Chapter 8

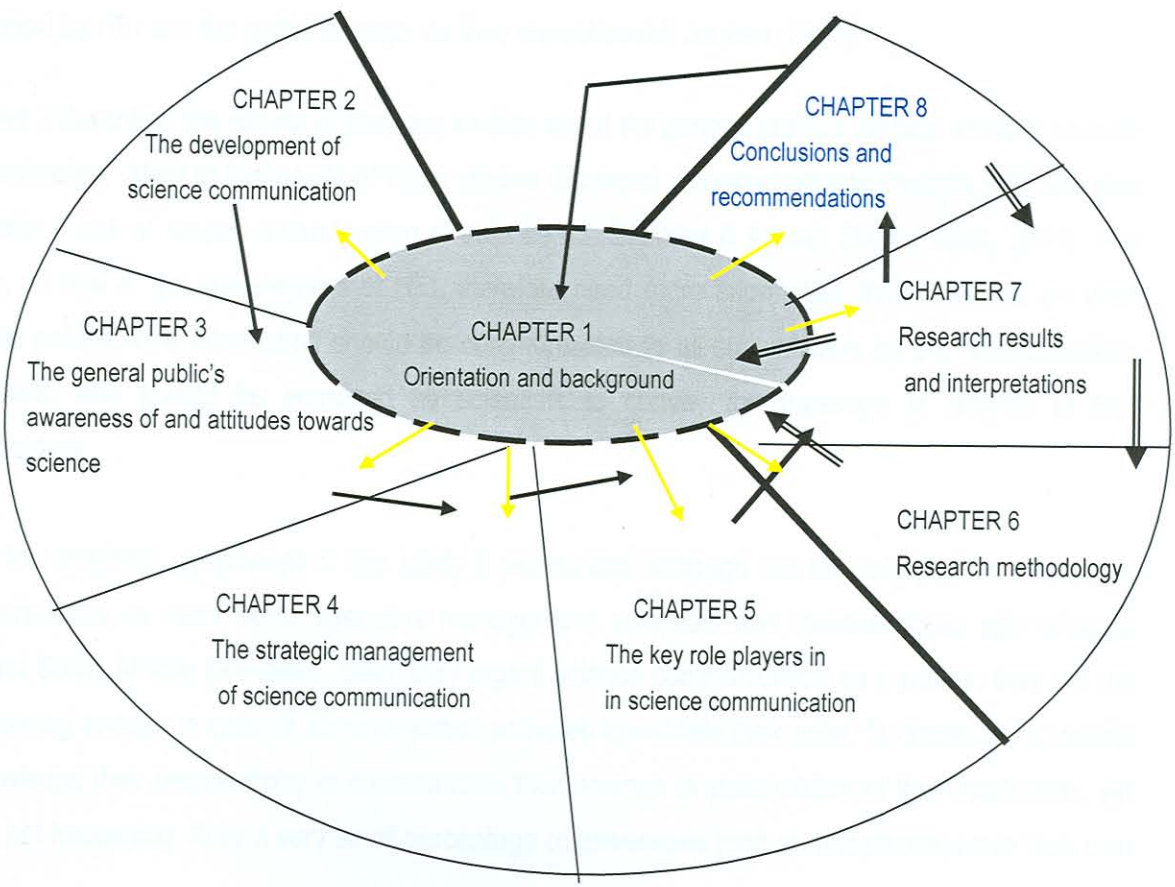
Conclusions and recommendations

8.1 INTRODUCTION

As stated by Rubin *et al.* (2000:12), "... the objective of academic research, whether by sociologists, political scientists, or anthropologists, is to try and find answers to theoretical questions within their respective fields". A very broad range of perspectives (theoretical and empirical) was covered in the preceding seven chapters. The main themes that emerged from the theoretical perspectives tested in Chapter 7 were described in Chapter 1 and formed the basis for this study. Chapter 8 is dedicated to a summary of the most important theoretical and empirical conclusions of Phase 1 and Phase 2, the identification of the limitations of the study, as well as recommendations for future research.

Following the visual representation used in all previous chapters, the interconnectedness of Chapters 1, 6, 7 and 8 is illustrated by Figure 8.1.

Figure 8.1: Chapter 8 in relation to other components of the empirical phase



8.2 CONCLUSIONS PER STATED OBJECTIVES

This study consisted of a theoretical as well as an empirical component. In the sections that follow, the main conclusions that were drawn from the theoretical and empirical component are summarised. As was explained previously, the general aim and objectives of the study were investigated by means of six objectives. Conclusions about these objectives are presented under each objective's heading. Phase 1, the survey research, is discussed under Objectives 1 to 5, while Phase 2, the content analysis, is discussed under Objective 6.

8.2.1 Objective 1: The importance of science communication

The current situation concerning science communication was described in Chapter 2, based on the information theory and the mass communication theory. It became evident that without information about the science that affects everyone's daily life, people would not even realise the risks and benefits of science or be interested in science. Information about science should be communicated to the masses, which in this particular study would be the stakeholders of HEI, including literate and illiterate, urban and rural and young and old people. HEI host the majority of South Africa's scientists and stakeholders of these institutions include the general public and the media. Although there are some initiatives around science communication activities, these activities are not optimised or supported by HEI and the public at large, as they should be (cf. Joubert, 2001).

Chapter 3 described the results of previous studies about the general public's attitude towards science and technology. Most of the results of these studies displayed a positive attitude towards SET, but also indicated a lack of proper understanding of science (cf. Blankley & Arnold, 2000; Pouris, 2001). The public, as one of the stakeholders of HEI, therefore need more information from scientists on what science entails. This information should be communicated to all stakeholders by the communication specialists who should be entrusted by scientists to convey the message of science to HEI stakeholders.

From the empirical component of this study it seems that although the key role players in science communication, in other words executive management, scientists and communication specialists at HEI and South African journalists, claim they regard science communication as a priority, they are not participating enough in science communication activities to validate their point. Furthermore, scientists acknowledge their responsibility to communicate their science to stakeholders of their institutions, yet this is not happening. Only a very small percentage of universities (and no technikons) have their own

science centre. The fact that technikons' main focus is not on scientific research, results in technikons not regarding science as important as would have been expected.

In Chapter 2 the information theory and mass communication theory were described and in Chapter 3 the stakeholder theory was discussed. The chapters respectively highlighted the importance of science information and the distribution thereof to stakeholders of HEI. However, the empirical results imply that science communication does not take place effectively yet. The information of science does not reach all stakeholders, including the literate and illiterate, urban and rural and young and old people of society effectively, but more research is required to determine the reasons why not all stakeholders receive the message of science successfully.

Overall, the results of the empirical component of Objective 1 indicate that more effort is required to enhance the awareness, importance and priority of science communication to ensure a sustainable environment. Further research is also required to include all other stakeholders (being the receivers of science communication) to determine their perception of the importance of science.

8.2.2 Objective 2: The relationship between key role players in science communication

Chapters 1 and 5 of the study, which refers to the relationships that should exist between key role players of science communication as well as with stakeholders, highlighted the importance of relationships at HEI. However, based on the theory in Chapters 1 and 5 it seems as if there is currently not a relationship of trust and empowerment among the key role players in science communication (cf. De Beer, 2001). The members of the executive managements at HEI should place enough trust in and empower communication specialists to participate in planning and implementation of science communication activities.

The theory furthermore reveals that scientists and journalists do not really understand one another in an interview situation, thus causing the wrong scientific facts to reach stakeholders (cf. National Association of Science Writers, 2001). One strong argument for this misunderstanding is a lack of proper training for all key role players of science communication (cf. Metcalfe, 2002).

The empirical component of the study indicates that:

- key role players in science communication do not have proper relationships with one another;
- there is a lack of trust and mutual understanding among key role players;

- there is a lack of empowerment of communication specialists;
- the lack of a relationship of trust and mutual understanding can be one of the reasons why very few scientific news reach the media and subsequently the general public.

These findings correlate with the theory of excellence in communication and corporate communication management. Unless communication specialists receive proper training, are trusted and empowered to act as managers where science communication is concerned and are accepted as the facilitator in the relationship between key role players, science communication might not become as powerful as it should be.

8.2.3 Objective 3: The role of communication specialists in science communication

The theoretical component of Objective 3 outlines the communication function at HEI. Communication specialists are the spokespeople at HEI and have an important role to fulfil as facilitators (cf. Mersham & Skinner, 1995). Communication departments are also expected to provide advice to executive management regarding technical and communication strategy dimensions. They are furthermore expected to build relationships with internal and external stakeholders. They need to be boundary spanners, planners, implementators and evaluators of the science communication plans after implementation (cf. Grunig, 1992). However, this is not always the case, since communication specialists need to be managers and technicians at the same time, and on occasion they are requested for their input into strategic issues regarding science communication (cf. De Beer, 2001).

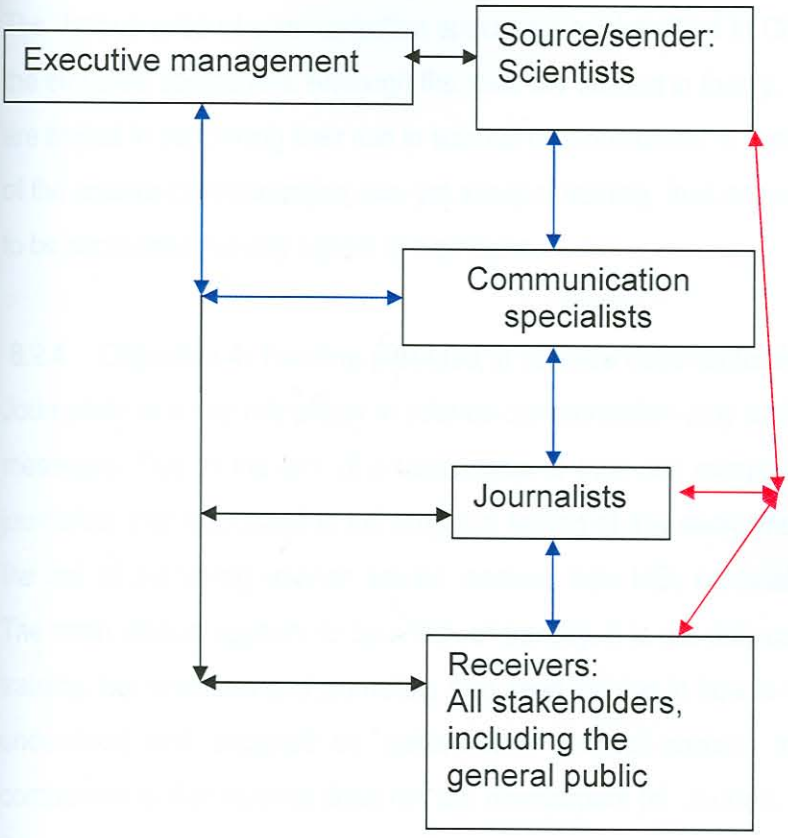
Three conclusions are presented from the empirical component:

- First, executive managements largely agree that communication specialists should interact with scientists and assist as facilitators to distribute the science message to the media and other stakeholders. However, scientists disagree, since they doubt the training of communication specialists to understand the science that should be communicated.
- Secondly, although the members of executive management and communication specialists agree that communication specialists make a strategic contribution regarding communication with stakeholders, executive management and communication specialists both indicated that communication specialists influence key strategic decisions to a lesser extent. This clearly indicates and confirms the role of executive management as strategists and communication specialists as the managers where science communication is concerned.

- The third conclusion drawn from the empirical component concerns the facilitating and/or mediating function of communication specialists in ensuring that scientists communicate their science through communication specialists to stakeholders. The empirical results imply that scientists and communication specialists are not as positive towards the facilitating function as are the executive management, probably due to a lack of trust in communication specialists' ability to interpret science messages correctly because of a lack of training in science writing.

In Figure 8.2 a proposed model for distributing science messages is illustrated to describe the most appropriate solution to the relationship amongst key role players. Communication specialists are the spokespersons of HEI, but in a situation where executive management and scientists have direct access to stakeholders, communication specialists have no control over the process and flow of information. In acting as facilitator between the institution and stakeholders, communication specialists serve the institution best by aiding the flow of news and information. The free flow of information should be encouraged, which will lead to more opportunities for positive coverage of news at an institution. Journalists are more likely to return to such an institution for experts to quote in their articles and to interview for radio and television. They are also more likely to trust releases and other information from this institution and specifically from its communication specialists (National Association of Science Writers, 2001). Communication specialists' role as facilitator would imply that as far as possible, they should act as facilitators at all times, especially where information could be prejudicial to the institution. Communication specialists should have the authority to decide what information may be conveyed to the media and other stakeholders. However, it would be impossible for communication specialists to be everywhere at the same time and scientists would have to communicate directly with all stakeholders. Yet, scientists should be encouraged that when communicating directly with the stakeholders do it in conjunction with communication specialists and where possible in their presence.

Figure 8.2: The proposed preferred relationship between key role players in science communication at HEI



Source: Own visualisation

There is a new concept in research at HEI that is called contract research. Contract research involves typically scientists, an external partner (in most cases an industrial company) and the research office or research business unit at HEI. However, there might be more role players involved, depending on the research project. The research business units at HEI were especially established to act as facilitators between scientists and industry. The role of these units is to ensure a proper contract is in place between scientists and industry and to protect the intellectual property of the research. In the case of contract research, the research business unit takes over the role of communication specialists to ensure that a relationship of trust and mutual understanding evolves between scientists and their industry partners. However, the scientist who worked from the start together with the industry partner

has to communicate the results of the study directly to the industry partner. In the case of contract research, the sender is the scientist and the receiver will be the industry partner, without any facilitation from communication specialists at HEI.

The various roles of communication specialists as described in Chapter 5 are linked to the results of the empirical component. Although the roles are defined in theory, in reality communication specialists are limited in performing their role in science communication. It is expected of them to fulfil all functions of the science communication role, yet a lack of training, trust and empowerment increase their inability to be successful in every aspect of their tasks.

8.2.4 Objective 4: Training provided in science communication

Journalists as a key role player in science communication play a vital role in the distribution of science messages. Due to the lack of a relationship of trust and mutual understanding of nearly half of the journalists that responded to the empirical testing of this study, these journalists are not likely to take the risk of publishing science articles received from HEI, especially from communication specialists. The main reason appears to be a lack of training. It is not only communication specialists who need training, but scientists and journalists also need training in how to write science articles that would be understood and accepted by stakeholders. Another concern that emerged from the theoretical component is that science does not sell newspapers (cf. Joubert, 2001). This cliché might be one of the reasons why very few science articles to appear in the media.

Conclusions from the empirical component can be summarised as follows:

- The lack of training in basic science might be one of the reasons why journalists and scientists misunderstand each other and why they often do not reach some mutual understanding during an interview.
- The results of the empirical component indicate that scientists do not provide enough information to be communicated to stakeholders, including the general public.
- The low indication of HEI offering a course in science journalism raises a concern.
- Most importantly, however, is the indication that communication specialists and journalists do not receive any training in science writing and the fact that journalists do not have knowledge about science.

The conclusion that a lack of training might be one of the reasons why a proper relationship of trust and mutual understanding does not exists between communication specialists and journalists, is emphasised by the reflection of the profile of respondents. This is substantiated by the fact that no communication specialists at HEI received any science writing training; a very high percentage of communication specialists' qualifications were not related to public relations; and only a small percentage had obtained a master's degree.

8.2.5 Objective 5: Coverage of scientific topics in the mass media

The media constitute an important distributor of messages to large audiences. Without the participation of the media in distributing the message of science, science communication is therefore doomed to fail (Nelkin, 1995). In Chapter 5 the role of the media is described in detail and the conclusion reached from the theoretical perspective is that the media overall should be utilised more effectively. However, the use of the media cannot be effective unless a relationship of trust and mutual understanding is present. Furthermore, if information on science matters does not reach the media, no messages can be distributed. It is therefore imperative that all key role players in science communication should aim to enhance a trust relationship with the media at large.

The empirical component was applied to test the theoretical perspective. The results imply that communication specialists and scientists do not have as much contact with the media as one would have expected. The results also indicate that far too little coverage of science is currently affected by the various media. A relationship of trust and mutual understanding should contribute to a lesser application of the gatekeeping function and would ensure that science is regarded as a higher priority in the agenda setting function of the media.

8.2.6 Objective 6: Content analysis of scientific articles

The theoretical perspective of Objective 6 has already been discussed in the conclusions of Phase 1 of the study. However, the role of the mass media cannot be overemphasised and the role of communication specialists and journalists are equally important (cf. Mersham & Skinner, 1995). The way in which the media covers science articles or broadcasts cannot be controlled to a large extent by scientists or communication specialists. Once again, a positive relationship between the key role players of science communication and the training of all role players in the communication of science are imperative for correct scientific facts to reach the general public.

The theoretical conclusions are substantiated by the empirical results of the content analysis. The small percentage of SET articles published during the research period (1 March to 31 May 2004) indicates a lack of SET coverage in the South African media. Furthermore, as the results have pointed out, the local media is too dependent on foreign sources in the provision of science articles. This is an indication that the situation has not improved since the previous study performed by Van Rooyen in 2002.

It seems that the number of published feature articles has improved since the previous study, especially in the weekly newspapers. However, time and economic restraints probably add to the apparent lack of devoted science writers in South Africa, while the lack of training may be a further reason for the smaller percentage of feature articles published in the daily newspapers. The positive evaluative tone of coverage and the discourse of benefits point to a positive attitude towards science.

The beneficial properties of visuals and infographics have been highlighted by several research studies, yet it seems as if the local media has not caught up with the trend yet, as there has been no significant improvement since the study conducted by Van Rooyen in 2002. There is a need for concern with regard to the prominence of coverage of scientific articles, as the front-page coverage of science is highly insignificant. However, possible reasons for this imbalance are hard to define and beyond the scope of this study.

8.3 HOLISTIC VIEW OF THE RESEARCH PHENOMENON

The description of theoretical and empirical conclusions would not be completed without a summative view on the research phenomenon, that is the role of communication specialists in science communication at HEI in South Africa. Such a view is presented as a means of summarising the key aspects from the previous chapter and the preceding conclusions.

As was indicated previously, the ultimate purpose of the empirical investigation was to provide an exploratory answer to the general aim and the objectives of this study. Therefore, the objectives need to be answered as part of the answer to the general aim. Beside the fact that key role players of science communication indicated that in their opinion science communication was regarded a priority, the results of their actual participation in science communication activities made it clear that in practice science communication did not enjoy such a high priority.

There is definitely room for improvement to establish a proper relationship of trust among the key role players in science communication as the model in figure 8.2 proposes. Interesting results were obtained from the questions about the role of communication specialists in science communication. Executive management and communication specialists agreed that communication specialists should act as managers in science communication and the implementation of science communication activities. The lack of proper training has a further negative result in that the coverage of science and technology in the South African mass media amounts to only a small percentage. It can be argued that if the key role players were trained properly in science communication, the understanding of science would improve, which would also enhance the general public's realisation of the importance of science communication. The above arguments are also applicable to the coverage of scientific articles in the media. Results have indicated that, overall, the coverage of science by the printed media is too low. In comparison to the 2002 study by Van Rooyen, there seems to be not much improvement in the mass media coverage of science.

8.4 RECOMMENDATIONS

Recommendations are presented in relation to the objectives, thus also contributing to the holistic understanding and future management of science communication.

8.4.1 The importance of science communication to key role players

In Chapter 2 a map of science activities illustrated what future actions regarding science communication could be taken. Joubert (cf. 2001) highlighted certain specific processes that should be implemented to improve an awareness of science communication. However, the empirical results of this study suggest that not much has happened since Joubert's recommendations in 2001. South Africa still needs a national forum to conduct an audit and formulate a structured, reasoned national science communication action plan for South Africa. In formulating such a plan, communication specialists need exposure to best practices in the field so that opportunities are not missed and scarce resources not wasted on unnecessary schemes that are not successful. Although the Department of Science and Technology in South Africa provided funding for some science communication activities in the past, more feedback should be given to the science communication community about who would be funded and for what projects. Furthermore, the Government of South Africa should encourage HEI to organise public debate sessions where scientists and the general public can discuss controversial issues regarding science and research in the open.

HEI in South Africa, especially universities, have three core activities. First, and most important, is the provision of academic training to students. Second, and equally important, is the conducting of research and thirdly, initiation and participation in community projects. Unfortunately many South African universities and technikons, in terms of promoting and communicating research to the institutions' stakeholders, as well as participating in community projects, neglect these two activities. HEI should be encouraged towards and credit should be given for interdepartmental collaboration in the field of science communication and participation in community projects. Ultimately, scientists themselves must embrace their role in science communication, for without them communication specialists and science journalists have nothing to say.

8.4.2 Establishment of a relationship of trust and mutual understanding between key role players in science communication

From executive management to scientists to communication specialists and journalists, a relationship of trust must be encouraged. However, to achieve a workable situation as set out in Figure 8.2, an effort should be made to enhance mutual understanding. The lack of trust and understanding between scientists and journalists, which is an impediment to the progress of science journalism, must be stopped.

Executive management should encourage scientists to provide information to communication specialists, who then should convey the scientific facts to the media and other stakeholders of the HEI. HEI should also consider implementing activities such as targeted, competitive grants to support innovative communication of research at community level (complementing development communication initiatives), annual popular science writing competitions for postgraduate students, and many more.

8.4.3 Improvement of the role of communication specialists at HEI

Science communication in South Africa would be stimulated if the science communication specialists could meet regularly and exchange ideas with communication specialists from other countries. Communication specialists should also be trusted and empowered to create structured opportunities for scientists and journalists to meet and interact. They should create and support a science writers' network in South Africa; develop and promote databases of science writers and media-friendly scientists; collect science articles from scientists and prepare them for publication together with supporting visuals; facilitate linkages and collaboration with corporate sectors, and participate in international networking and visiting expert programmes.

However, all the above cannot be achieved without support from executive management and collaboration from scientists at HEI.

8.4.4 Provision of training in South Africa in science communication

A valuable information source for the public about SET is the mass media. Unfortunately, South Africa lacks science journalists and above all, proper training. Currently, science journalism is generally not a subject presented by South African universities or technikons, except as a module of communication management at the University of Stellenbosch and Rhodes University. A further drawback is that scientists and journalists do not have good relationships – due to a lack of trust on both sides. Added to this problem is a lack of confidence in communication specialists to act as facilitators in science communication. The assumption can be made that if more science articles appear in newspapers, it would definitely not influence the sale of newspapers negatively – on the contrary, it might even increase the sale of newspapers. Training in science communication can further promote the success of a relationship between executive management, communication specialists, scientists and science journalists.

According to Joubert (cf. 2001), training could include numerical issues for those journalists who have difficulty coping with large numbers, percentages and statistics, and for those who do not understand probabilities and therefore battle with risk reporting and the presentation of research outcomes. Others may need help with research methods, or with accessing and interpreting research articles and Internet material. Scientists, however, also need communication skills. For many scientists public communication does not come naturally, and even when they are prepared to become involved, they need some help. Journalists, again, are often intimidated by science and do not know where to find credible science articles and media-friendly scientists. Therefore, training is required for scientists to enable them to communicate with journalists and the general public; for communication specialists to enable them to act as facilitators and to facilitate the communication process between scientists and journalists as well as to provide journalists with the correct information; and for journalists to enable them to communicate the correct scientific facts to stakeholders in an interesting way.

There has never been a better time for HEI to realise that they should provide training to many of their most important stakeholders. At first, a short course could be offered to the key role players of science communication in writing science articles, and after that a module in existing communication courses

could be considered to reach the ultimate goal of a postgraduate degree programme in science communication.

8.4.5 The improvement of the amount of coverage of science in the mass media

South Africa needs strategies, high-level commitment and support to improve the quality and quantity of local science in local broadcasts. Science need to be integrated into popular, peak-time programmes such as local dramas, historical and other documentaries, talk shows, and even soap operas. There is also a need for regular science inserts on news broadcasts and science fillers between programmes. Although newspapers are one of the most important mediums to distribute news, it is a medium that is not utilised to its fullest potential. Another perhaps more effective medium is radio, since it can reach many more households and even illiterate publics. The Internet is also a very effective medium to reach large audiences at once. The communication specialists at HEI could much more effectively promote research findings, profile science achievers, and build media relationships between researchers and journalists. Although communication specialists should facilitate these contacts with the media, they would not succeed without the trust and empowerment of their executive management HEI and without the facts from scientists to convey to the mass media.

8.4.6 Enhancement of the quality of scientific articles in the media

The media in South Africa have four focus areas, namely the environment, health/medical, technology and education. For scientific articles to be published, or for a journalist to attend a science communication activity, the activity should relate to one of these focus areas. The fact that South Africa's media do not even have a category dedicated to science raises a grave concern. Therefore, local scientists need a better insight into how the media work. They must make it their business to build relationships with journalists and freelance science writers eager to publicise new research. Furthermore, the media should be encouraged to devote a certain minimum amount of space in their publications to scientific articles.

Science writers must include interesting styles of writing such as fiction, poetry, satires, skits, discussions, and so on. Furthermore, misleading scientific information, a continuous decay of creativity in presentation, distortion in translation, inconsistency in organising the contents, lapses in the use of language and many more deviations should be abandoned.

8.5 LIMITATIONS

8.5.1 Theoretical limitations

A single study cannot, and should not, attempt to cover all aspects of a particular field of enquiry, as the delimitations of this study set out in Chapter 1 indicates. Seeing that this was an exploratory study, the theories that provided the theoretical base for the study were not discussed in-depth. Based on all the perspectives that were discussed, the following other research efforts can be focused on, for example:

- The role of stakeholders in science communication
- The various audiences (stakeholders), i.e literate and illiterate, urban and rural and young and old people with whom HEI communicate
- The role of HEI in development communication
- Analysis of other mass media in science communication (the content analysis of this study focused only on the printed media in South Africa)

8.5.2 Empirical limitations

Survey research was conducted to supplement the theoretical component of the study. Although the research was exploratory in nature, a quantitative approach was used. The motivation behind the use of quantitative research was to obtain as wide a range of perspectives as possible, and not to gather in-depth information. The survey research was expanded to include a content analysis of selected printed media.

Unfortunately the response rate in this study was low, even after reminders had been sent out. One reason could be that scientists and journalists are busy and in many occasions, e-mails concerning surveys are simply deleted. Participants in general have reached such a level of exposure to survey research that most of them are not willing to participate in it any more.

The term 'stakeholders' were not identified and explained to participants in the study and therefore might have been interpreted differently by participants than what the researcher required.

The content analysis focused only on selected print media, although there are many other branches of the media that could have been included, for example, television, radio and the Internet. The reason for focusing on this particular media was because the current study was to be compared with a study

with the same objective of analysis that was conducted in 2002. A lack of time and finances also played a role.

8.6 RECOMMENDATIONS FOR FUTURE RESEARCH

8.6.1 A continuation of the present study

It is recommended that this study be replicated, but by means of personal interviews conducted with key role players of science communication. This would improve the response rate and clear any uncertainties that might have occurred in the questionnaire. Secondly, focus group discussions with key role players, as well as different media groups and representatives from the general public would complete the communication loop, that is a perspective from other role players that need to convey the messages of science. Thirdly, the exploratory study could be formalised by means of causal studies, including hypotheses or propositions. Finally, future studies could benefit if the recipients of science communication, the general public, for example, were to be included in the study.

8.6.2 Research topics

Opportunities for future research in science communication are virtually limitless. Based on the limitations of this study, the following recommendations can be made for future research:

- In-depth research is required to investigate whether journalists focus only on sensation when writing about science.
- A "lack" of coverage as used to illustrate the small percentage of scientific articles published, is difficult to define and according to Bauer *et al.* (cf.1995), "... such a judgement is inherently political, and different stakeholders in the scientific community and the media are likely to have different views". More research is required to assess the view of readers and to express the amount of scientific coverage in terms of other areas of coverage.
- Further research is also required to determine why scientific articles very seldom reach the front page of the South African media and why a new science discovery is not regarded as important as a political struggle or violent attack.
- The researcher agrees with Van Rooyen (cf. 2002) that Phase 2 of this study should be repeated at regular intervals. If conducted over a longer period (one year perhaps), the results might be even more reliable. This would compensate for irregularities in breaking news stories (e.g. Mark Shuttleworth's space voyage in April 2002 when the Van Rooyen study was conducted) and would enhance the validity of comparison studies.

8.7 CONCLUDING REMARK

Communication specialists play a vital role at HEI to act as facilitator between HEI and its stakeholders, and therefore communication specialists should be equipped with the necessary training and skills development to fulfil their role optimally in the relationship between the key role players and stakeholders of HEIs in science communication. By providing the required power and trust to communication specialists to act on behalf of their institutions with stakeholders, all key role players as well as stakeholders in science communication at HEI would be benefited positively.

In the realm of science communication, South Africa faces the same problems as First World countries, together with the myriad problems of an impoverished Third World continent. The country was able to pull off at least one miracle, a relatively peaceful transition into a new South Africa. It is now time to focus on ways to achieve closer relationships between science and society, to the benefit of science and all the people in the country.