

# The Influence of Cyber Security Levels of South African Citizens on National Security

Joey Jansen van Vuuren<sup>1</sup>, Marthie Grobler<sup>1</sup> and Jannie Zaaiman<sup>2</sup>

<sup>1</sup>Council for Scientific and Industrial Research, South Africa

<sup>2</sup>University of Venda, South Africa

[jjvuuren@csir.co.za](mailto:jjvuuren@csir.co.za)

[mgrobler1@csir.co.za](mailto:mgrobler1@csir.co.za)

[jjzaaiman@univen.co.za](mailto:jjzaaiman@univen.co.za)

**Abstract:** In South Africa, cyber security has been identified as a critical component contributing towards National Security. More rural communities are becoming integrated into the global village due to increased hardware and software corporate donations, the proliferation of mobile Internet devices and government programs aimed at bridging the digital divide through major broadband expansion projects. These measures facilitate the rapid growth of South African Internet citizens, both through desktop or laptop computers, iPads and mobile phones. Comprehensive research conducted by the authors show that many of the new Internet users are not aptly trained to protect themselves against online threats, leaving them vulnerable to online exploits and inherently exposing the national system to potential international cyber attacks. It is estimated that mobile phone penetration in South Africa is about 98%. In addition, it is suggested that 39% of urban and 27% of rural South Africans are browsing the Internet from their mobile phones. Mobile phone penetration statistics are used in correlation with the economic development and exposure to technological advances of South Africans to classify participants in the survey in three groups: urban netizens, semi-rural netizens and rural netizens. South African citizens from areas within the Gauteng, Limpopo and Mpumalanga provinces participated in this study. This article works towards the identification of any correlation between the economic development and mobile use propensity of Internet users with regard to National Security. The classification is based on availability of digital amenities, availability of and access to the Internet, the number of users per computer and the level of computer maintenance. Separate from these criteria, the availability of and access to the Internet via mobile phones has also been taken into consideration. The article uses the results from the surveys to identify direct and indirect links between the factors in question. These results are then used to extrapolate the potential threat factor to National Security based on South Africans' cyber security awareness levels. As part of a larger research study, the participants completed surveys regarding their exposure to technology and their responses to presented cyber scenarios.

**Keywords:** cyber security, awareness, security threat analysis rural communities, South Africa, national security, broadband access

## 1. Introduction

The increase in African broadband access has had a significant effect on the Internet access of South Africans. With more South Africans having access to the Internet and a large portion of the population that has not had regular and sustained exposure to technology and broadband Internet access, South Africa is currently much more exposed to cyber threats than before the significant increase in broadband availability in 2009 (Grobler, Jansen van Vuuren & Zaaiman, 2011). As an additional threat, South Africa is in many ways the Internet entry point to the African continent and could therefore be used as a hub for launching cyber warfare type attacks on the rest of the world (Jansen van Vuuren, Phahlamohlaka & Brazzoli, 2010). In this context, it is of paramount importance to increase the awareness of cyber security in the broader South Africa communities to prevent South Africans from falling victim to shrewd cyber criminals. An increase in cyber security awareness will also prevent South African citizens from inadvertently being used as digital soldiers in cyber attacks against other countries. This article investigates the influence of cyber security awareness levels of South African citizens on National Security.

The reduction in cost of especially mobile access (McLeod, 2011), contributed to the increase in mobile Internet access to 83% of mobile users, and Internet access to 27.5% of the South African population. Prepaid mobile phone technologies contributed much to this extensive availability. These estimations correlate with the economic development and exposure to technological advances of South Africans to classify participants in this research survey in three groups: urban netizens, semi-rural netizens and rural netizens. This classification was based on availability of digital amenities, availability of and access to the Internet, the number of users per computer, and the level of computer maintenance. For the remainder of this article, views will be given based on the three participant group classifications.

## 2. Internet access in South Africa

According to 2007/2008 statistics, only 4% of the continental population in Africa was estimated to have Internet access. As a result, the development of the African undersea cables was a much needed addition to Africa's technological readiness. The results of the increase in broadband access can be seen in the significant rise of Internet access of South Africans citizens since 2009 (refer to Figure 1). Most of the undersea cables featured in the graph have already been activated.

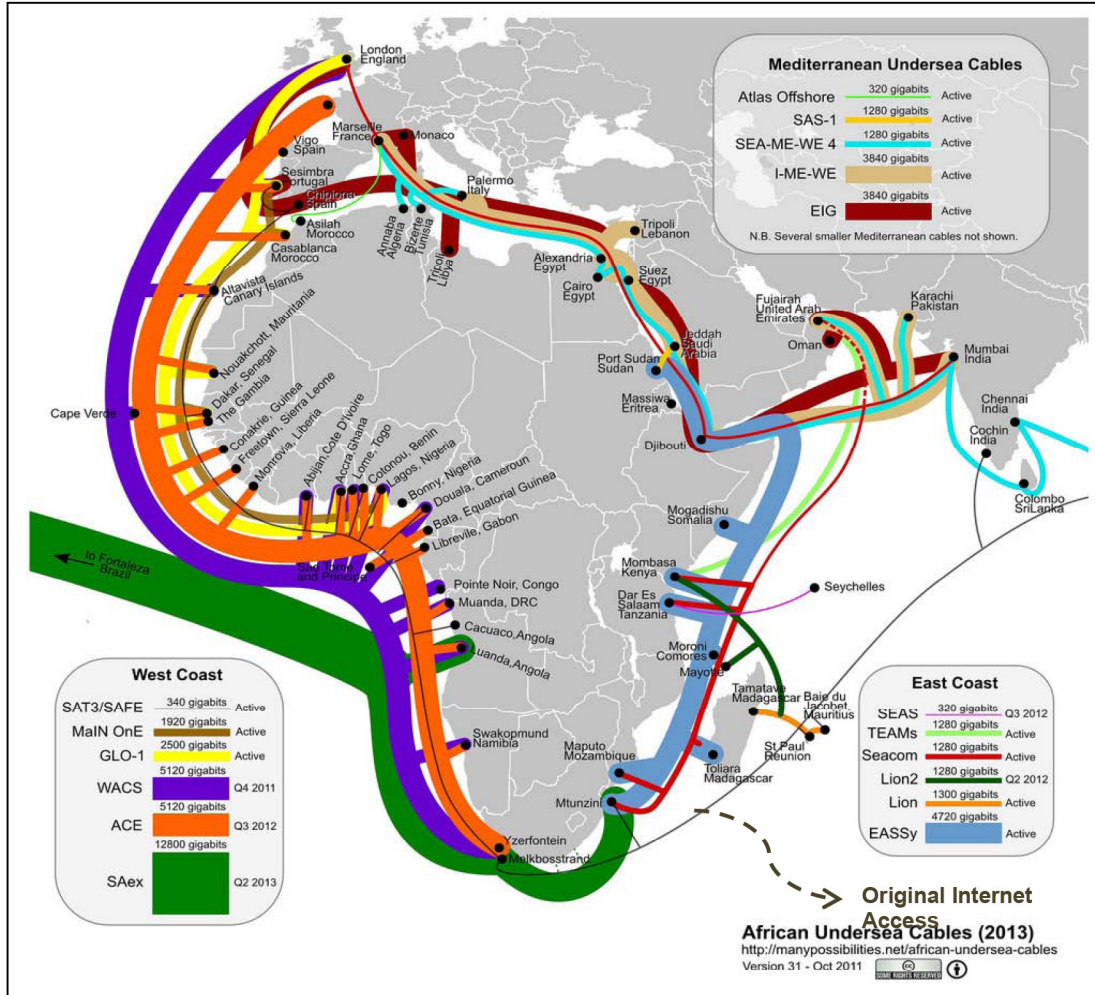


Figure 1: Broadband access in Africa (Song, 2011)

Before 2008, Internet access was mostly dependant on access to computers which was mainly available in five isolated areas in South Africa (refer to Figure 2). In addition, telecommunications in South Africa is largely dependent on mobile phones since most of the rural communities do not have access to landlines. It is estimated that mobile phone penetration in South Africa is about 98%. According to the International Telecommunications Union (ITU), only 17% of South African Internet users utilise fixed landlines for Internet access (ITU, 2010).

The Mobility 2011 research project by World Wide Worx (2011) have shown that the mobile phone habits of South African phone users have evolved dramatically in 2011 since smart phones, mobile applications and the mobile Internet entered the mainstream. It also determined that Internet mobile usage in South Africa exceeds 83%, with 39% of urban netizens and 27% of rural netizens browsing the Internet on their phones (refer to Figure 3).

This increase in mobile access can be attributed to the competition between the South African mobile phone service providers: Vodacom, Cell C, MTN and 8ta (McLeod, 2011). This mobile Internet access also contributed largely to the increase in Internet access of 7.2% in 2007 (Van Huysteen & Botha,

2008) to 27.5% (StatsSA, 2011a) shown in Figure 4. This implies that more than a quarter of South African households had at least one member who used the Internet either at home, work, place of study or Internet cafés. It is further estimated that this percentage exceeded the 30% mark in 2011 (at the time of writing, no formal statistics were available).

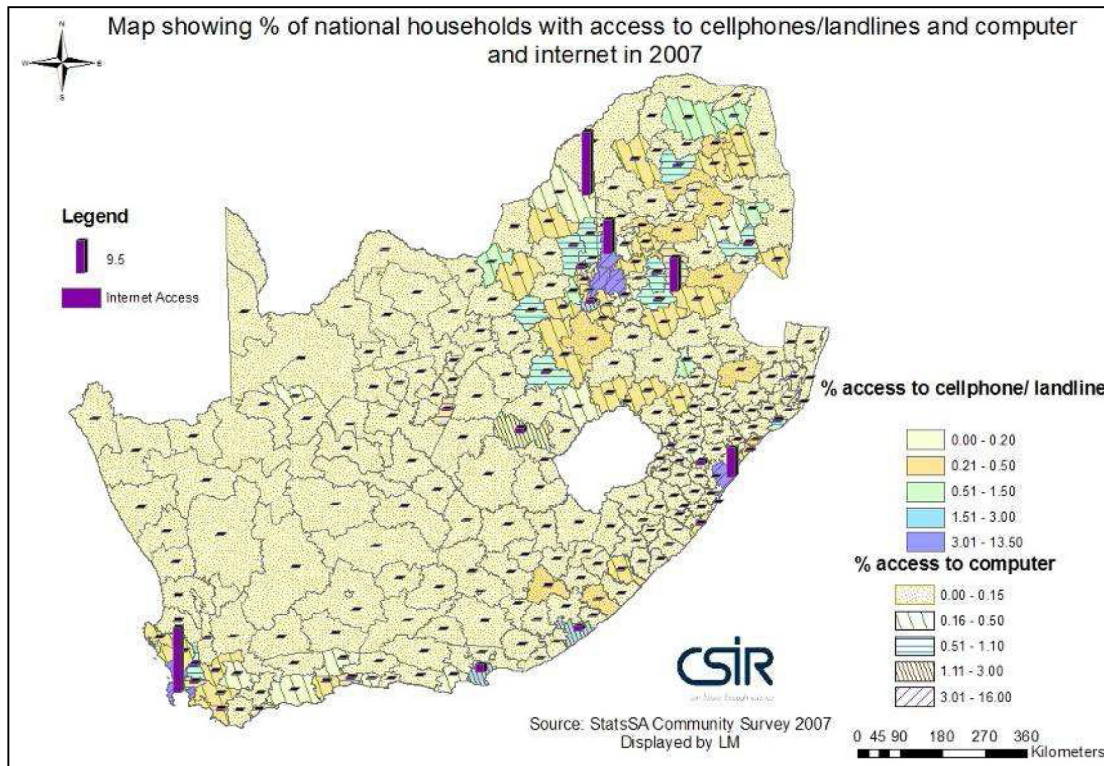


Figure 2: South Africans' access to mobile phones/landlines, computers and Internet (Van Huysteen & Botha, 2008)

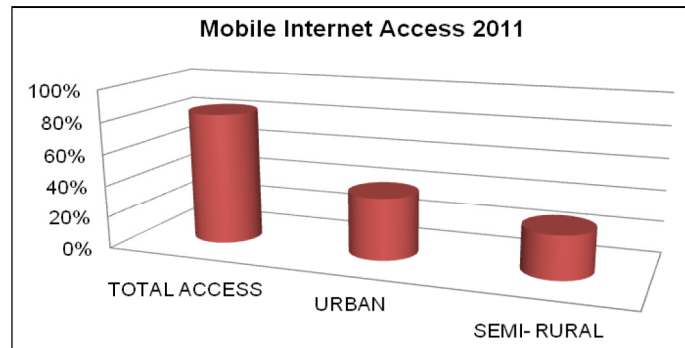


Figure 3: Mobile internet access in South Africa 2011

According to Figure 5, Internet usage in 2010 was the highest in the Western Cape (45,6%), Gauteng (41,6%) and Free State (28,1%) provinces. South African household members mostly used the Internet at work (16,7%), at home (10,2%) or at school/university/college (5,5%). The Internet access however differs according to the spatial distribution of the population and the access to landlines. Households with no access to any phone services (mobile or landline) were found mainly in Northern Cape (22,8%), Eastern Cape (19,4%), Free State (14,3%) and North West (13,5%) provinces. Mobile phone usage as the only means of telecommunication was the highest in Mpumalanga (8,2%) and Limpopo (85,5) provinces. The Western Cape province had the lowest percentage of households with only mobile phones in their dwellings (51,1%) and the highest percentage of households that were using only landlines (3,1%). The use of a combination of both mobile phones and landlines in households were most prevalent in the more affluent provinces, namely Western Cape (34,3%) and Gauteng (22,6%) (StatsSA, 2011a).



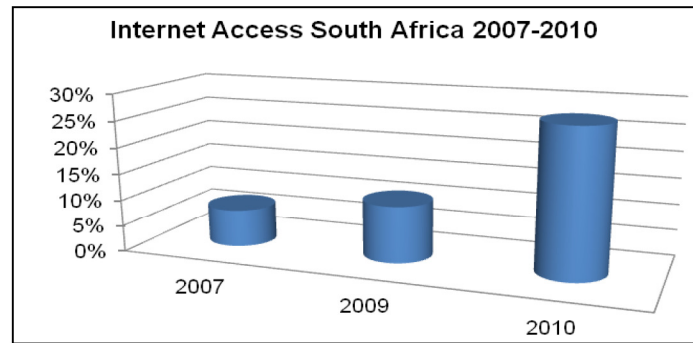


Figure 4: Increase in Internet access in South Africa from 2007 - 2011

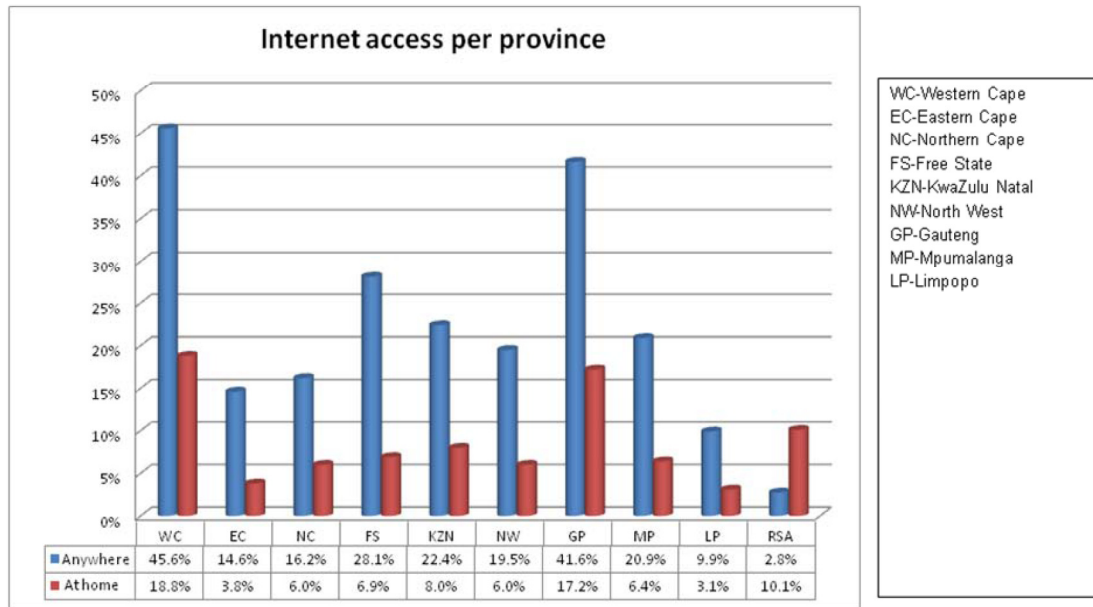


Figure 5: Internet access in 2010 per South African Province (StatsSA, 2011a)

The demographical distribution of the Internet access of local municipalities in 2007 can be seen in Figure 6. According to this map, the areas with the highest concentration of Internet users can be found in the Western Cape province (Western Namakwa, parts of the West Coast, Cape Town, Overberg and Eden), KwaZulu-Natal (eThekwin), Mpumalanga (parts of Bohlabela), and Gauteng (Johannesburg and Pretoria). This statistics correlates largely with the 2010 information in Figure 5 above.

### 3. Demographical distribution

The demographical distribution of the South African population has an impact on the economic livelihood and skills of citizens. City-region areas have the most highly skilled portion of the formal and informal labour market, as well as the biggest number of citizens that are unskilled, economically inactive and in search of livelihood opportunities. It was therefore important to keep these demographical areas into account in the calculation of the awareness levels of citizens. For the purpose of this study, the main classification categories are *urban areas*, *semi rural areas* (consisting of the combined urban/rural areas) and *rural or deep rural areas*. The proposed definition of each of these areas is as follows:

- An **urban area** is highly developed with all major services and is characterised by a high population density in comparison to areas surrounding it. These areas are mostly cities and large towns with a population exceeding 150 000 people. The urban areas do not include rural settlements such as villages. Urban areas are created and further developed by the process of urbanisation. There are normally well established industrial development and host secondary schools, higher education institutes and large shopping malls (Wikipedia, 2011). Figure 7 shows

the facilities available during a cyber security awareness training session in an urban area in Gauteng.

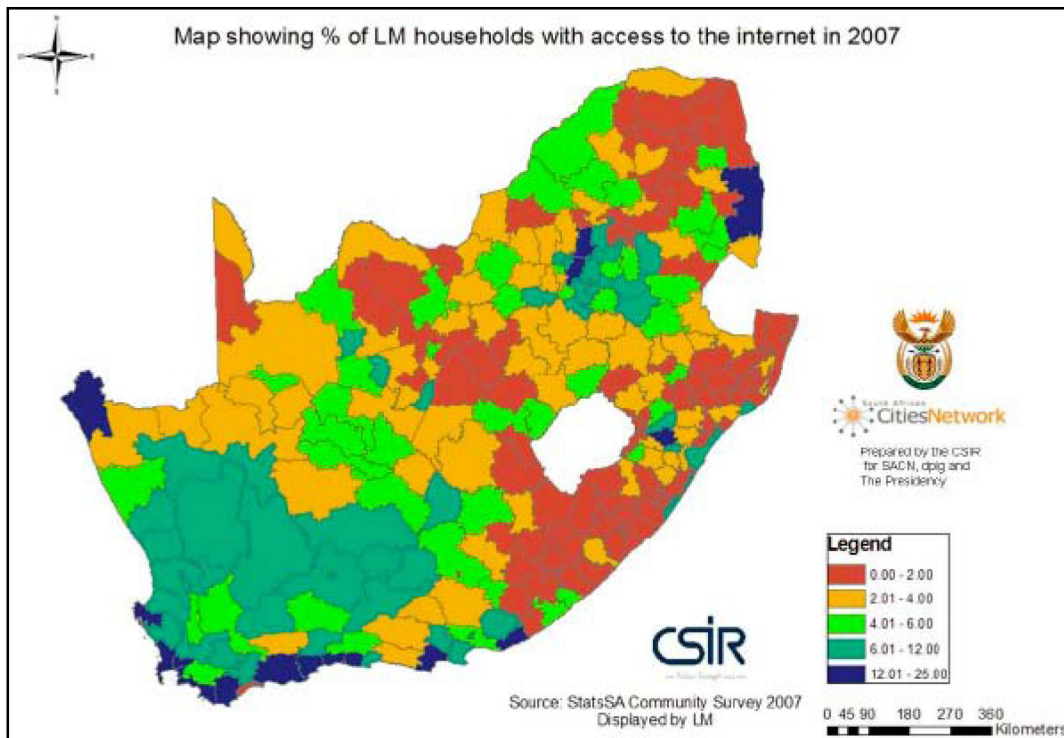


Figure 6: Demographical distribution of Internet access in 2007 (Van Huysteen & Botha, 2008)



Figure 7: Cyber security awareness training in an urban area

- A **semi rural area or combined urban/rural areas** is characterised by a high population density and vast human features in comparison to areas surrounding it. It is generally found in and around cities and metropolises and include urban areas surrounded by rural areas with densely populated informal settlements and townships. These townships often lack basic services such as proper water supply, electrical supply and sewerage facilities (Wikipedia, 2011). Figure 8 shows the facilities available during a cyber security awareness training session in a semi rural area in Gauteng.



Figure 8: Cyber security awareness training in a semi rural area

- **Rural areas** or **countryside** are areas that are not urbanised, though when large areas are described, country towns and smaller cities will be included. These areas have a low population density, and typically much of the land is devoted to agriculture. **Deep rural areas** are areas defined as communities with fewer than 1 000 households, located at least 30 minutes' drive time from a centre with a population of more than 10 000. These areas are faced with unique challenges relating to their populations and migration patterns, wellbeing and welfare needs, local service provision, and employment. Deep rural areas are characterised by lack of road infrastructure, limited tarred roads, no formal water provision system no sewerage system lack of public transport and shopping centres, limited medical facilities, no railway system and limited ATM facilities (Wales Rural Observatory, 2008). Figure 9 shows the facilities available during a cyber security awareness training session in a rural area in Mpumalanga.

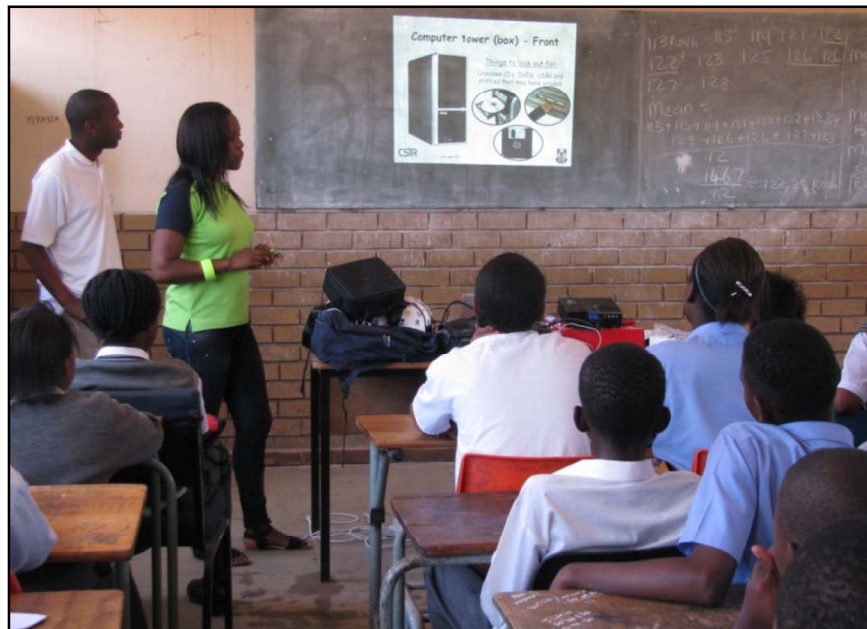


Figure 9: Cyber security awareness training in a rural area

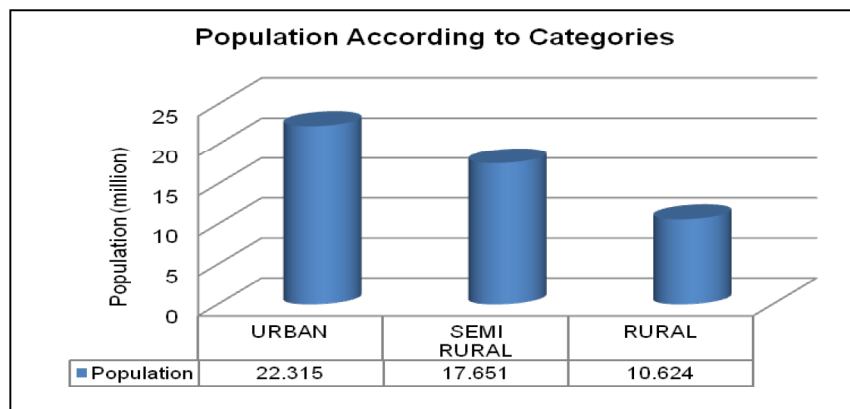
For the purpose of this article's comparison between the survey participants' level of cyber security awareness, the Gauteng province (high Internet penetration), the Mpumalanga province (medium Internet penetration), and the Limpopo province (low Internet penetration) is used. Surveys were distributed to South African citizens from these areas to determine the cumulative cyber security awareness levels of the area. These awareness levels are then used to extrapolate the influence of cyber security levels of South African citizens on National Security. These citizens are classified in three groups (urban netizens, semi-rural netizens and rural netizens) based on availability of digital amenities, availability of and access to the Internet, the number of users per computer and the level of



computer maintenance. The rural areas and deep rural areas were also combined as not enough data were available to divide them in different categories. Urban areas included in the study refer to the bigger cities and smaller towns with significant economic and public services and economic livelihood opportunities. The semi rural areas include the densely settled clusters and dispersed settlements in the former Bantustans, forming home to 21% of the South African population. 32% of these rural area citizens live under the minimum living level (Van Huysteen & Botha, 2008).

#### 4. Current level of awareness

In the first order analysis there were indications that the awareness in South Africa differs according to the spatial distribution of the population. This was identified as one of the assumptions of the study. The 2011 South African population figures of 50,59 million people used for the analysis were retrieved from the Statistics South Africa estimates of June 2011 (StatsSA, 2011b). The percentage distributions of cities in terms of urban and rural distribution were determined by using the analysis of GeoHive based on 2007 census statistics (GeoHive, 2007). The percentage population for cities in 2007 (44%) were assumed as the urban population figure. The population figure for rural areas is 56%, divided into semi rural areas (21%) and rural areas (35%). These statistics are indicated in Figure 10.

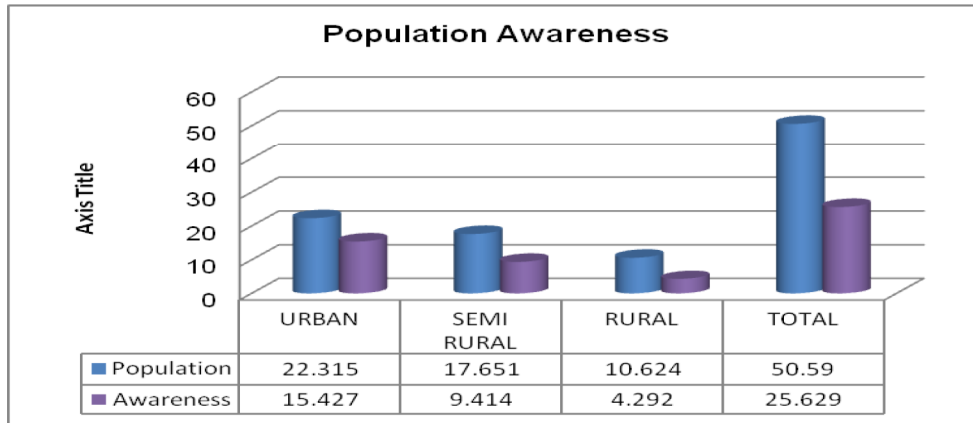


**Figure 10:** Classification of South African population according to categories

The initial levels of awareness were calculated by analysing questionnaires completed before cyber security awareness training took place. In terms of these questionnaires, any answers given by participants that indicate good Internet behaviour were seen as a positive contributor for awareness. Completed questionnaires were retrieved from different geographical areas (South African Gauteng, Mpumalanga and Limpopo provinces) and were categorised in urban areas, semi rural areas and rural areas according to the above definitions provided earlier in this article. The levels of cyber security awareness for urban areas (69%), semi-rural areas (53%), rural areas (40%) and total awareness based on the overall awareness of the sample group (51%) are presented in Figure 11.

The questionnaires used to test the participants' level of cyber security awareness were designed to include questions pertaining to physical computer security, malware and malware countermeasures, safe surfing and social aspects of cyber security. These questionnaires also provide an anonymous view on the participants' demographic profile, technological background and reaction in specific cyber related scenarios. It was interesting that most of the rural students (93%) indicated that it is illegal and dangerous to download movies from the Internet as opposed to 22% of the urban students. In addition, the answers to the question pertaining to a banking scenario were received particularly well by the participants, irrespective of their demographical classification. The question sketched a scenario depicting a phishing email sent by an entity pretending to be a bank, asking for the email recipient's password. Most of the candidates (100% of the urban participants, 91% of the semi rural participants and 85% of the rural participants) indicated they will not respond to these phishing emails. In South Africa, all the banks focused intensely on attracting attention and media exposure to make people aware of phishing scams targeting the banking environment. Based on the results of this specific question, it can be deduced that the banking sector's advertising campaigns were successful and contributed largely to influencing South African citizens' level of cyber security awareness. This specific statistic is very positive in terms of the influence that cyber security awareness levels can

potentially have on National Security in South Africa: if fewer people fall victim to phishing scams, the country's economy is not as vulnerable and the National Security is perceived as much stronger.



**Figure 11:** Cyber security awareness based on South African population classification

Another interesting observation was that the younger people are more willing to enter information into websites than older people: 76% of the participating students and 77% of the participating school children indicated that they will enter details like their names and towns on a website. A very small percentage, however, will enter all their personal details on the website. This can be attributed to the number of young people who are active in social media sites. The social media site most used in South Africa is MXit, which are currently used by 24% of mobile phone users aged 16 and above (29% of urban, 19% of rural users). Facebook is however rapidly increasing their market, reaching 22% of the users. In the urban over-16 market Facebook users has exceeded MXit users, with a 30% reach, versus 13% among rural users. At the end of 2010, 6% of mobile phone users subscribed to Twitter. The proportion of urban Twitter mobile users is exactly double that of rural users: 8% against 4% (ITWEB, 2011).

## 5. Other factors contributing to cyber security levels

The use of mobile Internet services resulted in a dramatic increase in the availability and use of email in the rural user base. There were also an increase in usage of email, resulting in the most among urban users rising from 10% in 2009 to 27% at the end of 2010. Email usage in rural communities was almost non-existent before 2010, therefore the 12% penetration reported for 2010 indicates mobile email becoming a mainstream tool across the population (WorldWideWorx, 2011).

The use of social networking can also have a serious effect on National Security. Drapeau and Wells argues that the proliferation of social networks has ramification for National Security spanning future operating challenges of a traditional, irregular, catastrophic, or disruptive nature. Concerns such as security, accountability and privacy can drive the government and National Security institutions to limit Internet access. Drapeau and Wells further states that *"Information security concerns are very serious and must be addressed, but to the extent that our adversaries make effective use of such innovations, our restrictions may diminish our national security"* (Drapeau & Wells, 2009). Figure 12 identifies South Africa as the third most attacked country in the world (Amit, 2011).

South Africa has a huge responsibility to promote awareness taken into account the fact that if wrongful acts are committed inside a country, the State can be held responsible for these acts, since the State is obliged to fulfill the interest of the entire international community. In the light of existing international law doctrine the state can be held responsible, for a breach of an international obligation. This obligation relates not to actions but to omissions, i.e. for not preventing that attack to take place. This interpretation is derived from the wording of Article 14(3) of the International Law Commission (ILC) Draft Articles, which provides that a State may be held responsible for the conduct of organs of an insurrectional movement, if such an attribution is legitimate under international law. The State has therefore an obligation to show best efforts, and to take all "reasonable and necessary" measures in order to prevent a given incident to happen.



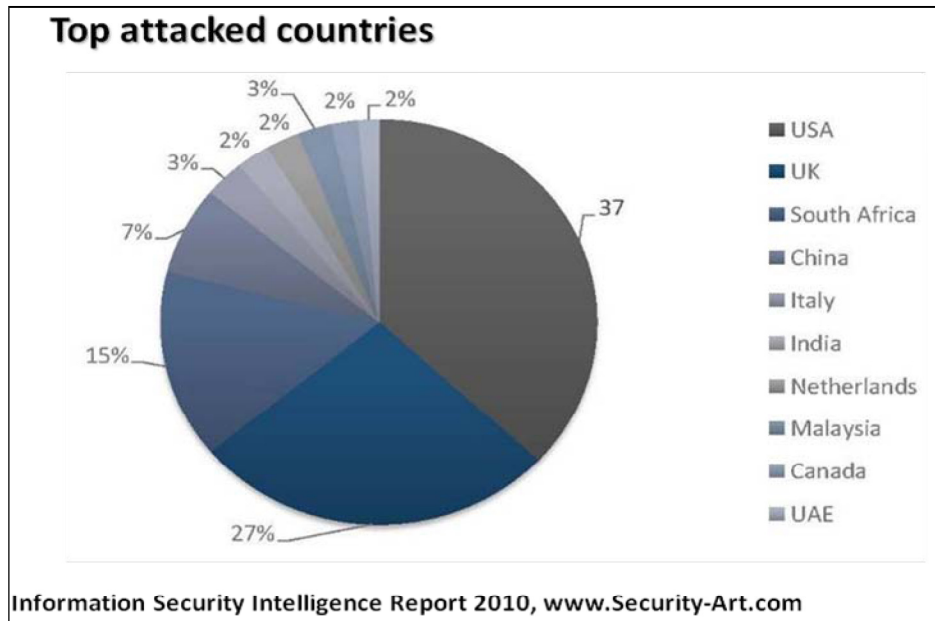


Figure 12: Top attacked countries 2010 (Amit, 2011)

## 6. Conclusion

Cyber security has been identified as a critical component contributing towards National Security. Focusing on the recent large-scale integration of rural communities into the global village, this article looked at the Internet penetration statistics of South Africa and how the level of cyber security awareness of South Africans can influence National Security.

South African citizens from areas within the South African Gauteng, Mpumalanga and Limpopo provinces participated in this study. These citizens were classified into three groups: urban netizens, semi-rural netizens and rural netizens. Each participant received a questionnaire with a number of cyber security related questions. Based on the answers received on these questions, the approximate level of cyber security awareness of the participants were calculated as 69% for urban areas, 53% for semi-rural areas, and 40% for rural areas. Although the sample population used in this study is very small, the indications are that only 50% of the population has some level of cyber security awareness. It can therefore be readily assumed that the level of cyber security awareness does have an impact on National Security.

The value of this study indicated that although rural and semi-rural citizens are less aware of cyber security threats, these areas should become the focus for cyber security awareness training. Because of the significant increase in broadband to South Africa and the high usage of mobile phone technology in semi-rural and rural areas, these areas can become a soft target for attacks. It is thus very important to increase the security awareness training efforts in particularly semi-rural and rural areas.

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