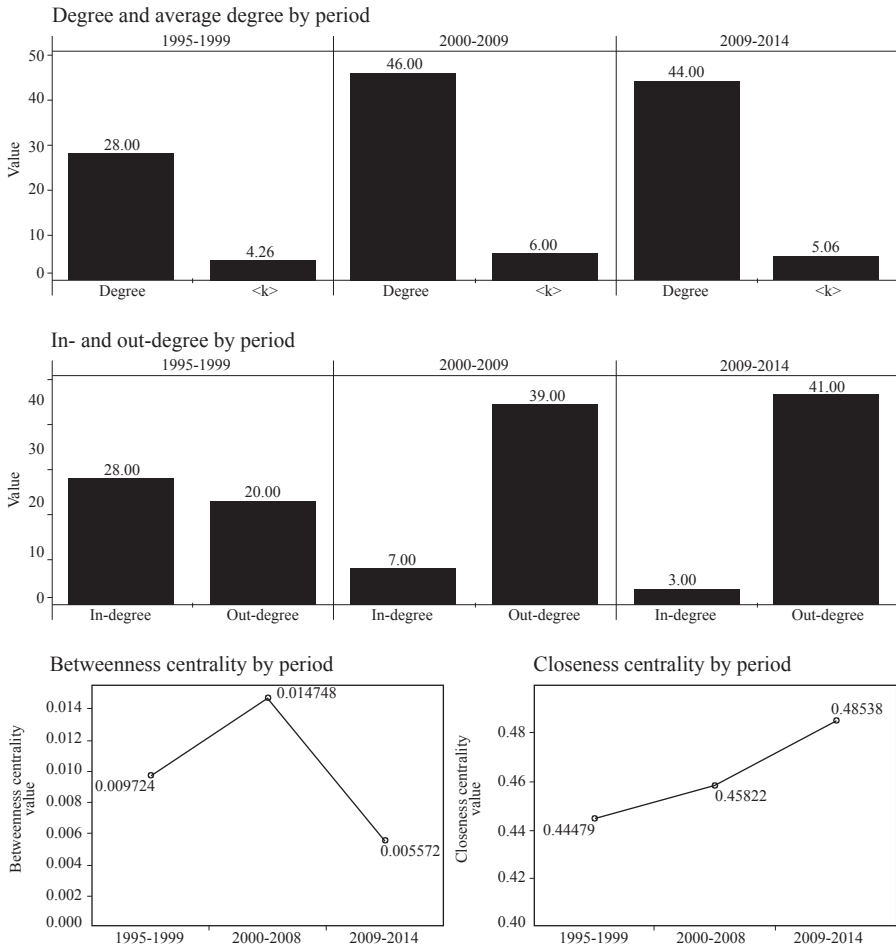
Under Thabo Mbeki (2000-2008), South Africa traded with the following 43 countries or organisations: African Union, Algeria, Azerbaijan, Brazil, Burkina Faso, Burundi, Cameroon, Canada, the Republic of the Congo, Djibouti, Finland, France, Gabon, Germany, Ghana, Guinea, India, Indonesia, Iraq, Ireland, Jordan, Malawi, Malaysia, Mali, Mozambique, the Netherlands, Norway, Russia, Rwanda, Saudi Arabia, Senegal, Spain, Swaziland, Sweden, Tanzania, Thailand, Uganda, United Arab Emirates, United Kingdom, United Nations, United States, Yemen, and Zambia. New trade partnerships are Azerbaijan, Brazil, Burkina Faso, Burundi, Djibouti, Finland, Gabon, Indonesia, Iraq, Ireland, Jordan, Malawi, Malaysia, Mali, Mozambique, Netherlands, Norway, Russia, Saudi Arabia, Senegal, Spain, Tanzania, Thailand, Yemen, and Zambia. The sales to Iraq are post-2003, and include 115 Mamba APCs (some of it used by the Private Military Company Blackwater) in 2006, and 300 Ingwe anti-tank missiles in 2010. In addition, a large number of the sales to Sweden occurred under Mbeki's presidency.

Under Jacob Zuma (2009-2014), South Africa traded with the following 40 countries/organisations: African Union, Algeria, Angola, Azerbaijan, Benin, Burkina Faso, Congo, Republic of the Congo, Ecuador, Egypt, Equatorial Guinea, Finland, Gabon, Ghana, Guinea, India, Iraq, Ireland, Israel, Jordan, Kazakhstan, Kenya, Malawi, Malaysia, Niger, Nigeria, Oman, Rwanda, Saudi Arabia, Senegal, Sierra Leone, Singapore, Somalia, Sweden, Thailand, Uganda, United Arab Emirates, United Nations, United States, and Yemen. New trade partnerships include Angola, Benin, Ecuador, Egypt, Equatorial Guinea, Kazakhstan, Kenya, Niger, Nigeria, Oman, Singapore, and Somalia.

The above shows that South Africa had the highest number of trade partners during the presidency of Thabo Mbeki, and the lowest number under the presidency of Nelson Mandela. There is therefore a correlation between the high volume of trade seen during the Mbeki and Zuma years, as shown in Figure 2, and the number of partners South Africa traded with during these years.

Figure 3 provides the figures for South Africa's changing position in terms of betweenness and closeness centrality, as well as in- and out-degree, and South Africa's degree is related here to the average degree ( $\langle k \rangle$ ) for the entire ATN.

**Figure 3. South Africa’s changing centralities in the ATN 1995-2014**

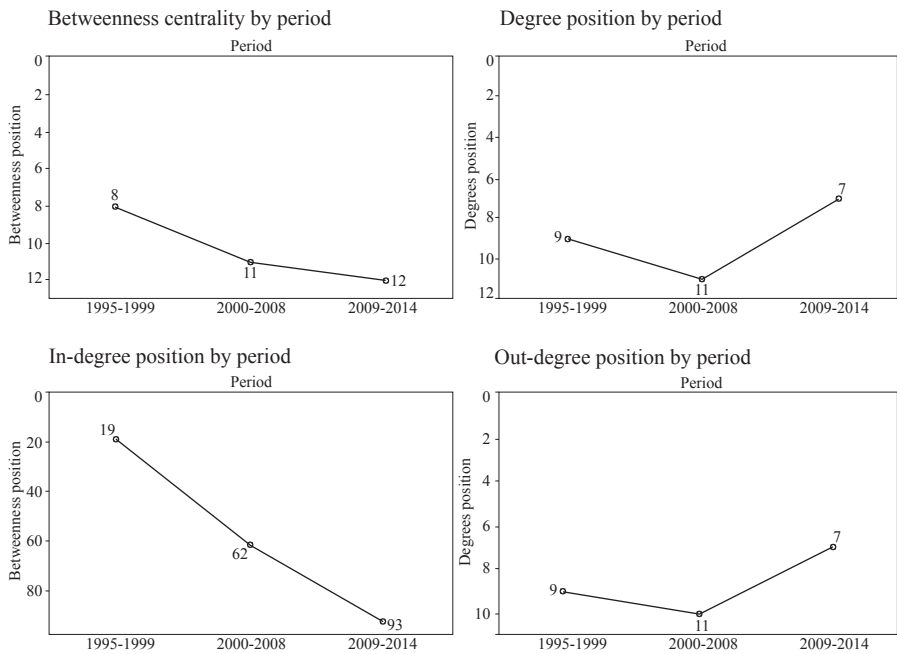


As can be seen in this graph, South Africa had its highest degree and betweenness centrality score under Mbeki, and overall, South Africa’s degree remained significantly higher than the average degree in the ATN for the entire period. This illustrates that South Africa is an active role player in the ATN that trades with a significantly higher number of partners than the average country. There is however a nuance to the degree that is shown in the graphs representing the in- and out-degree: while South Africa’s total degree was the highest under Mbeki, the country’s out-degree was the highest under Zuma, which means that the country exported

to more countries under Zuma than under Mbeki. Also note that the country’s out-degree is always significantly higher than its in-degree, which indicates that arms exports always occur to significantly more countries than imports.

It is also significant to investigate how South Africa’s rankings on these centrality measures changed over time, i.e. whether the country for instance scored in the 8<sup>th</sup>, 11<sup>th</sup> or 12<sup>th</sup> places on betweenness centrality in the entire ATN under different presidents. The following graph shows South Africa’s position under consecutive ANC presidents in terms of betweenness, degree, and in- and out-degree:

**Figure 4. South Africa’s changing rankings on centrality measures 1995-2014**



Firstly, note that South Africa’s ranking using betweenness centrality declined steadily, but the country remains high on this measure. Given the fact that betweenness centrality usually identifies the most important nodes in a network, this shows that South Africa was consistently one of the most important role players in the ATN in terms of connections throughout this period. Degree centrality is also significant, as South Africa was on average one of the ten countries in the ATN that had the highest number of trade partners, although the country was ranked 11<sup>th</sup>

under Mbeki. In-degree shows that South Africa's importance in the ATN as an arms importer has decreased rapidly under consecutive ANC presidents, with the country ranking respectively in the 19<sup>th</sup>, 62<sup>nd</sup> and 93<sup>rd</sup> place on in-degree. However, as an exporter (out-degree), the country has consistently ranked in the top ten, and is currently the country with the 7<sup>th</sup> highest out-degree. In- and out-degree rankings clearly show how South Africa's position in the ATN is predominantly in the role of exporter: out of 159 countries that traded in the ATN between 1995 and 1999, South Africa had the 9<sup>th</sup> highest out-degree; out of 178 countries that traded in the ATN between 2000 and 2008, South Africa ranked 10<sup>th</sup>, and out of 175 countries that traded in the ATN between 2009 and 2014, South Africa ranked 7<sup>th</sup>.

## 5. CONCLUSION

This article has shown how, in terms of connections to other role players in the ATN, South Africa continues to play a relatively important role. Indeed, using degree-, closeness-, and betweenness centrality scores, South Africa consistently ranks under the twenty highest-scoring countries in this trade network, showing South Africa to have been a highly active, central and structurally important country over the past twenty years – despite its relatively small overall economy. However, despite the ruling ANC's previous connections with the Soviet Union and other Communist countries, these connections have been shown to be limited since 1994, and South Africa's trading partners since the advent of majority rule have mostly been Western countries. It was also shown how South Africa's trading partners changed under three different presidents, with the country trading with the highest number of countries under Mbeki's rule, and with the lowest number of countries under Mandela's rule. Through South Africa's rankings on betweenness- and degree centralities, as well as in- and out-degree, South Africa's changing position was shown, in particular how in- and out-degree characterise the country as an important role player in the ATN as an exporter.

An important further question is how South Africa's changing position in the ATN relates to the past; how did the arms embargoes affect South Africa's position in the ATN? This could be the subject of a future study.

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