The media as watchdog in the commercialisation of science: a case study of 6 publications

Alexander J. Valentine

Department of Journalism

University of Stellenbosch

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Prof. George Claassen

DECLARATION

I, the undersigned, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Name : AJ Valentine

Date : 10 February 2006

SUMMARY

The role of the media as a watchdog for the social institution of science is viewed as part of the media's role to protect society. In this regard, the role of media was studied in reporting the phenomenon of the commercialisation of academic research at universities. The current study was conducted by analysing articles in 2 scientific journals (*Science* and *Nature*) and 4 printed newspapers (*The New York Times, London Times, Mail & Gaurdian, Business Day*) for the year 2003. The methods of investigation for each publication included the number of articles covering the topic, the percentage coverage, headline analysis, summary of contents and analysis of the themes. *The New York Times* had more articles on the topic of the "commercialisation of science at universities" than the other publications. However, based on the number of issues per year, *Science* and *Nature* had a greater coverage of the topic than *The New York Times*. Based on the analyses of the articles, it is concluded that *The New York Times* had the most balanced and informed coverage of all the issues and stakeholders involved in the commercialisation of science at universities. This is attributed to the *The New York Times's* position of standing outside the realm of science and its experience in covering broad issues.

OPSOMMING

Die rol van die media as ‘n waghond vir die sosiale instelling van die wetenskap, word gesien as deel van die media se rol as die beskermer van die samelewing. In hierdie opsig is die media se rol in die verslaglewering van die kommersialisering van die wetenskap by universiteite ondersoek. Hierdie studie is uitgevoer deur artikels in 2 wetenskaplike vaktydskrifte (*Science* en *Nature*) en 4 koerante (*The New York Times*, *London Times*, *Mail & Guardian*, *Business Day*) vir die jaar 2003, te analiseer. Die metodes wat gebruik is om elke artikel te ontleed, het die aantal artikels, die persentasie van artikels in elke publikasie, hoofopskrif analise, opsomming van inhoud en ‘n analise van die artikel se tema, ingesluit. *The New York Times* het meer artikels omtrent die onderwerp, die “kommersialisering van die wetenskap by universiteite”, as die ander publikasies gehad. Gebaseer op die aantal uitgawes per jaar, het *Science* en *Nature* meer aandag geskenk aan die onderwerp as *The New York Times*. Volgens die analises van die artikels, word afgeleui dat *The New York Times* die mees gebalanseerde en ingeligte dekking gehad het oor die betrokke sake en partye in die “kommersialisering van die wetenskap by universiteite”. Dit word toegeskryf aan die *The New York Times* se posisie as buitestaander in die wetenskap en die koerant se ondervinding om ‘n wye veld te dek.

TABLE OF CONTENTS

“Science is not powerful because it is true. It is true because it is powerful” *Hilary Lawson, science philosopher*

Chapter 1: GENERAL INTRODUCTION

Science and technology pervades most spheres of modern life, and it stands to reason that its influence should be of interest to the public. The media, as the guardians of the public conscience and society's democracy, is itself very dependent on science and technology. In a globalised world, science as a public funded enterprise or a corporately financed endeavour, relies heavily on the media. With public awareness of sustaining healthy ecosystems, moral limits of medical research, and practical solutions to world problems, the modern society is occupying a position where it has increasing influence over how science is conducted. In this regard, the role of the media is vital in keeping the public abreast of developments in science.

The power of the media and public concern was seen with alarming effect in 1993, when the last of the "Big Science" projects was cancelled in Texas, USA, due to public pressure. This ambitious project was the Superconducting Super Collider (SSC), a multi-billion dollar project that was aimed at smashing atoms in a particle accelerator. The purpose was to study the sub-atomic forces and particles, which have hitherto, eluded scientists. However, the media raised public concern about the practical benefits and the diversion of budgets to a small number of the science community. After the project's initial phases and a subsequent lag period, the project was eventually terminated.

The role of the media in science reporting should not only include the reporting of science events, such as new discoveries and impacts on the environment, but also of science as an institution of society. In this regard, the changes to the institution of science should be part of the media discourse, just like in any other institution of society. But what are the issues at stake for the media also to remain vigilant toward science?

According to Hughes (2002), the twentieth century has seen a dramatic change in the major aspects of science:

i) geographical location,
ii) institutions conducting research,
iii) intellectual expansion of disciplines and

iv) the financial support of science.

The geography of science has changed in that more research was being conducted in countries other than the major locations of North America and Europe. The institutions of participating in research, were no longer only universities, but also new centers in private industry, government, non-governmental public organisations and the military. The intellectual growth in science can be measured by the staggering number of new disciplines and specialized areas within existing ones. These new disciplines also necessitated the establishment of new journals, in order to communicate the findings of their research. The funding for science research diversified, in that the government and universities were no longer the major sources for research money, but there were also donors from industries, public enterprises and the military who supported research.

As is evident from the above changes, most of these can be seen as improving the culture of science and the lives of people around the world. However, exceptions may be the concern about the financial support of science research, from private industry and military sources. Ever since the development of the atomic bomb during the Second World War's Manhattan Project, military research has invoked ethical questions about the role of science in politics. In the USA, the Department of Defence funds approximately 65% of university science research, whilst the US National Science Foundation funds only 3% (Lhee *et al.* 2004).

Although Lhee *et al.* (2004) did not elaborate on the contribution of industrial funding to university research, it is very likely that it is a considerable proportion, based on the strong commercial ties between universities and industry (Kenny, 1998; Press and Washburne, 2001). Industry-funded research may not broach the same ethical issues as military research, the impact of industrial funding on the culture and functioning of university research is perhaps more influencial.

It is this influence that the public should be made aware of, since many universities are publicly funded and the commercialisation may place the inventions of public-sponsored research in the hands of industry. Alternatively, the industrial funding may also mean there is support of better infra-structure, more practical outcomes-driven research and the training of the new generations for industry-related skills. In this regard, the role of the media is vital in engaging the public and private industry in a balanced discourse on these issues. Furthermore, it is important in the interest of a balanced discourse, to place this commercialisation of academic science in context with the changes in society and the economy. Therefore, this media discourse should take two important factors into account, as lens through which the commercialisation of science can be viewed. These factors are: the interaction between science and society and the changes in global capitalism.

The interaction between science and society subsumes all the influences and attitudes of society toward science. Although science is the driving force of growth and development within advancing societies, it is this very society whose prejudices, superstitions and needs are reflected in the way public science is being funded and controlled by its political masters. But the changes in global capitalism, have resulted in a new phase of market capitalism that is becoming increasingly reliant on "soft commodities" or intangibles, instead of the old commodities like minerals, petro-chemicals and manufactured goods. These intangible commodities of the new capitalism include patents, software, intellectual properties, ideas and new molecules. This reliance requires a vibrant science and technology sector within the economy to drive the generation of these new commodities (Suarez-Villa, 2000; Suarez-Villa, 2001; Suarez-Villa, 2003)

The influence that these two factors have on the commercialisation of science has not been widely debated by the mass media. It is clear that to have a balanced debate on the changes in science, the media should facilitate the public understanding of the issues at stake.

AIM:

Therefore, the aim of this research is to investigate how the media have reported the phenomenon of the commercialisation of academic research at universities. This was conducted by analyzing published articles in 2 scientific journals (*Science* and *Nature*), and 4 printed newspapers (*The New York Times, London Times, Mail & Gaurdian, Business Day*)

Chapter 2: SCIENCE AND SOCIETY

2.1 *The social nature of science*

It may sound stranger than science fiction, but history shows that human society has a more profound influence on the life of science itself, than science has on our lives.

Within society, there is a growing awareness that our decisions and attitudes impact on the directions and expansion of science. This makes us all the heirs of the benefits of science, but also of the horrors attributed to it. So how are we responsible for the fruits of science, ranging from the wonders of electricity and vaccines to the fears of nuclear and biological weapons?

Science can be seen as just a tool, which enables us to study the laws of nature for our own understanding and perhaps to master the elements of the natural environment. But science does not operate in the absence of a social environment. As a society, we have fueled this generation of knowledge with our goodwill and of course our financial and political support. And for good reasons too, because the past centuries have seen sections of human society advancing with the power of electricity, industrialisation, and vast improvements in food production and medical treatments.

Science is also an institution of society, much like religion and government. So whenever the outlooks of society change, these are often mirrored by developments in science. Society's enlightened age of discovery and curiosity has encouraged science to study the stars for the orientation and navigation of early human explorers. This human will to discover was later to expand into several fields of scientific enquiry, leading to the human conquest of space and the moon. Now, with many of the mysteries in our solar system being simplified by rational theories, the charm and distance of other stellar bodies are also mere technological problems away.

But society's desire for other conquests has also given science the license to develop the weapons of the two world wars. The First World War called upon chemistry to provide a more humane way to kill and maim. The obliging scientists gave us chemical weapons with such brutal efficiency, that we banned them to preserve our human dignity. Needless to say, we blamed science and called it the "chemists' war". Now, if that war belonged to chemists, then surely the nuclear physicists owned the Second World War. The ghastly sight of an atomic mushroom cloud following the first nuclear explosion, caused its developer, J. Robert Oppenheimer to reflect from the Bhagavad-Gita, “Now I am become death, the destroyer of worlds”. After the bomb’s horrific public debut on two Japanese cities, these weapons made nuclear physics a science of national security. Needless to say, many of these scientists of national security reaped our society’s rewards of generous military funding for many years to come. This polarized much of the world into the camps of east and west, marking our descent into the political cold war, which lasted for decades.

Since people are embedded in the process of science, their cultural attitudes can greatly influence science, just like in any other social institution. Even science was not free from racial stereotypes. As scientists gleaned their ideas of race from society, they developed new disciplines that could amass scientific facts to justify society’s prejudices and affirm the established social hierarchy. This period saw the science of craniometry and phrenology being applied to the “inferior races” to study their cranial capacities or relating the character of a person to the morphology of his skull! In spite this embarrassing past, science has changed as society had changed its attitudes, and today science continues to reflect our ever-changing minds.

Since science has no moral dimension, no real means of applying its discoveries to the greater public good, the means of scientific knowledge generation and application is ultimately a human responsibility.

2.2 *Science and religion: Did science kill God?*

It is a popular position for religious followers to blame science for the death of God, but ultimately it is a flawed accusation. Science, like religion is an institution of human society. Although both institutions seek out the truth in nature, only science relies on facts not blind faith, to evaluate and affirm its understanding of nature.

In its proper social context, science is an institution of our society, but it differs from other institutions in that it is the focal point for new knowledge and consequently the advancement of civilisation. This position of science as the sole arbiter of truth and source of knowledge in this world, often clashes with the self-proclaimed position of religion, which also claims to have the exclusive lease on truth. This often leads to tension between science and religious thinkers. But both institutions are embedded in human culture, and are strongly influenced by the attitudes of its human practitioners.

The retreat of society from its religious foundation is related to the postmodern world that society finds itself in, and not the progress of science. This postmodern view describes a world where truth and knowledge is constructed and is very skeptical of any discipline that proclaims to be the source of ultimate truth and knowledge.

Therefore, the role of God as the foundation of faith in our society has vanished at the hands of human activity. This is further reiterated by Friedrich Nietzsche's parable in *The Happy Science* "God is dead. God remains dead. And we have killed him!" Based on this position, the only religious crime that science can be accused of is that its theories for evolution and the Big Bang have cast very strong doubts on the religious account of the origin of life. Indirectly, these scientific theories have made the concept of God irrelevant.

2.3 *From little science to Big Science*

Contemporary science appears to have grown up in the last 100 years, from a small-scale, and mostly isolated activity to a large multi-million discipline that interacts with other social institutions such as political groups, private industry and public organisations. Science has now taken on a new dimension of size, to warrant a the term: Big Science. This occurred during the 20th century, which according to Hughes, (2002) saw the most remarkable growth to the scale, scope and cost of scientific research. The beginnings of big science can be traced back to the development of the atomic bomb, during the national, multi-national and multi-million dollar collaboration under the umbrella of The Manhattan Project (Crump, 2002). Today big science is showcased by the large, multinational teams addressing some of the biggest questions of their discipline (Appignanessi, 2002). A typical publication from a big science laboratory, would normally include many authors with affiliations to different countries and laboratories. An example is at CERN, the European Organisation for Nuclear Research, where the discovery of new sub-atomic particles in 1983, culminated in the publication of an article that was authored by 138 scientists (Hughes, 2002).

According to Christopher Horrocks (Appignanessi, 2002), big science is still larger than the sum of the parts described by Hughes, (2002) who attributes big science to the scale, scope and cost of scientific research. Horrocks argues that the "bigness" of modern science has achieved its position for three main reasons (Appignanessi, 2002).

1) First of all, as the participants of big science engage in their quest for answers to the big questions, science itself has become a subject of study by groups outside the normal scientific communities. These groups come from disciplines such as sociology, philosophy and history. Therefore, big science can be placed within the realm of society, and affirms Thomas Kuhn's view that science is a socially constructed activity (Kuhn, 1996). Furthermore, as big science expands beyond the "sum of its parts", interested groups from society participate in debates within the sciences of physics, chemistry and especially biology (Hughes, 2002). This is evident in the in the way scientific ideas are negotiated with social groups at various levels of the public domain (Appignanessi, 2002). Examples hereof include the constant debates between religious groups and scientists about the biological principle of evolution, the issues relating to genetically modified organisms, and the public participation in the allocation of large amounts of national budgets for scientific endeavours.

2) Secondly, big science enlarges beyond its own boundaries when the mass media attempts to popularise and simplify it to the consumers. Furthermore, scientists have also become popularized in the mass media, in their own attempts to communicate with the general public. Stephen Hawking and Richard Dawkins are currently two of the better-known scientists, whose books are normally well advertised and bought by the public. However, it was Einstein who first achieved scientific stardom in the mass media. When an experiment was performed in 1919 to test his general theory of relativity, the media coverage made Einstein a household name (Appignanessi, 2002).

3) Thirdly, big science is further expanded by its interactions with theories from other disciplines, even though they seem to challenge science's authority. Such is the province of postmodern theory, which proposes that all truth is constructed and mediated, and is therefore weary of science that proclaims its sole lease on the truth and knowledge (Appignanessi, 2002). This is rooted in the findings that science is

often linked to politics, and its knowledge must be negotiated by peer-review, to be accepted as truth.

Using these three reasons of Horrocks, it easy to realise that the interactions between society and science have increased. The contemporary society is described to be a postmodern society (Eckersly, 2002), where the ideals of modernism have been largely abandoned or are being cast in doubt. It is therefore pertinent to understand the impact of this postmodern world on science and technology.

2.4 *Science in a postmodern society*

The development of Big Science is perhaps still part of the modernist vision, even though our society has now been described as postmodern. According to Eckersley (2002), this modernist vision relies heavily on science and technology as its key instruments to achieve the promises of a brighter future and better social order. The modernistic project of the Enlightenment was to achieve a grand narrative through science and technology. However, the vision of the enlightenment has faded in the postmodern world, and there appears to be two major schools of thought on the role of science in a postmodern society: the "academic left" of postmodern science studies and the "science warriors" of natural science (Zaman, 2001).

2.4.1 *The "academic left" of postmodern science*

The view of postmodern science studies, is that it is suspicious of science's authority on the truth and knowledge (Appignanessi, 2002). This is because postmodernism embraces the idea that all truth and knowledge are not discovered, but constructed and that they are not foundational, but rather contextual (Appignanessi, 2002; Eckersly, 2002). Eckersly (2002) also states that a postmodern world is characterised by ambivalence, ambiguity, relativism, pluralism and contingency, and is coming to terms with its own limitations. It is ironic that science's endeavour to understand the nature, is now being confronted by attitudes that solutions to some of the world's problems may forever remain elusive.

Furthermore, Anthony Elliot (in Eckersly, 2002) asserts that in a postmodern society, the knowledge generated by science is increasingly being associated with the production of risks and hazards on a global scale. This is clearly in contrast with the modernistic view that science and technology would master the world's problems to create a better social order. In his book, "The end of science", John Horgan (1996) visits the possibility that the grand era of scientific discoveries pertaining to our understanding of the universe and our place in it, is diminishing or has already passed. Horgan (1996) supports his argument with the view that: 1) most of the major discoveries have already been made,

2) many science disciplines are confronting the limits of their investigations due to lack of resources,

3) many natural processes are random and unpredictable, making them elusive to scientific manipulation and investigation.

Eckersly (2002) also believes that pure science will atrophy from its position as the major ideology, which defines society's progress, but is confident that applied science or technology will continue to grow. However, Eckersly (2002) also suggests that science must adapt with the changes that it is causing within society. In this regard, science should not compromise its rigorous process of thinking, but should become more culturally integrated with the public.

2.4.2 *The "science warriors" of natural science*

The view of the "science warriors" of natural science, contrasts sharply with that of the "academic left" of postmodern science studies. Some of the main proponents in the defence of science are scientists, many of whom are also philosophers of science: Mario Bunge, Alan Sokal and Jean Bricmont are physicists; Paul Gross and Martin Levitt are mathematicians. These scientists argue the points that the postmodern thinkers are grossly ignorant of science and are engaging in activities of anti-science and pseudo-science.

Gross *et al.* (1997) argue that the view of postmodernists towards science is far too reductionist and coarse to appreciate the "conceptual texture" of important scientific thought. The opinions of Gross and Levitt (1997) are congruent with the idea that science is a cultural construct that reflects the economic, social and political needs of the day, but they strongly disagree with the postmodernist view of science as a mere social discourse or the transcription of Western male, capitalist and social perspectives. They claim that the existence of the postmodern movement is rooted in their proponents’ belief that Western culture is sustained by a system of science and technology, and that the methods and ideology of this system, are incorrect and on the “point of collapse” (Gross and Levitt, 1997)

Sokal and Bricmont (1998) assail most the prominent postmodernist thinkers, as philosophers who abuse scientific concepts and terminology. The authors also state, that "The natural sciences are not a mere reservoir of metaphors ready to be used in the human sciences. Non-scientists may be tempted to isolate from a scientific theory, some general 'themes' that can be summarized in few words such as 'uncertainty', 'discontinuity', 'chaos' or 'nonlinearity' and then analyzed in a purely verbal manner. But scientific theories are not like novels; in a scientific context these words have specific meanings, which differ in subtle but crucial ways from their everyday meanings, and which can only be understood within a complex web of theory and experiment. If one uses them as metaphors, one is easily led to nonsensical conclusions." (Sokal and Bricmont, 1998: 177). They imply that, the postmodern view of science interpret theories either incorrectly or grossly out of context, because there is too much focus on the language used by scientific treatise and not the understanding thereof. Furthermore, A. Sokal has published a hoax article in a the journal *Social Text* in which he parodies the criticism of science by postmodern thinkers (Sokal, 1996). Although the article was accepted as a serious scholarly work, the author later revealed it as a hoax.

The view of Mario Bunge (1996) is perhaps the most vitriolic and rapacious toward the postmodern thinkers. Bunge (1996) asserts that universities have been infiltrated by the enemies of learning, rigour and empirical evidence. He labels them as intellectual slobs and frauds who have “mounted a Trojan horse inside the academic citadel with the intention of destroying higher culture from within”. Bunge (1996) groups these mounted enemies at universities into two groups: the anti-scientists and the pseudo-scientists. The anti-scientists profess that there are no universal truths or objectivity in that everything is constructed and relative (Bunge, 1996). For this group, the scrutiny of language usage in scientific texts, is very important as means to highlight how relative and constructed scientific theories are. The pseudo-scientists are not directly against science, but engage in its disservice by promoting ideology, wild conjectures and fuzzy concepts as if they were legitimate scientific findings (Bunge, 1996). This group typically includes the followers of astrology, Egyptology, parapsychology, pyramidology, "scientific" creationism and graphology (Bunge, 1996).

Bunge (1996) asserts that science is the trademark of modern culture and for this reason there is such a determined drive by the anti-science and pseudo-science groups to use science to lend credit to their superstitions. He accepts that both sciences and rationalist humanities are valuable public goods for the promotion of welfare, production and democracy. However, Bunge (1996) stresses that the search for authentic knowledge should be protected from ignorant attack and counterfeit both inside and outside academia, to prevent modern civilisation from slipping into a new Dark Age.

The view of Bunge (1996) that science should be protected against aggressors and fraudsters from inside and outside academia, brings to the fore the pertinent role of the media as society's guardian of democracy. In light of the threats to science, and the consequent effects on modern civilisation, the role of the media may now have to include the guardian of science as well.

Chapter 3: TECHNOCAPITALISM AND ACADEMIC SCIENCE

3.1 *The rise of Technocapitalism.*

Market capitalism is changing in the so-called knowledge society. In fact, some authors believe that the knowledge society is a direct product of the changes in market capitalism (Suarez-Villa, 2000; Suarez-Villa, 2001; Suarez-Villa, 2003). This change in market capitalism is called “technocapitalism” because it is reliant on science and technology and is based on the technological innovations and inventions of scientific research (Suarez-Villa, 2001; Suarez-Villa, 2003). Although we are at the early stages of this new phase of capitalism, all the signs point to a closer relationship between science and industry to drive this new era forward.

According to Suarez-Villa (2000; Suarez-Villa, 2001; Suarez-Villa, 2003), intangibles such as creativity and knowledge and are at the heart of technocapitalism. These intangibles are the commodities of technocapitalism, in very much the same way as tangible raw materials, factory labour and capital were the commodities that underpinned industrial capitalism (Suarez-Villa, 2000; Suarez-Villa, 2001). In fact, the emergence of technocapitalism has elevated the knowledge resource to such a powerful position, that the material commodities are beginning to occupy secondary positions. This is evident in that creativity and knowledge commodities are already accounting for 75% of the value of most of the existing products and services on the world today (Suarez-Villa, 2000; Suarez-Villa, 2001). The interaction between technocapitalism and science is also generating new networks for collaboration and disciplines for technological innovations. These include for example, biotechnology, nanotechnology, bio-informatics, software, bio-robotics and genomics. It is clear that the organizations, both public and private, at the heart of technocapitalism, are driven by research and innovation (Suarez-Villa, 2000). This is in sharp contrast to the organisations of industrial capitalism, where the factories focused more on production, and to a lesser extent on research (Suarez-Villa, 2000). In this new economy, where science and technology are vital sectors to advancing societies, it is pertinent to ponder what the relationship is between technocapitalism and the traditional homes of science and technology at academic institutions.

In societies that are aspiring toward advancement and increasing their living standards in this new age of technocapitalism, there should be a great drive toward building up creativity and knowledge (Suarez-Villa, 2000). In this regard, the role of institutions of higher learning is pivotal in educating the next generation for this market place. During the past 50 years, closer ties have been forged between universities and industry, which may be related to macro phenomena that supported the rise of technocapitalism. According to Suarez-Villa (2000), the macro phenomena in the latter half of the 20th century include the dramatic expansion in science and technology education and the unprecedented increase in physical infrastructure such as educational facilities and research laboratories. These closer ties have transformed many universities into a business-minded approach, and concern has been growing about the effects that the commercialisation of university research would have on the university as an institution (Kenney, 1998).

3.2 *Public-funded universities under threat?*

Remember when science fiction portrayed certain areas of research as dabbling in the creation of doomsday monsters? Well, closer to science fact is that over the past 20 years, research in science has insidiously given rise to a formidable commercial creature: University-Industrial Complex. This beast is the offspring of the commercialisation of science at universities and may doom many of the relevant characteristics of public funded academic institutions.

Among some academics there is growing concern about the commercialisation of science at universities. The traditional roles of public funded institutions is seen as being: the conscience and critics of society, the education of new generations and the pursuit of knowledge or truth, free from market forces or government agendas. The university-industrial complex, amid all its widely-touted financial benefits, appears to threaten these characteristics that define a good university. So what is university-industrial complex? It can be defined as the intimate ties that exist between universities and industrial enterprises, to the extent that the public accountability of the academic institution is undermined for profit.

Concerns about the commercialisation of universities began to emerge during the debate of the late 1970's about the safety issues surrounding the then-new recombinant DNA technology. The concern centered on the potential influence of the commercialisation of university research on the university as an institution (Kenney, 1998). Contractual relationships between academia and industry create loyalties, or at least vested interests, that restrict a university's freedom of expression. For example, Nike's funds from the Universities of Michigan, Oregon and Brown were withdrawn because of student protests against the company's factory labour practices in developing countries (Warde, 2001). Freeport MacMoran funds a Chair of Environmental Studies at the University of Tulane, yet is accused of environmental misconduct in Asia, and The Gap supports the University of California's Berkeley Business School, which uses the company's case studies in its academic courses (Press and Washburn, 2001).

Nowhere else has the growth and influence of the university-industrial complex been more visible than in the USA, as illustrated by the biotechnology industry and its related pharmaceutical applications. The techniques and products of the biotechnology industry have been commercialised more than any other academic technology (Kenney, 1998).

Knowledge developed by non-profit academic institutions does not lend itself readily to commercialisation. However, the past few decades have seen a number of key decisions that have catalysed the commercialisation of academic research and the growth of the university-industrial complex. In 1974 the USA National Institutes of Health consented that universities be allowed to patent and license their genetic engineering research, freeing government-sponsored research from any public claims of ownership and thus fostering the privatisation of government-funded academic research. (Kenney, 1998). The 1980 Bayh-Dole act of the US Congress empowered universities to patent and commercialise state-funded research at a time when the US economy was weakening relative to that of Japan, creating a climate in which commercial forces increasingly dictated universities' educational and academic missions and ideals. It also led to a massive increase in funding to universities. Between 1980 and 1998, funding for research at US universities increased annually by 8%, reaching a staggering 1.9 billion US dollars in 1997 (Press & Washburn, 2001). As with all new technologies, it is unlikely that commercial finance was readily available from the start. Where did the funding initially come from?

The commercialisation of university research in the USA was initially funded by venture capital firms that arose after the Second World War and have since grown to a multi-billion dollar financial sector that supports high-risk, high-reward ventures. Emboldened by the rewards of financing the high-technology research that generated companies such as Apple Computers, Sun Microsystems, Lotus and Intel, these firms were primed to gamble on another untried technology. Their locations near university campuses with strong electronic engineering faculties placed venture capital firms conveniently close to the molecular biology laboratories at which many of the early advances in recombinant DNA technology were made (Kenney, 1998; Wilson, 1985; Florida & Kenney, 1990).

One of the earliest biotechnology firms in the USA was Genentech, founded by venture capitalists in 1976. The impetus for Genentech’s early commercial research was supported by the infrastructure of its scientific partner, the University of California at San Francisco. Genentech's commercial success and public prominence were ensured by its cloning of a human insulin gene into a micro-organism and the subsequent licensing of this procedure to the largest insulin producer in the USA. Despite the steady growth of the biotechnology industry, the recruitment of top scientific staff from universities was surprisingly difficult, prompting venture capital firms to create scientific advisory boards upon which scientists from prominent universities could sit without compromising their tenured positions (Press & Washburn, 2001)

The commercialisation of biological research has also broadened dramatically in recent decades. In the 1970's and 1980's, recombinant DNA and monoclonal antibodies were the main biotechnologies subject to commercialisation, but in more recently the health and pharmaceutical industries have capitalized on biological metabolites, including, liposomes, antisense molecules, peptides, carbohydrates and stem cells.

Increased commercial funding of universities in the mid-1980's led to the formalisation of the spirit with which biological materials were exchanged. University laboratories in the USA required researchers to complete biological material supply forms to gain access to biological materials. In turn, universities became more aggressive in patenting and protecting their intellectual property, leading to greater caution on the part of large multinational firms that had initially signed very lucrative agreements with universities in order to gain access to their intellectual property.

The university-industrial complex may compromise academic standards of research. According to and editorial in the journal *Nature* (2001), recent publications in biomedical journals show that company-sponsored researchers more frequently report results favourable to company products than the reverse, implying bias. Before the arrival of the university-industrial complex, the culture of science could be likened to communism, where intellectual property was freely exchanged and shared and knowledge was generated for the public good. With industry-sponsored research, there was a shift towards confidentiality and the practice of allowing the sponsors to manipulate the manuscripts before publication to serve the interests of the companies. US-based examples include 35% of researchers in engineering which allow their sponsors to manipulate their manuscripts and a large pharmaceutical company, who removed passages from a draft publication that their drug may cause strokes and heart failure (Press & Washburn, 2001).

Furthermore, companies may attempt to curtail academic freedoms or institutionalise their influence at universities. For example, the biotechnology company Norvatis, is paying the University of California at Berkeley 5 million US dollars per year for plant research and granting the university access to company databases. In exchange for seats on university and departmental research committees and first negotiating rights of up to 30% of all academic discoveries made by the supported departments. Furthermore, Norvartis has prevented the academics from discussing this deal, which is an encroachment on academic freedom (*Nature* 2001, Press and Washburn, 2001).

Another serious impact of the university-industrial complex is the price-tagging of science departments, based on how much industrial money they can attract and the downsizing of humanities faculties. Hunter Rawlings (1999), the President of Cornell University, recently argued that the new tendency to be driven by financial considerations can lead to short-sighted favouring of research fields that show commercial potential and neglect of those that do not. Humanities disciplines provide serious critique on the influence of science on global culture, enlarge our worldview and act as the keepers and conveyors of culture in a democratic society. Since the time of Socrates, the humanities have been catalysts for social change, providing society with a critical spirit and a mind set upon argument (Rawlings, 1999). Loss of the humanities would come at great cost to global society and thus to universities themselves.

Should the role of the university be redefined to keep up with the realities of global economic changes? Bill Readings (1998) argues that the university has outlived the purpose defined for it 200 years ago, when it was seen as the guardian of national culture. Perhaps South African universities are following the trend described by Readings (1998) for the USA, where universities are now operating as autonomous bureaucratic institutions and do not care much about the values of specific ideologies. Instead, they are aimed at generating and exchanging information that is useful to the corporations and government, those who call the tune for paying the piper.

The implication of this view is that fundamental research might be curtailed in favour of more short-term commercially viable options. The danger of this can be seen in the case of the Nobel Prize winner Paul Berg, whose fundamental research at Stanford University laid the groundwork for the splicing of DNA and consequently was one of the main thrusts behind the rising biotechnology industry. However, shortly after his innovative finding, he discovered that a scientist at a large pharmaceutical company had been pursuing the same research, but was prevented by the company from taking the work beyond a certain point. Berg highlights that this example represents the limitations of corporate research (Press and Washburn, 2001). Innovative discoveries are more likely to be published if they arise from fundamental academic research that is free of industrial obligations.

One should recognise that these impacts on academic institutions may not be global, at least not yet. There are differences that exist on the campuses within the developed economies such as Europe and North America. Despite this difference, it may also seem that the growth of the University-Industrial Complex sharply follows the divide between universities from developed and developing economies. But with shrinking budgets in developing economies, this difference might soon change. In South Africa, with the dwindling size of government coffers for fundamental research, there has been an increasing trend to encourage academic research to form tighter bonds with industry and to commercialise research. This is also evident in the rapid increase of intellectual property offices at local universities. Although several years behind for the phenomenon in the USA, the benefit of such a lag is that we can observe the potential dangers and avert similar conflicts of the history yet to come.

Chapter 4: MEDIA COVERAGE DURING 2003 ON THE COMMERCIALISATION OF SCIENCE AT UNIVERSITIES.

4.1 *Introduction*

Public concern about the commercialisation of academia often stem from the potential establishment of a "university-industrial complex". This complex encompasses the intimate relationship between academic institutions and industrial enterprises. Opponents of university-industrial complex are concerned about the commercialisation of science at universities, to the extent that the public accountability of the university may be undermined for profit. The opponents fear that the university-industrial complex, amid all its financial benefits, will dismantle characteristics that define a good university. These fears may not be entirely groundless, since examples from US-universities have shown that contractual relationships between academia and industry create loyalties, or at least vested interests, that can restrict the traditional roles of the public funded institutions. These are seen as being: the conscience and critics of society, the education of new generations and the pursuit of knowledge or truth, free from market forces or government agendas.

An often-neglected danger of the university-industrial complex is that science departments may become price-tagged based on the industrial money they can attract. This in turn, may threaten the humanities faculties with downsizing their "non-money making" departments. The university can now be seen as an academic corporation, adjusting to new economic realities of trading information that is of financial interest to potential clients. The new economic reality is that late-industrial capitalism, as we know it, may be changing and driving the commercialisation of universities. The emerging form of capitalism, known as "techno-capitalism" due to its dependence on science and technology, is based on knowledge as its commodity. The realisation of knowledge as a tradable commodity is already apparent in view of the establishment of intellectual property offices at most research universities.

Although the media relies heavily on technology in the modern globalised world, it should also be critical of the impact of technology on society. One of these impacts is the commercialisation of academic research at public-funded universities.

4.2 *Methodology*

a) Publications and keywords used

The following publications were selected to investigate the reporting on the "commercialisation of science at universities" during 2003:

1) *Nature* (UK, science journal)
2) *Science* (USA, Science journal)
3) *The New York Times* (USA, daily newspaper)
4) *London Times* (UK, daily newspaper)
5) *Mail & Guardian* (South Africa, weekly newspaper)
6) *Business Day* (South Africa, daily newspaper)

The databases of the selected newspapers and magazines were searched on 14 August 2004. In order to browse for the articles on the "commercialisation of science at universities" the following keywords were searched for between 01 January and 31 December 2003:

1) science commercialisation
2) science industry
3) university industrial complex
4) academic industrial ties

Although the keyword search retrieved many articles containing these keywords, only the articles that specifically covered the topic of the "commercialisation of science at universities", and issues (patents, commercial academia, university businesses, etc) related to the topic, were selected for further analysis.

b) Article analysis

Table 1a. The number of articles *directly* related "the commercialisation of science at universities", by their coverage of this specific topic.

Description of table:

This table contains the number of articles that directly cover “the commercialisation of science at universities”. The number of articles is expressed as a percentage of the total number of publications for that year. This percentage describes the proportion of published issues devoted to covering this topic.

Table 1b. The number of articles *indirectly* related to “the commercialisation of science at universities”, by their coverage of closely related topics. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the number of articles that indirectly cover the “the commercialisation of science at universities”. The indirect coverage refers to topics that are not specifically dealing with the commercialisation of academic science, but rather to broader issues related to it. In this regard, issues such as patents, commodification of education, academic and industrial ties, objectivity in research supported by commercial funding, intellectual property and university licencing. The number of related articles is expressed as a percentage of the total number of publications for that year. This percentage describes the proportion of published issues devoted to covering related topics of the commercialisation of academic science.

Table 2. References of articles under analysis that are *directly* related to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the references of articles that directly cover “the commercialisation of science at universities”.

Table 3. Summaries of articles under analysis that are *directly* related to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the summaries of articles that directly cover “the commercialisation of science at universities”.

Table 4. Titles/headlines and leads of articles under analysis that are *directly* related to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the titles/headlines and leads of articles that directly cover “the commercialisation of science at universities”. The purpose of isolating the headline, is to ascertain how the article exhibits attracts the reader’s attention to the coverage of “the commercialisation of science at universities”.

Table 5. Lexical cohesion I: statements describing the benefits of the “commercialisation of science at universities”. The articles under analysis are *directly* related to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the epithets (the descriptive phrases in the text) that describe the benefits of “the commercialisation of science at universities” in articles that directly deal with this topic. The purpose of the epithets is to ascertain how the article covers the benefits of “the commercialisation of science at universities”.

Table 6. Lexical cohesion II: statements describing the dangers of the “commercialisation of science at universities”. The articles under analysis are *directly* related to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the epithets (the descriptive phrases in the text) that describe the negative aspects of “the commercialisation of science at universities” in articles that directly deal with this topic. The purpose of the epithets is to ascertain how the article covers the negative aspects of “the commercialisation of science at universities”.

Table 7. Thematic analysis of articles on the “commercialisation of science at universities”. The articles under analysis are *directly* related to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Description of table:

This table contains the themes (the manner in which the subject matter is dealt with in the text) and the rhemes (clauses that give information about the theme) regarding "the commercialisation of science at universities" in articles that directly deal with this topic. The purpose of the themes and rhemes, is to ascertain how the article uses language to convey the bias of its message to the reader on "the commercialisation of science at universities".

4.3 *Results & Discussion*

In the survey of the coverage of the topic the "commercialisation of science at universities", both newspapers and science journals had articles related to the topic during 2003. *The New York Times* was the most informed newspaper in this survey on the topic. This is based on the number or articles, which directly covered the topic and the percentage of the coverage that was devoted to it **(Tables 1a & 1b)**. Since the commercialisation of science at universities, is more prominent in the USA than in most other countries (Press & Washburn, 2001), it stands to reason that it would receive more coverage in *The New York Times* as a USA daily publication. The lack of coverage in the UK *London Times* and the South African *Mail & Guardian* and *Business Day*, suggest that commercialisation of science at universities may not yet be an issue in the UK and South Africa. Although *The New York Times* had a greater number of issues covering the "commercialisation of science at universities", than *Science* and *Nature*, the newspaper had a lower percentage of its total publications covering this topic, than the scientific journals. This is because *The New York Times* is a daily publication with approximately 360 issues per year, whilst *Nature* and *Science* are weekly publications with an average of 50 issues per year.

It is commendable that a newspaper should cover an important science issue, in more articles than the top science journals themselves. In spite of having a lower number of articles than *The New York Times* **(Table 1a)**, the scientific journals published articles that were not directly related to the "commercialisation of science at universities", whilst *The New York Times* dedicated its coverage to the topic directly **(Table 1b)**. This may be indicative of the scientific journals having a wider view of the commercialisation of science at universities, because they do not only cover the topic directly, but also the surrounding issues that are affected and implicated.

When comparing the coverage of the two scientific journals, *Nature* and *Science*, it was found that they had equal coverage of the "commercialisation of science at universities" during 2003 **(Table 1a).** In addition to this direct coverage of the topic, *Science* had a wider coverage of the indirect issues surrounding the "commercialisation of science at universities" **(Table 1b)**. This may be the result of *Science* being a USA publication, compared to *Nature* being a UK publication. For this reason, it is possible that *Science* is in a much better position to monitor the changes to the American sciences, where commercialisation of science at universities is more prominent than in most other countries (Press & Washburn, 2001).

An analysis of the manner in which the titles/headlines of the *The New York Times* viewed the "commercialisation of science at universities", found that this newspaper was more "descriptive" about the topic than the scientific journals **(Table 3)**. In this regard, the term "descriptive" is used because these titles alluded to the involvement of other issues such as education and business in the commercialisation of science at universities. Brief summaries of the content of these articles **(Table 4)** covered by the scientific journals and the newspaper, showed differences in manner in which the topic was treated. The article from *Nature*, covered only complaints by scientists about the "commercialisation of science at universities", and offered no further insights into the topic **(Table 4)**. The article from *Science* covered the collaboration of industry and universities as a benefit, with no further reflection about the potential dangers of commercialising science **(Table 4)**. *The New York Times*, had articles which covered the benefits of commercial ties between science and industry, the real and potential negatives aspects and a balance between the two **(Table 4)**.

Using the tools of lexical cohesion (statements describing the benefits or dangers) **(Tables 5 & 6)** and the thematic analysis (themes ascribed to specific rhemes) **(Tables 7a & 7b)**, the articles from *Science*, *Nature* and *The New York Times* were further analysed for their angle of approach on this topic. Based on this information, the article in *Science* article was positive about the "commercialisation of science at universities", and the *Nature* article more negative about it. In contrast to the scientific journals **(Table 7a)** , *The New York Times* had a more in-depth coverage and understanding of the "commercialisation of science at universities" in all its articles on this topic **(Table 7b)**. This is because *The New York Times* covered more of the issues and stakeholders involved in the commercialisation of science at universities. Some of these issues and stakeholders include: the education mission of a university, commercialisation of higher education, the financial benefits of industrial funding, technology transfer from academia to industry, intellectual property and the inhibition of scientific progress by industrial trade secrets **(Table 7b)**.

Conclusion

During the survey year of 2003, *Science*, *Nature* and *The New York Times* covered the topic of the "commercialisation of science at universities". However, the better coverage by *The New York Times* may stem from the newspaper's position of not being so close to science as *Science* and *Nature.* It may also be due to the newspaper's experience in normally covering broad issues such as business, politics, education and social news and therefore being better able to integrate them with the changes in science.

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APPENDIX

Table 1a. The number of articles **directly related** "the commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication source	Number of publications for 2003	Articles covering the science commercialisation	% Issues of publications dealing with science commercialisation
Nature	50	1	2.00
Science	50	1	2.00
New York Times	360	4	1.11
London Times	360	0	0.00
Mail & Guardian	50	0	0.00
Business Day	360	0	0.00

Table 1b. The number of articles **indirectly related** to "the commercialisation of science at universities", by their coverage of closely related topics. The articles were sourced from 6 selected publications during 2003.

Publication source	**Number of publications for 2003**	**Articles related to science commercialisation**	**% Issues of publications dealing with science commercialisation**
Nature	50	1	2.00
Science	50	2	4.00
New York Times	360	0	0.00
London Times	360	0	0.00
Mail & Guardian	50	0	0.00
Business Day	360	0	0.00

Table 2. References of articles under analysis, which are **directly related** to "the commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication source	**Reference**
Nature	Volume 426, 18/25 December 2003, p 741
Science	Volume 302, 21 November 2003, p 1293
New York Times	16 April 2003, by Sara Rimer
New York Times	11 May 2003, by Ken Stier
New York Times	6 September 2003, by Felecia R. Lee
New York Times	23 September 2003, by Melody Peterson

Table 3. Titles/headlines and leads of articles under analysis, which are **directly related** to “the commercialisation of science at universities”, by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication source	**Titles/Headlines and leads**
Nature	Scientists attack industrial influence (18-25/12/03)
Science	Industry and academia in transition (21/11/03)
New York Times	A warning against mixing commerce and academics (16/04/03)
New York Times	The business of education (11/05/03)
New York Times	Academic Industrial Complex (6/09/2003)
New York Times	Uncoupling campus and company (23/09/05)

Table 4. Summaries of articles under analysis, which are **directly related** to "the commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication source	**Summaries**
Nature	(18-25/12/03): Scientists report on the industrial manipulation of their research findings.
Science	(21/11/03): The benefits of collaboration between academia and private industry to benefit both partners
New York Times	(16/04/03): Industry investments in universities, come with strings attached and cause conflict with the academic mission of the institution
New York Times	(11/05/03): The benefits of industrial funding to generate commercial ventures at universities
New York Times	(6/09/2003): Review of the dangers and benefits of industrial funding at universities
New York Times	(23/09/05): The negative aspects of commercial funding to universities and their effects on the progress of science and medical research

Table 5. Lexical cohesion I: statements describing the **benefits** of the "commercialisation of science at universities". The articles under analysis are *directly* related to "the commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication source	**Date**	**Epithets**
Nature	(18-25/12/03)	none
Science	(21/11/03)	"impressive infrastructure support"; "had value and could attract venture capital" "powerfull capital tools" "objective-driven management" "it would be a bargain" "deploy leveraged private resources"
New York Times	(16/04/03)	none
New York Times	(11/05/03)	"entrepreneurial edge throughout educational process" "sprouted companies with billion-dollar possibilities" "universities are encouraged to profit from government-financed research"
New York Times	(6/09/2003)	"university has been primary engine of economic development" "its growth paralleling with liberal capitalism" "degree from university is a market-driven commodity" "close connection always existed between university and industry" "university became central to economic production"
New York Times	(23/09/05)	none

Table 6. Lexical cohesion II: statements describing the **dangers** of the "commercialisation of science at universities". The articles under analysis are *directly* related to "the commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication source	**Date**	**Epithets**
Nature	(18-25/12/03)	"work has been suppressed by biotechnology industry" "obstacles in disseminating research findings" "industry attempts to suppress and discredit his work" "asked by industry not to publish his findings"
Science	(21/11/03)	none
New York Times	(16/04/03)	"blur boundaries between corporate and academic worlds" "commercial practices...unprecedented size and scope" "commercialisation threatens to change character of university, limits its freedom, sap its effectiveness, lowers its standing in society" "secrecy…inhibits scientific progress"
New York Times	(11/05/03)	none
New York Times	(6/09/2003)	none
New York Times	(23/09/05)	"lure of profits is transforming universities" "they are no longer independent…centers of learning" "areas that struggle to get funds…don't have potential for great commercial values…those that pursue causes of disease"

Table 7a. Thematic analysis of articles from Nature and Scince, that are **directly related** to the "commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication	**Theme**	**Rheme**
Nature (18-25/12/03)	Industry interference	"work has been suppressed by biotechnology industry" "denied tenure… because of outspoken stance" "industry attempts to suppress and discredit his work"
	Threat to academic freedom	"obstacles…faced in disseminating research findings" "asked by industry…not to publish his findings"
Science (21/11/03)	Good source of money	"impressive infrastructure support"; "had value and could attract venture capital" "powerfull capital tools" "it would be a bargain" "deploy leveraged private resources"
	Mutually beneficial	"both sectors are performing basic research and doing it well" "both have access to technologies to support….biological analysis"
	Good research management	"objective-driven management"

Table 7b. Thematic analysis of articles from The New York Times, that are **directly related** to the "commercialisation of science at universities", by their coverage of this specific topic. The articles were sourced from 6 selected publications during 2003.

Publication	**Theme**	**Rheme**
New York Times (16/04/03)	Commercialisation of higher education by industry	"blur the boundaries between corporate and academic worlds" "commercialisation threatens character of university"
	University's financial need makes it an easy target for rich industry	"today's commercial practices…unprecedented scope and size" "universities sell rights to use their scientific discovery to industry" "university administrators under intense pressure to become more entrepreneurial"
	Hampering scientific progress	"treat valuable information…as permanent trade secrets" "secrecy…limiting flow of information and ideas" "pressured researchers to suppress unfavourable findings"
New York Times (11/05/03)	Benefits of academic transfer of technology to industry	"creates new technologies that benefit society" "the companies essentially become the classroom" "research institutes as critical components of local economies"
	Government research support for Stevens Institute of Technology	"has done small ship design for the US Navy for decades" "Pentagon…sizeable percentage going toward university research" "swelling budget shortfalls and corporate sector still licking its wounds" "Defence Department has increased its research support"
New York Times (06/09/05)	Commercialisation of higher education by industry	"traditional mission and standards of the university are at risk" "university in danger…of selling its soul" "corporate logos on syllabuses and course material"
	Potential benefit of university and industry co-operation	"better balance between historical objectives of the university: economic development and human development" "new economy demands creativity"
New York Times (23/09/05)	Commercialisation of higher education by industry	"lure of profits is transforming universities… no longer independent" "studies favour…the financial interests of their sponsors"
	Hampering scientific progress	"privatization of research affects both …studies…and outcomes" "financial interests have brought dangerous drugs to the marketplace"