Chapter 7
Research

Fundamental and Applied ICT Research in South Africa: Finding a Balance

Elroy Jumpertz, Jeroen Schutte, Bob Klaase and Daan Pijper

Abstract

This paper aims to give a comparison of ICT research in South Africa and in the Netherlands. This is done by placing the results along one of Hofstede's cultural dimensions, namely the focus on long-term versus short-term oriented research. Specifically, the aim is to find out whether South Africa as a country is focused on long-term or on short-term ICT research.

Several key factors are taken into account, such as the ways in which research is being funded in the Netherlands as well as in South Africa, the positive discrimination program initiated by the South African government ("Black Economic Empowerment") and the tendency of highly skilled employees to leave South Africa in large numbers ("brain drain").

Methods used are literature study and interviews, both in the Netherlands as well as on location in Pretoria, South Africa.

It can be concluded that although the South African government stimulates short-term research to address several concrete problems in South African society, professionals in the field of academic research argue that long-term research is equally, if not more, important. The reason for this opinion is that South Africa should not fall behind on a global level and that fundamental research is crucial for the country's development.

Introduction

Being part of the continent of Africa, South Africa is a country in development. Most publications on ICT research in the continent of Africa focus on bringing the ICT infrastructure up to standard with the rest of the world. The balance between practical research, such as infrastructure, and fundamental research is an interesting one and it is expected that South Africa's priorities are different from those in the Netherlands. Moreover, South Africa has large ethnic diversity and is still struggling to overcome the after-effects of Apartheid. Poverty and unemployment, crime, HIV and an unstable government are major issues as well. These cultural factors will also be taken into account when looking at the current state of ICT research in South Africa.

Research question and hypothesis

For this research the cultural model as developed by Hofstede [1] will be used as a framework and as guidance. One of the cultural dimensions as defined by this model is "long-term versus short-term orientation". This dimension is taken as the leading characteristic of the research question. During the study ICT research in South Africa is examined: whether it is short-term or long-term oriented and how this orientation is affected by public interest.

When taking into account the aforementioned issues that South Africa is facing and which prevent the country from developing into a First World country, the hypothesis is that research in South Africa (and ICT research in particular) focuses on short-term issues rather than long-term solutions. It is expected that long-term ICT research will bloom once the urgent matters have been dealt with in a sufficient manner.

Research methods

The first stage of the research project consisted of a literature study. Specific attention was paid to cultural differences between South Africa and the Netherlands in order to get an understanding of the factors that might influence South Africa's policies with respect to ICT research. Another important subject was the way in which ICT research is carried out in the Netherlands. This knowledge was needed in order to make a valid comparison between countries.

The second stage comprised a ten-day visit to Pretoria and surroundings. Interviews were conducted with various professionals in the fields of ICT, education, and social sciences. In order to give a meaningful answer to the research question, it was essential that people were contacted that represented the three main parties concerned with nationwide research: universities (University of Pretoria), the government (NAPTOSA) and the industry (Accenture, IBM).

The third stage consisted of analyzing the results obtained from the visit to Pretoria, as well as additional research needed to draw sound conclusions.

Important concepts

Affirmative action / Black Economic Empowerment

The term affirmative action refers to policies to promote access to education and employment for social politically disadvantaged groups (mostly racial minorities and women). Many nations have some form of affirmative action. For example female empowerment, which aims to increase the amount of women in the working population and in higher positions, is prevalent in some form in most developed countries. South Africa, however, takes the concept a little further. The government's measures go as far as to impair corporations that fail to do their part by employing a certain quota of previously disadvantaged people.

Brain drain

Due to social economic issues, a large portion of the skilled population grasps international job opportunities to leave the country. In particular, nations of the British Commonwealth are popular destinations. This migration is commonly referred to as the brain drain. The affirmative action, discussed in the previous paragraph, is another reason for people belonging to previously advantaged groups to leave the country.

Hofstede's cultural dimensions

A central theme within the course "ICT in a different culture", the Cultural Dimensions help researchers to quantify cultural aspects of a nation. Geert Hofstede, now a professor at the University of Maastricht, originally created the framework based on data on IBM employees as far back as 1967 [1]. Hofstede found that the cultural aspects of countries could be captured within five dimensions:

- Power Distance Index (PDI): Dealing with the actual distance between people high-up in the hierarchy and those who are lower placed. This could be the relationship between employer and employee, as well as government and citizens. It is important to note that a high Power Distance indicates that both leaders and followers are endorsing the level of inequality.
- Individualism (IDV): This axis measures individualism as opposed to collectivism. A low score does not necessarily indicate that all people are part of one homogenous group. It signifies that people have strong ties with the groups that they are a member of, and define themselves in terms of those groups.
- Masculinity (MAS): A somewhat ambiguous term, masculinity reflects the distribution of roles between genders. Hofstede discovered that the behavior of women display about the same behavior in both feminine and masculine societies, but that in a masculine environment the men were more assertive and competitive, creating a gap between roles.
- Uncertainty Avoidance Index (UAI): This metric deals with a society's view on risks and ambiguity. The higher the score, the fewer individuals are prepared to take risks. Hofstede explains on his website that this axis deals with "man's search for truth". A high score indicates that the culture programs its members to feel uncomfortable in uncertain situations and often advocates the belief in absolute truth, both on the philosophical and religious level. When dealing with less extreme figures, it reflects a stance on business opportunities and personal

endeavors.

- Long-Term Orientation (LTO): This dimension is not part of the original Hofstede research. A group of students found it in their study among students in 23 countries around the world. Low values indicate respect for traditions and the will to fulfill social obligations. Higher values indicate an acceptance of short-term losses in favor for long-term gain. The next paragraph will further elaborate on this axis, as it plays a central part in this paper.

Long-term and short-term orientation

During the visit to South Africa it became clear that "long-term" and "short-term" aren't the best terms to describe the balance in ICT research. For example, AIDS research would qualify as short-term according to urgency, but since the problem has been around for a couple of decades and a cure is still to be found, it would qualify as long-term research. From this point onward, "long-term" and "short-term" will be replaced by "fundamental" and "applied", respectively, or "unspecified" and "specified", in order to eliminate ambiguity.

ICT research in the Netherlands

As announced in the introduction, a short introduction to the Dutch approach helps putting the findings in South Africa into perspective.

Two important organizations that boost research and provide funding in the Netherlands are NWO and STW. NWO is concerned with pure fundamental research. To acquire funding from STW, the research must have a clear practical application. Both organizations have their own range of scientific disciplines, funding programs and agenda. When submitting research proposals to these parties, one must commit to their current guidelines in order to be eligible for funding. Therefore, a lot of the topics being researched are in some way influenced by political agendas.

Additionally, there are other methods to acquire funding for a research project. The Dutch system has three classes of subsidy, called flow of funds. The example mentioned above is concerned with what is called second flow of funds. These are quantities of money that are distributed by the government or by commercial parties to different parts of the scientific community in the Netherlands. They are specified as follows [2]:

- First flow of funds: the money that is allocated to universities. Universities then reallocate the money to specific research projects.
- Second flow of funds: the money that is given to organizations such as NWO and STW, which then redistribute it according to their own policy.
- Third flow of funds: the money that comes from companies or non-profit organizations. When research is carried out in cooperation with a commercial party, the necessary funding is labeled third flow of funds.

In Dutch ICT research, it is almost equally common to acquire funding through the second flow as through the third flow [3]. This means that a lot of projects have acquired funding from the government, and that the remaining projects are funded by companies or organizations. This way, there is a fair balance between fundamental and applied research.

Findings

ICT research in South Africa

Each university, company or country has its own goals in research. One of the key factors that define a research project is funding. In the industry, a company can decide for itself which research to fund and for how long, because the results might generate profit eventually. Research at a university differs, in that a university relies on funding from external parties in order to conduct research. These parties are the government and the industry.

In order to be eligible for government funding, a researcher has to send a request to a governmental organ such as the National Research Foundation (NRF). The NRF is responsible for the distribution of government funding, according to their own agenda. In the other case, research can be funded by the industry. This way, the cooperating company will automatically receive all intellectual property rights to the results. For some faculties it is relatively easy to acquire a contract with a company, for other faculties this is harder because of a reduced interest in their field of study. At the University of Pretoria, for the departments of Computer Science and Information Science it is easy to start cooperation with a company, for Informatics it is much harder. At the department of Informatics the focus is on how computers and information are used within a company and the students have a management background. Within the Departments of Computer Science and Information Science the focus is more on developing new technologies. So it seems that companies are more interested in funding technical departments than management departments.

The political focus with respect to ICT research in South Africa

When looking at government policies and political agendas, the situation in South Africa is quite similar to the situation in the Netherlands. For example, programs that aim to stimulate women to get involved in exact sciences are present worldwide and South Africa is no exception. But because of the relatively recent Apartheid years some other government programs have been developed. These are concerned with adjusting the balance between the "advantaged" people during the Apartheid period, and the "disadvantaged" population. Affirmative action plays an important part throughout all levels of society in South Africa and its effects are clearly visible in the field of ICT research as well [4]. To give a practical example: the University of Pretoria used to be a "white" university that supported the Apartheid regime. As a result, government funding for this particular university is low compared to universities that used to be associated with the previously disadvantaged population. This is part of the nationwide affirmative action program.

The importance of the usage of ICT is increasing, but the procedures the government takes are not always effective, learned by way of interviewing an employee of YESA. YESA (Young Engineers and Scientists of Africa) is an organization dedicated to producing more scientists, engineers and technologists. In South Africa there is a need to focus on fundamental research instead of applied research, even though applied research could solve problems in the daily life of the South African population. By solving these kinds of problems applied science will cause scientific advancement to fall behind when compared to other countries. Moreover, the general opinion on fundamental research is that it is at least as important as applied research. For the last thirty years, building houses and feed-

ing the population has been the priority of the South African government. On the long run however, people will have less chance of a successful future, because they are not educated for working with modern technology. Qualified employees should be well developed on social, economical and educational levels. A healthy industry that supports good research is a prerequisite, as it stimulates people to go to university and develop themselves.

This phenomenon is described as a vicious circle by a professor at the Faculty of Information Technology at the University of Pretoria. Educating people to become scientists requires teachers. But those teachers also have to carry out fundamental research to develop their specialism, which costs money. However, universities don't have the money to invest in more research, or to employ more teachers.

According to another interview there is a sound political agenda with respect to ICT research and there is enough funding to implement it. What causes problems is the lack of skilled people. At the same time, confidence of the South African population in science is very low. On average, only middle-class citizens have faith in science.

The balance between industry and government funding of ICT research

Because of the relatively high interest by industry in ICT research, the government spends little money on this type of research. As mentioned before, the University of Pretoria receives less government funding because of its background. A professor at the University of Pretoria thinks that the affirmative action program eventually could lead to reverse discrimination. And, she argues, career opportunities should be based on competence and not on race. This system creates a "forced" situation for both the previously advantaged and previously disadvantaged groups. Therefore the system should be normalized in the future.

The funding from industry in ICT research is largely based on short-term research, or applied research. In this context, "short" signifies a period of three to four years. The cause for this is that the industry traditionally focuses on research from which the industry itself has the most benefit. Accenture has no specific research projects directed towards the South African market. For multinationals like Accenture, South Africa is not their biggest area of distribution; these are Europe and the USA. So, the research that Accenture does focuses on the markets in Europe and in the USA.

Concluding, funding of ICT research between industry and government is not equally distributed. It is relatively easy for universities to receive funding from industry because the interest is high. As a result, the government grants more funding to other fields of study. The effect of this policy is a decrease in fundamental ICT research.

Brain drain and ICT research

There is a small group of people who are well educated and able to help bring the South African ICT research to a higher level. But many of them leave South Africa for a better career and future for their children. According to local professionals, brain drain is a serious threat to the development of South Africa. Numerous highly educated individuals leave the country to fulfill a job abroad where career opportunities are better, or quality of life is higher. Concrete reasons for emigration are crime rates, fear of AIDS, and unemployment [5].

From university to industry, each person mentioned the importance of fundamental research as a countermeasure to brain drain. Currently there is too little interest in technical science among South African students. Young students must be exposed to technology to a higher extent, in order to create awareness and interest with these students. Once more students pursue a technical career and when the government supplies more funding to favor fundamental research, the number of qualified professionals that leave the country will eventually stagnate.

During the visit at the South African branch of Accenture, a manager mentioned that he sees the Black Economic Empowerment program as a catalyst for brain drain. Because of BEE and the corresponding point system, it can be difficult for persons of other ethnicities to pursue their careers.

In conclusion, two causes for brain drain are given: on one hand the lack of fundamental research and the lack of professionals that pursue careers in that field and on the other the influence of BEE on career opportunities of skilled personnel belonging to the previously advantaged population.

The effects of affirmative action on ICT research

South Africa knows many different forms of affirmative action. The most prominent being black economic empowerment and empowerment for women.

However, these government strategies deal with employment of these groups and the funding of universities as a whole. Universities are treated based on their disposition and location during the years of Apartheid. Be that as it may, the majority of ICT research funding is coming from the industry, which does not discriminate.

Because of the government's policy on funding topics that are already adequately funded through the industry, the various forms of affirmative action do little to steer ICT research either towards a fundamental or an applied focus.

Conclusion

The majority of the people interviewed acknowledge the importance of fundamental research. They argue that fundamental research is as least as important as applied research. The main reason for this opinion is the fear of falling behind on a global scale. To push the argument even further, it was argued that fundamental research often produces the kind of results that truly change the world, contrary to applied research.

The industry traditionally focuses primarily on applied research because of the interest in research that has the potential to produce solutions to concrete problems that the company itself is facing. Due to the fact that there are no companies that risk investing in fundamental research in South Africa, there are little to no major R&D departments of multinationals in the country. The cause of this is that the multinationals haven't got a big customer base in this area of the world. The biggest markets for these companies are located in Europe and USA.

In conclusion: even though the government stimulates applied research, fundamental research is of equal importance in order to safeguard the future of South Africa.

References

1 - HOFSTEDE, G. (1991). Cultures and organizations: Software of the mind. London: McGraw-Hill

2 - KNAW; http://www.onderzoekinformatie.nl/nl/oi/landschap/inhoud/

3 - Prof. Dr. Dr. h.c. Ir. M.J. Plasmeijer, Professor at the Faculty of Computer Science, Radboud University Nijmegen; interview on 01-07-2008

4 - Government gazette, Republic of South Africa, Vol. 463 9 January 2004, No. 25899

5 - South Africa hit by 'brain drain' - http://news.bbc.co.uk/1/hi/world/africa/2149297.stm