A critical analysis of the use of IP as a form of information warfare against the developing world

by

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Thesis

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Summary

A critical analysis of the use of IP as a form of information warfare against the developing world

The initial intention of the intellectual property regimes (IPRs) was to promote intellectually produced assets and also to ensure that they are accessible. Modern-day intellectual property regimes put more emphasis on the protection of intellectual products. This has led to lesser emphasis being placed on optimising access to protected information in general.

Indigenous knowledge (IK) has recently attracted more attention from different role-players who are interested in exploiting its economic potential. This has resulted in some IK-based products being patented. Consequently, indigenous communities may no longer have free access to these products. Access to protected information has been limited by higher prices of products protected by IPRs. In some cases it became illegal for the indigenous communities to utilize the resources they had used for centuries. Various organisations interested in IK have already made it available over the Internet, in some instances without the consent or recognition of the indigenous people. This situation translates into a form of information warfare in which the original indigenous owners of knowledge have no access to their own IK resources. Although various measures have been implemented to promote and protect IK, these have not proved to be very efficient.

Based on an Information Science perspective of information warfare, this research suggests that there is a need for improved access to protected information, with special reference to IK. It is proposed that all national governments, especially those of the developing world, should initiate projects to document, digitise and store information on IK resources in repositories or rather databases. An international repository with a union catalogue, as well as the local and national repositories, should be established to enable access to the IK resources via the Internet. The World

Intellectual Property Organisation would take responsibility for the creation and maintenance of the international repository. It is further proposed that information and communication technologies be employed to protect and promote access to IK. Digitised IK will have to be catalogued or organised according to Dublin Core Metadata Element Set and stored as such in repositories to ensure uniform storage. Cryptography and digital watermarking techniques are technologies that could be employed to protect digitised IK.

The Open Archives Initiative Protocol for Metadata Harvesting is a transport protocol which is recommended for information retrieval from the repositories. Metadata such as Resource Description Framework which is a standard for the management of IK on the World Wide Web, and MPEG-7 that would ensure implementation of multimedia objects, would be implemented. These ICT mechanisms also allow for the management of IPRs, which would assist in the prosecution of those who infringe IPR. Such infringements have not always been easy to prove with regards to electronic IP infringement.

The following key terms are covered in this thesis:

Information warfare; Information and communication technologies; Indigenous knowledge; Intellectual property; Information Science; Repositories; Dublin Core Metadata Element Set; Open Archive Initiative Protocol for Metadata Harvesting; Digital watermarking; and Cryptography

I declare that

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is my own work and that all the sources that I have quoted have been indicated and acknowledged by means of complete references

Acknowledgements

The author wishes to express his gratitude:

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In memory of a dear colleague and friend, Rina van Zyl.

May her soul rest in peace…

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Chapter 1

Introduction

1.1 Introduction

Increasing globalisation of the world by means of the exponential growth of modern technology has had negative effects on developing nations, in part due to the substantial increase in electronic imperialism. Today's news is overwhelmed with information on the latest breakthroughs in communications, the Internet, cyberwar, and information warfare (IW). These advancements in technology increase the imbalances in the world (IASIW n.d.).

Information technology is used in almost every sector of the business realm across the globe. An intrinsic element of the information age is that information carries more value than in previous periods of history. IW involves achieving and maintaining an information advantage over competitors or adversaries (Cramer 1996). IW thus adversely affects the information products in the developing world due to the developed world's technological advancement and superiority. The highly researched information products (inventions) of the developed world are urgently required by the developing nations for higher productivity and increased development, but they are only available at a price which most of the developing world cannot afford.

The origin of the concept of IW is briefly discussed under the subtopic of point of departure. Background information is also provided on the subject of IW.

1.2 Aim of the study

The aim of this study is to investigate the elements of IW concerning intellectual property rights (IPRs) and their effects on the developing world. A context-specific

and appropriate solution will be formulated to address the circumstances that promote IW against the developing world.

1.3 Study objectives

The objectives of this study are to achieve the following:

- Determine what IW is
- Investigate the subject of IW within the field of Information Science
- Determine the relationship between IW and IK
- Understand the relationship between IPRs and IK
- Investigate how is IK currently protected
- Determine measures required to promote and protect digitised IK.

1.4 Research problem

The impact of the information exclusion aspect of IW against the developing world warrants a concern regarding the existing regimes for protection of IPRs. Indigenous knowledge (IK) is a form of intellectual property that the developing nations have at their disposal and mostly sought after by certain developed nations or, rather, their industries. For the aim of this research to be realised, a problem statement needs to be identified. The main problem statement to be investigated through this research is:

To critically investigate IW against IK in the developing world with specific reference to intellectual property rights.

It has become common knowledge that growth in cyberspace has reduced the distance between nations. This increases the exchange of information between the nations across the globe, which in turn allows IW to gain momentum. A brief background of IW is later discussed in this chapter under the point of departure. Relevant researches related to this one are analysed in this chapter.

This research will be based on the issues pertaining to the effects of information exclusion as a form of IW via the strict application of IPRs, with specific reference to the developing world in the information age and their status in the international IP arena.

The main research problem statement is supported by the research sub-problems that will be addressed as research sub-questions in this thesis. The following research sub-questions will be used to assist in answering the main research problem statement. The research sub-questions will be formulated and answered by the chapters as stated below:

What constitutes information warfare?

This question will be answered in chapter two, in which the background of IW will be outlined and the concept 'information warfare' defined within the context of the information age. An Information Science perspective of IW will thus be obtained. The IW approach to be adopted in this thesis will also be explored in chapter two.

What is IP and what role does it play in globalisation?

This sub-question will be answered in chapter three. This chapter will investigate what IP is and its global status. Supporting arguments will investigate how it has been implemented in various countries.

What constitutes IK and how is it treated in the global IP regimes?

This question will be addressed in chapter four. This chapter investigates different forms of IK that exist and how IK is influenced by the existing IP regimes.

What is the current state of IW against IP?

Chapter five addresses the above sub-question. It assesses several cases of IK appropriation and the validity of the Information Science perspective coined in chapter two. Some context specific case studies will also be used to elucidate the issues identified and discussed in chapter four.

Which measures are currently used to protect and promote IK?

This question is addressed in chapter six. Various measures that are currently used to promote and protect IK are investigated.

What information and communication technologies (ICT) solutions exist to promote and protect IK?

This question will be answered in chapter seven. Existing information and communication technologies (ICT) are employed to promote and protect IK as additional measures to those discussed in chapter seven.

1.5 Research methodology

This research covers a wide range of topics related to the theme of IW perpetrated against the developing world. This study includes a qualitative research design comprising an intensive literature study. It also entails some theoretical principles coupled with context-specific case studies. A critical analysis stance is taken in the analysis of various issues and cases identified. This research is descriptive in nature and uses professional and disciplinary literature. The literature researched consists mainly of multidisciplinary scholarly publications, which include, among others, scholarly empirical articles, dissertation, monographs and books, electronic articles, scientific publications and other types of material such as non-empirical scholarly articles. Certain nationally and internationally recognised magazines are also consulted (Berg 1998:257; Straus 1998:48-9).

The main reason for the choice of a qualitative methodology is that it ensures that the researcher explores the work of other researchers on the subject of IW, IP, IK and ICT. The idea is to cite relevant literature in the process of presenting the underlying theoretical and methodological rationale for this research. This means citing key studies and emphasising major findings rather than trying to report on every study done on the problem or providing unnecessary detail. It concentrates on whether the researchers' findings were consistent or whether they disagreed. It leads to the exploration of theories that address the topic. It can also determine whether there are flaws in the body of existing researches (Babbie 1998:112; Berg 1998:256-7; Singleton Jr, Straits & Straits 1993:505; Straus 1998:50).

This research investigates different aspects of IW perpetrated against IK of the developing world. The costly discoveries and inventions of developed nations are required by the developing nations mostly for survival. The economic conditions of the day disable developing nations to acquire such information legally or with consent. The developing nations contend that such information is required for development. The literature analysis does not only demonstrate scholarliness, but it also allows for extending, validating and refining the existing body of knowledge (Straus 1998:52).

IW within the Information Science milieu is determined by and leads to the establishment of an Information Science perspective of IW. A definition of IW is therefore also coined. This is possible by using the literature used as an analytic tool to allow for conceptualisation (Straus 1998:53).

This study also analyses the nature and evolution of IP in various areas of the world. Both the Western perspective (developed world) and those in other parts of the developing world are investigated. It is further ascertained that IK is a form of IP. Some IK resources are of economic value and are thus appropriated by multinational companies and researchers with interest in their properties. Research into IK is used to illustrate some cases, some of which were conducted in conjunction with indigenous researchers. IK researchers sometimes use various types of published and unpublished material to supplement their interviews and field observations (Straus 1998:53).

Through a critical examination of the literature, an analysis of the published studies, and a study of official documentation, IK appropriation as a form of IW against the developing world is studied. Particular attention is given to biodiversity, traditional names and tourism IW cases. In each case, an attempt is made to identify IW perpetrated against the developing world (Babbie 1998:A17).

Various measures, including IPRs, that are currently employed to promote and protect IK are identified. The impact and characteristics of these measures are investigated and their sustenance to promote and protect IK is assessed. Thereafter, the need for additional measures to protect and promote IK is investigated.

Finally, ICT is proposed as a tool that can be used to promote and protect IK. The implementation of technologies such as the deployment of repositories, cryptography, and digital watermarking are employed to protect IK. The organisation, promotion and retrieval of digitised IK will be done by means of DC Metadata Elements Set and OAI-PMH.

1.6 Point of departure

The origin of the concept of "information warfare" can be traced as far back as Sun-tzu in 400 BC, and as recently as the Gulf Wars of 1991 and 2003 (Cramer 1996; Devost, Houghton & Pollard, 1997; Harknet 1996; Janssen 1999:313; Luzwick 2000). Although IW has been used to describe the "war" on the Internet (Haeni 1997:4), it entails more than that. In chapter two, various perspectives of IW are identified and discussed. The infringement of copyright, trademarks, inventions, patents or designs, are not necessarily the only forms of known IW experienced by the world.

The real IW experienced by the developing world is exacerbated by the technological, economic and information exclusion caused by limited skills and technological know-how in these countries. This situation means that the developing world will continue to live on aid from the developed world without proper investment that could make

these countries economically sustainable. Their information needs are not truly represented by the mass media, even the local media, which in most instances, are still funded by or act as subsidiaries of developed nations (Sodipo 1997:64).

The following chapter explores the forms of IW that exist and determines the most appropriate approach to IW that can be adopted for this thesis. Chapter three investigates what IK is and determine various kinds of IK that exist. Several case studies are investigated in which IK is appropriated. This will be further investigated in chapter five. As the research progresses, problems relating to IW against IK are identified. Measures currently employed to protect and promote IK are investigated in chapter six. ICT-based solutions are identified in chapter seven to promote and protect IK.

1.7 Background

All forms of struggle over control and dominance of information are considered essentially a form of IW. The techniques of IW are seen as aspects of a single discipline because almost all forms of IW owe their origin to militaristic warfare (further elaborated on in chapter two). Those who are equipped and master the techniques of IW will find themselves at an advantage over those who are not (Libicki 2000).

One of the problems with IW, specific to this study, is that there is still as yet no specific, official definition for IW in the field of Information Science. An Information Science approach is therefore devised in chapter two of this thesis. The main reason for this lack of definition is that this kind of warfare is relatively new to the discipline. The military aspect of IW is very prominent and is also lately used to describe the "war" on the Internet (IASIW n.d.).

Libicki (2000) posits that the marriage of IW and economic warfare can take two forms: information blockade and information imperialism. The effectiveness of an information blockade presumes an era in which the well-being of societies will be as

affected by information flow as they are today by the flow of material supplies. These issues contribute further to the exclusion of developing nations from the rest of the world by the developed nations. The developed nations tend to be knowledge intensive, they require and reinforce skills, which is detrimental to less developed nations particularly those with low-wage and low skilled workforces that cannot easily compete.

1.8 Related research

It is important to determine whether IW-related research has been conducted before. The aim of the exercise is to ensure that the current study does not duplicate previous research. Several research projects were studied and only two were identified as being particularly relevant to the subject of this namely, the studies conducted by Matthee and Ntsoane respectively. This section assesses the relevance of such studies to this thesis.

Researcher(s):	H Matthee
Title:	**Information warfare**
Language:	English
Purpose:	Non-qualification
Status:	Current
Year of commencement :	1999
Institution(s):	University of Stellenbosch_(US) Center for Military Studies (CEMIS)
Subject:	History South Africa - Military history
Intended publication:	Report; Articles; Databases; Papers

Aim:

The research investigates the interaction between new information technologies and forms of warfare. Similarities and differences regarding the use of such technologies in Africa and elsewhere are traced. Particular forms of IW, for example the use of the Internet in psychological warfare, are researched in depth, to establish whether or to

what extent SA security may face such challenges in the region. A literature study and interviews form the mainstay of the research methodology (http://stardata.nrf.ac.za).

Researcher(s):	JM Ntsoane
Title:	The implications of **intellectual property** rights on IK systems in Southern Africa: a comparative study of selected rural communities in Botswana and South Africa
Language:	English
Purpose:	MSocSc
Status:	Completed
Year of completion:	2000
Institution(s):	University of the North-West (North-West) Dept of Sociology Subject Sociology Rural/Urban
Intended publication:	Dissertation

Aim:

The study investigated the implications of **intellectual property** rights and patents on veld product production and associated IK systems in Southern Africa with special reference to selected rural communities in Botswana and South Africa. The study was based on the argument that the exploitation of veld products and associated IK systems in South Africa should be viewed as part of the international capitalist exploitation of resources of developing countries including Botswana and South Africa through colonialism and other forms of imperialism such as globalisation. The study revealed that veld products and their related knowledge systems in the target communities were vulnerable to capitalist exploitation because there were no adequate structures for their protection from both local and private capitalist companies.

The research conducted by Matthee is founded on military history with a psychological perspective. This research investigates the different forms of IW and places less emphasis on its relationship with IK and IP. On the other hand, Ntsoane's research adopts a sociological perspective and does not consider the way IW influences IK. Neither study has a tightly coupled link between the IW, IK and IP.

These two research projects were selected because they are the only studies which seem to relate closely to this one. Most research solely emphasises IK, IP or IW.

The current study stands out from the above two and the others in the sense that it takes a holistic stance in assessing the influence of IW in the context of IK in the developing world. An ICT-based solution is devised to solve IW-related problems facing the developing world, with an emphasis on IK. An Information Science perspective of IW is used in conducting this research. This approach was selected because Information Science is a discipline that determines and assesses the information requirements and needs of the concerned target group and the satisfaction of such needs from authoritative sources. In this instance the focus is on the IK needs of developing communities. This study also reflects on issues pertaining to the protection and dissemination of such information. The uniqueness of this research is that it creates a relationship between the IPRs, IK, IW, and ICT-based solutions to solve IK appropriation and related problems (http://stardata.nrf.ac.za).

1.9 Concepts

The following concepts are covered in this thesis and some context specific definitions will be provided in the chapters as the concepts are discussed:

- Information warfare
- Information and communication technologies
- Indigenous knowledge
- Intellectual property
- Information Science
- National and international repositories
- Dublin Core Metadata Element Set
- Open Archive Initiative Protocol for Metadata Harvesting
- Digital watermarking
- Cryptography

1.10 Organisation

This thesis is divided into eight chapters containing the following content:

Table 1.1 Overview of the thesis

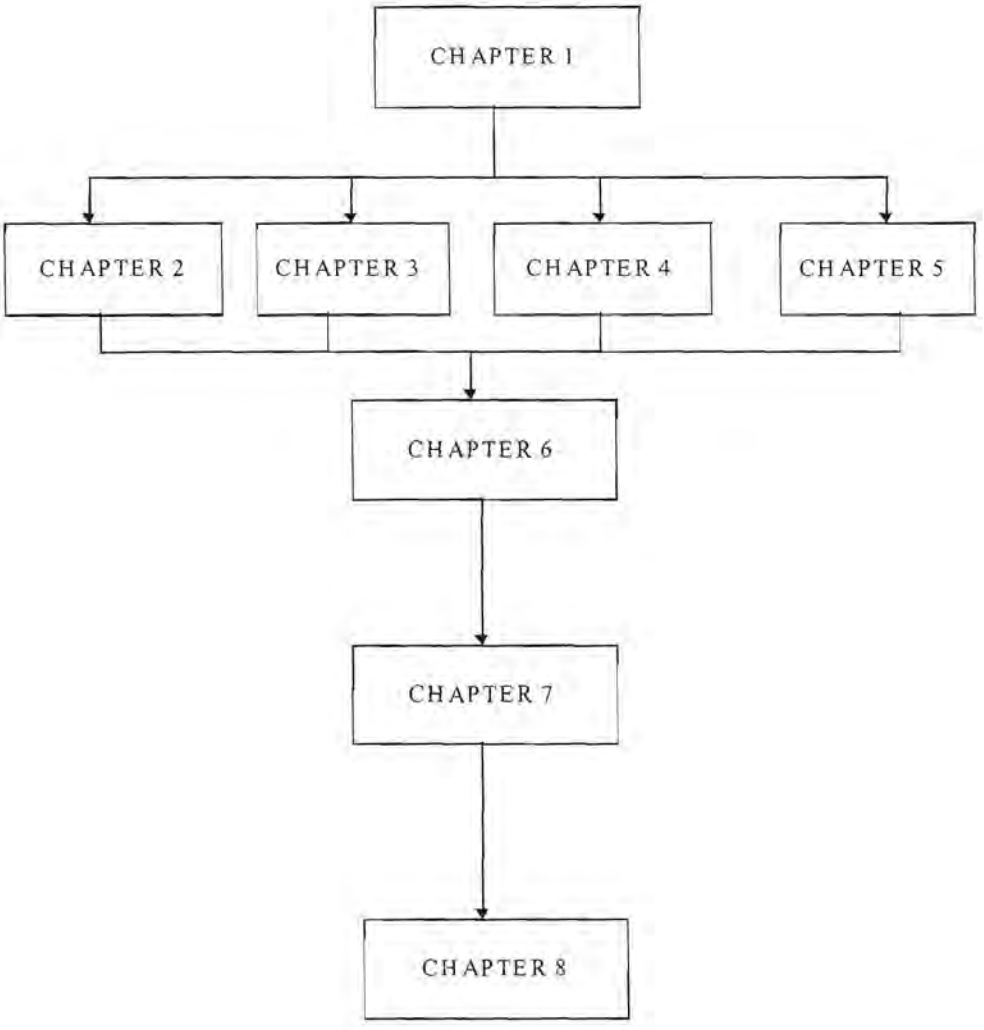
Chapter	Content
1. Introduction	Introduction, context, importance and statement of the problem. A 'road map' of the thesis is outlined.
2. Overview of IW	This chapter provides a background to IW and identifies various IW perspectives. A definition of IW within an Information Science context is composed.
3. Historical framework of IP in the global context	This chapter identifies various forms of intellectual property relevant to the context of this thesis.
4. IK within the global IPR context	This chapter investigates what IK is and its various types within the global IP context.
5. IW perpetrated against the developing world	This chapter investigates various case studies in determining whether IW is perpetrated against the developing world.
6. Current measures employed to protect IK	This chapter identifies various measures employed to protect and promote IK.
7. Using ICT to protect IK	ICT is used to protect and promote IK against IW.
8. Conclusions and recommendations	Conclusions are drawn from the strategy formulated and the implications of IW on societies are discussed. The contribution made by this thesis is discussed and evaluated. Future research directions are outlined.

1.11 Road map of this thesis

Figure 1.1 is derived from table 1.1. It shows the logical flow of this thesis. Chapter one provides the background to this research. Chapters two, three, four and five

contain components that should be understood before chapters six and seven can be studied.

Figure 1.1 Road map of the thesis



Chapter 2

Overview of information warfare

2.1 Introduction

In the previous chapter, a 'road map' of this thesis was outlined. In this chapter various forms of information warfare (IW) are investigated. IW as a concept has been used in various contexts. As such, various forms of IW will be explored. This is done to facilitate the development of an IW definition based on an Information Science perspective. In the attempt to address the main research problem statement, this chapter will answer the following research sub-question posed in the previous chapter:

What constitutes information warfare?

In answering this research sub-question, this chapter will be structured as follows. The background of IW will be outlined and various popular forms of IW will be investigated. An Information Science-based definition of IW will be investigated for use in the remainder of this thesis.

The aims of this chapter can be summarised as follows:

- to identify the origin of the concept IW
- to identify prominent forms of IW
- to revisit the fundamentals of Information Science as a discipline
- to define IW within an Information Science context

2.2 Background

The terminology of IW has its roots in military operations and many of its elements have been part of military doctrine for many centuries. Although IW owes its origin to the military, the modern concepts have evolved more recently, born from the changes that have been driven by the new technologies (Cramer 1996).

In their book *War and anti war*, Alvin and Heidi Toffler approach the history of warfare using a model of three waves. The agricultural revolution started the first great wave of change in our history. Agriculture enabled communities to produce economic products in that age and was also the cause of many wars. '*War*' is usually defined as a state of "open, armed conflict", and *'warfare'* as a "conflict, struggle or strife" (Barrett n.d.).

Barrett (n.d.) posits that in the information era, IW is simply understood as the process of waging war within the domain of information processing resources. It involves the exploitation of computers, databases and network connections. It also involves the strategic application of computer viruses, network 'snoopers', electrical emission detectors and a host of sophisticated, technological tools.

IW is thus a consequence of the changes brought about by the information revolution. It is forced by nations that are highly technologised. IW on the battlefield will therefore be used mostly by the highly technologised nations. Unfortunately, today, most potential enemies of the developed world do not have the technological capability to respond to such attacks and thus IW can successfully be used against them (Cramer 1996; Haeni 1997:14).

The industrial revolution (the second wave according to Toffler & Toffler (1993)) changed the way wars were fought. The element of mass production introduced weapons of mass destruction (nuclear and chemical). In the late 1970s and early 1980s, third wave technologies and ideas began to change industrial wave societies. Further development of technologies bolstered the amount of information available to

these societies. The mass society thus slowly became a communication society. With this development the military doctrine began to change (Cramer 1996; Devost et al. 1997; Haeni 1997:3; IASIWA). Among the three waves only the third wave forms the core part of this thesis, and will be given particular attention in chapter seven.

The late 20th and early 21st centuries have come to be known as the 'information age'. The growing sophistication of digital technology and data processing capabilities has enabled organisations to work even more effectively. This unfortunately has also enabled their competition to work more effectively. Organisations must then increasingly depend upon information processing technology, not simply to operate efficiently, but also to perform their basic work. Due to this, organisations of the same nature become steadily more vulnerable to the theft, destruction or subversion of their technological resources (Barrett n.d.).

Various forms of IW are discussed in this chapter, and one approach adopted for further use in the current research. The logic of the adopted approach will be further expanded on in subsequent chapters.

2.3 Forms of information warfare

It is important to identify and discuss various kinds of IW. Libicki, the US defence analyst, identified several forms of IW (Libicki 2000). Such forms include militaristic (command-and-control) warfare, intelligence-based warfare, electronic warfare, psychological warfare, hacker warfare, economic warfare and cyber warfare. Each of these forms of IW is discussed in this chapter.

The 1991 Gulf War inspired widespread realisation of the immense importance of information superiority in a modern conflict. It is not surprising that the Gulf War also saw the emergence of an alternative image of information vulnerability, the flip side of the information dominance coin (Eriksson 1999).

Harknett (1996) presumes that what is potentially revolutionary and distinctive about the information age is the emergence of the network organisational form and the increasing importance of connectivity among existing computer networks. Arquilla & Ronfeldt (1993) place netwar in the context of a competition over ideas. As they present it, the target is information itself, or more specifically, knowledge. To consider societal connectivity (networks) as a useful target, a society must be dependent enough on these networks to make their loss important. Thus, nomadic, feudal, or even moderately industrialised societies that show few signs of network characteristics are not likely targets for offensive netwar operation. However, should they make their indigenous resources available through the Internet, the possibility of them being violated on the network increases (Harknett 1996).

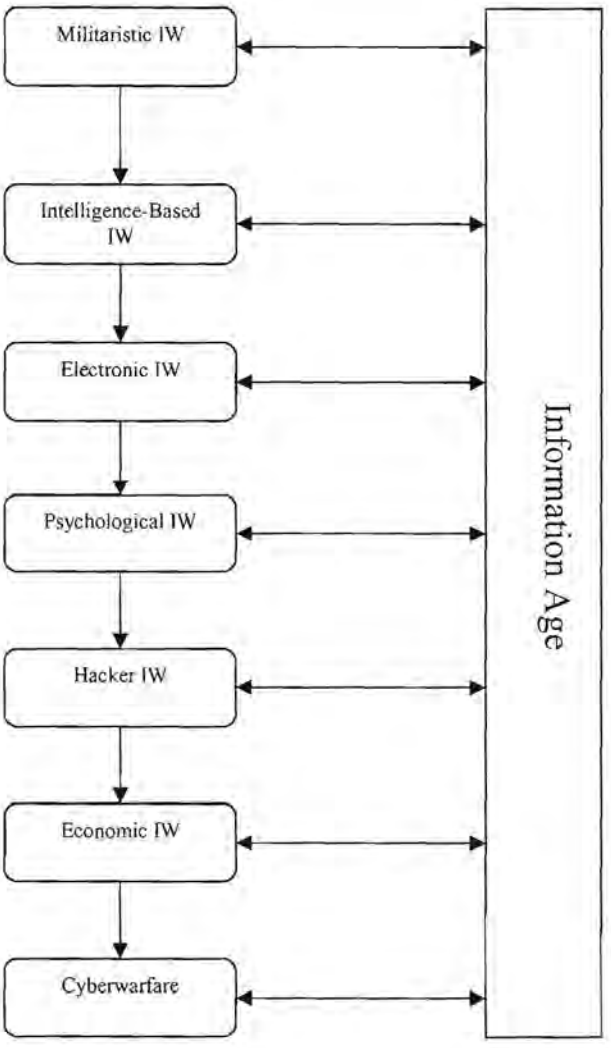


Figure 2.1: Forms of IW

Figure 2.1 shows how the information age determines the nature of various forms of IW. Militaristic warfare is the forerunner of other types of IW as most of them evolved from it.

2.3.1 Militaristic warfare

Military warfare is the forerunner of the other forms of IW. Throughout history, military doctrine, organization and strategy have continually undergone profound,

technology-driven changes. Industrialisation led to attrition warfare by massive armies in World War I. Mechanisation led to manoeuvre predominated by tanks in World War II. The information revolution implies the rise of a mode of warfare in which neither mass nor mobility will decide outcomes; instead, the side that knows more will enjoy decisive advantages (Arquilla & Ronfeldt 1993). This is the form of IW explained in the previous chapter that is experienced by the developing world.

The following definition of information warfare provided by the US Department of Defense (DoD) covers only the military perspective:

IW comprises "actions taken to achieve information superiority in support of national military strategy by affecting adversary information and information systems while leveraging and defending our information and systems" (Devost et al. 1997; IASIWA).

IW was introduced as a major basis of US military strategy by the then Chairman of the Joint Chiefs of Staff, General Colin Powell in 1993. Emmet Paige, the Department of Defense's Director of IW, has an interesting definition of IW. He maintains that:

> "Information Warfare consists of actions taken to achieve information superiority in support of national military strategy by affecting adversary information and information systems while leveraging and protecting our information and information systems ... Information Warfare addresses the opportunities and vulnerabilities inherent in increasing dependency on information and the use of information throughout the conflict spectrum ... Information Warfare has offensive and defensive elements ..." (Barrett n.d.).

The important elements of this definition are the requirement that military warfare activities are performed in support of "national military strategy", that it involves both "offensive and defensive elements", and that it is important throughout the conflict spectrum. IW will become as central to battles of the future as 'firepower', 'air superiority' and 'mobility' have proved to be in the battles of the 20th century (Cramer 1996; Harknett 1996).

Bey (n.d.) contends that the information age is characterised by misinformation, missiles and propaganda bombs of outright IW. Traditionally, war has been fought for territory or economic gain. Information wars are fought for the acquisition of territory indigenous to the information age, namely, the human mind itself. In particular, it is the faculty of the imagination that is under the direct threat of extinction from the onslaughts of multimedia overload. According to Bey (n.d.), as a culture becomes more sophisticated, it deepens its reliance on its images, icons and symbols as a way of defining itself and communicating with other cultures.

In the past, to perform sabotage, a person had to be physically present at a key point as a trespasser, an insider, or a combination of the two. Technological development benefits the cyber attacker because methods and resources of attack can be freely moved to and launched from anywhere to any target (Anderson & Hundley 1994; Eriksson 1999).

The elements of IW are closely allied to the equivalent elements of 'normal' warfare. Barrett (n.d.) and Cramer (1996) identify five activities of interest which are discussed in the paragraphs that follow:

- the gathering of 'intelligence' and of information relevant to an enemy's use of computer resources
- the introduction of 'disinformation' or propaganda into an enemy's computer resources
- the act of 'denying' an opponent access to information resources upon which they rely
- the 'destruction' of those resources - an act of permanent denial
- the 'protection' of one's own resources from similar activity or responses from one's enemy

Figure 2.2 represents various military IW activities that demonstrate that most, if not all, other types of IW emanated from military IW because such activities are evident

in almost every form of IW. The following subtopics on military IW activities will be based on figure 2.2.

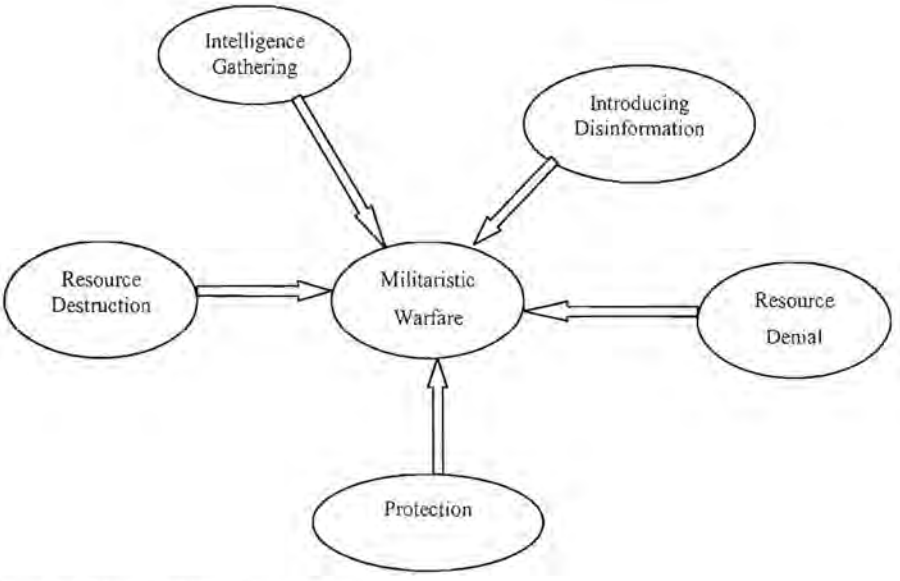


Figure 2.2: Military IW activities

2.3.1.1 Intelligence gathering

In military terms, intelligence is not equated with formal, academic degrees and a high IQ; military intelligence is concerned with learning about one's enemies, their position, strength, information sources and intentions; in the crudest sense, it is about *spying*. In the context of IW, such spying relies on discovering the contents of an enemy's data transmission and computer systems. It involves the application of hacking techniques, but with a crucial difference.

An important difference between general hacking and hacking with military intelligence in mind is that the latter must leave no traces of the penetration, and is directed with specific objectives in mind. Even without actual penetration of a computer system, a great deal of intelligence can be easily gathered in the information age. For example, electronic intelligence techniques that detect and locate radio transmissions can allow an enemy's headquarters to be discovered (Barrett n.d.).

2.3.1.2 Introducing disinformation

Intelligence gathering simply requires information to be abstracted from an enemy's computer system. Disinformation, on the other hand, requires that false or misleading information be *introduced* into the system (Barrett n.d.).

This is an efficient way to corrupt an adversary's databases. It relies on providing false information to the targeted competitor's collection systems to induce this organisation to make bad decisions based upon faulty information. For example, a software developer, Company A, gets information about a new product being developed by a competitor, Company B. Although it has no comparable product in development itself, Company A issues a press release describing its own superior (but fictional) product.

In response to Company A's press announcement, Company B thinks that it has lost its market lead and puts its development efforts elsewhere. Even after Company B brings the real product to market, its lead can be effectively lost when potential customers postpone their purchases waiting for the fictitious product from Company A. This example has unfortunately become commonplace in today's software market. The military versions of this type of denial operation include tactical deception and psychological operations (Cramer 1996).

Information can therefore be introduced through channels that seem to be valid, and so fool the enemy's own data gathering activities. Alternatively, the data already within the system can be manipulated by changing the contents of databases. By introducing such polluted data, news articles can be modified; threat databases of operating anti-aircraft missiles can be subverted; key financial information can be ignored; even traffic control systems can be undermined. Because many modern processes rely on first capturing, then operating with, and finally acting upon database-held information, modifying it can have very wide impact (Barrett n.d.).

2.3.1.3 Resource denial

A clearly hostile act is to 'deny' the enemy access to its own information resources. This seldom involves permanent or even temporary damage to the resources themselves; instead, the means by which the enemy gains access is subverted.

In computer systems, for example, a series of failed login attempts usually then results in the user being barred from the system, and it is then is necessary for a system manager to explicitly re-admit them. Denial of service can therefore be achieved by a series of quite deliberate failed login attempts, targeted at a known user. Alternatively, large quantities of electronic mail can be generated, swamping system resources; or computer viruses can be introduced that seize all process and file space on the system (Barrett n.d.; Cramer 1999).

2.3.1.4 Resource destruction

Through standard Internet protocols such as the file transfer protocol (FTP), the entire contents of a computer can be copied or replaced within minutes. Integrity attacks include the introduction of corruption into data or software so that the targeted competitor will not be using the information or processes it expects (Cramer 1996).

The permanent denial of information resources usually occurs through their destruction. It is far easier to destroy a database or other computer resource than it is simply to subvert it. Introducing false information in a way that is undetectable and convincing is very difficult; deleting the database is simplicity itself. Both data and systems can be destroyed through a logical, hacking attack that can delete not only data files, but also programmes, or even the whole operating system (Cramer 1999).

In practice, of course, this is not achievable remotely. It is necessary to be physically quite close to the machine to destroy it in this way; nonetheless, such units have been developed and used by the US military to destroy missile control systems, for example.

Cramer (1996) notes that direct attacks on an adversary's computer networks are a highly risky and usually illegal activity; nevertheless, the current state of the Internet makes attacks difficult to trace and international intrusions difficult to prosecute. According to this author, direct attacks are an element of IW that an adversary may choose to employ as part of its strategy, they must be considered in formulating strategy and in planning protection.

2.3.1.5 Protection

The obverse of destroying, subverting or illicitly accessing machines is the parallel requirement to ensure that such attacks are not possible against one's own resources. Protection is a key part of any military strategy, but it is even more important in the case of IW. It is vitally important to understand that the security and protection of any computer system is as much a question of people as it is a question of technology. Barrett (n.d.) and Cramer (1999) state that most security breaches are found to have been caused by a system's legitimate users; indeed, the majority of breaches are entirely accidental. In an IW context, any target that is vulnerable is a potential victim. Even without the storage of sensitive data, or a requirement to handle particularly crucial parts of the country's infrastructure, a system can still be a potential target (Barrett n.d.; Cramer 1999).

Once information is collected by an organisation, the next logical consideration is how to protect it. Cramer (1996) states that an organisation's information includes items that may have a high value to a competitor. Examples include future plans, product technical data, customer lists, personnel files, and financial records. This type of data needs to be protected from disclosure to competitors by controlling how, where, by whom, and when it is generated, stored, or accessed. Cramer (1996) goes on to note that the specific data being protected in these ways are often identified in some distinguishing manner and labelled as proprietary, confidential, sensitive, or classified.

Protection is therefore required to an equal extent within the civilian infrastructure. A computer system that is connected to the global Internet is an open door to the rest of

the world; it can be used or abused by a hacker or cyberwarrior. These systems may unwittingly be sheltered by a poorly secured computer system or by an ignorant commercial or government organisation (Anderson & Hundley 1994; Cramer 1999; Vatis & Gallagher 1998).

2.3.2 Intelligence-based warfare

Intelligence-based warfare (IBW) occurs when intelligence is fed directly into operations, notably, targeting and battle damage assessment, rather than using it as an input for overall Command and Control (C2) (Libicki 2000). C2 warfare focuses on trying to maintain control over the enemy's military C2 information systems assets. The problem is that C2 warfare in itself lacks completeness since it does not integrate the broader strategic cultural, social, economic and political constraints into relevant action in support of the crisis management (Libicki 2000).

Despite differences in cognitive methods and purpose, systems that collect and disseminate information acquired from inanimate systems can be attacked and confused by methods that are effective on C2 systems. The evolution of IBW may be understood as a shift in what intelligence is useful for. Traditionally, the commander uses intelligence to gauge the disposition, location, and general intentions of the other side. The object of intelligence is to prevent surprise, a known component of IW, and to permit the commander to shape battle plans. Good intelligence allows for the coordination of operations; great intelligence allows for coherence.

Information technology can be viewed as a valuable contributor to the art of finding targets; it can also be viewed as merely a second-best system to use when the primary target detection devices are too scarce, expensive, and vulnerable to be used this way. Whether high-tech finders will necessarily always emerge triumphant over low-tech hiders, remains unclear.

2.3.3 Electronic warfare

Electronic warfare (EW) or operational techniques entails radioelectronic and cryptographic communications. EW attempts to degrade the physical basis for transferring information (Libicki 2000).

Libicki (2000) explains that a large portion of the EW community deals with radars (both search and target) and worries about jamming and counterjamming. Offense and defense keep coming up with new techniques. Traditional radars generate a signal at one frequency; knowing the frequency makes it easy to jam a return signal. More modern radars hop from one outgoing frequency band to the next. To counter radars, today's jammers must be able to acquire the incoming signal, determine its frequency, tune the outgoing jamming signal accordingly, and send a blur back quickly enough to minimise the length and strength of the reflected signal. Jamming aircrafts that are riding with attack aircraft often wipe out return signals by overpowering them, but doing so makes jammers very visible so they must protect themselves (Libicki 2000).

Harknett (1996) and Libicki (2000) believe that digital technologies will make spoofing (substituting deceptive messages for valid ones) nearly impossible. Digital signature technologies permit recipients to know both who (or what) sent the message and whether the message was tampered with. Unless the spoofer can get inside the message-generation system or the recipient cannot access a list of universal digital keys, the odds of a successful spoof are becoming quite low (Harknett 1996; Libicki 2000).

Electronic warfare is limited to radioelectronic and cryptographic communications. The context of the radioelectronic communication does not fall within the scope and parameters of this thesis.

2.3.4 IW as a form of psychological warfare

The use of psychological warfare against the national will, through either the velvet glove ("accept us as friendly") or the iron fist ("or else") approach, is a long and respected periphery to military operations (Libicki 2000). IW can also be used in a non-military attack against individuals and whole societies (IASIWA).

When using direct broadcast satellite, a nation does not need permission from overseas counterparts to speak directly to people in other countries. This capability is now available to anyone at a low cost. Techniques such as video morphing and communications spoofing make it possible for a country to manipulate the perceptions of its adversary's leaders and populace. According to Haeni (1997), a country may spread confusion or disaffection by covertly altering official announcements or news broadcasts, or it may confuse or frighten leaders by spoofing intelligence or other government communications.

The Somali clan leader, Mohammed Aideed, appears to have been a master of the uses of psychological warfare. In a confrontation that cost the lives of nineteen U.S. Rangers, Aideed's side reportedly lost fifteen times that number, roughly a third of his strength. Photographs of jeering Somalis dragging corpses of U.S. soldiers through the streets of Mogadisho, transmitted by CNN to the United States turned US TV audiences against staying in Somalia. U.S. forces left, and Aideed, in essence, won the information war using psychological tactics (Libicki 2000).

The use of psychological methods against the other side's forces offers variations on two traditional themes, namely, fear of death, or other loss, and potential resentment between the trench and the castle (or home front). In the Gulf War, coalition forces convinced many Iraqis that if they abandoned their vulnerable vehicles they would live longer. The coalition's persuasiveness was fortified by weapons that had just destroyed such vehicles during the fighting.

Psychological warfare can also be applied to the everyday task of deceiving opposing bureaucracies, diplomats and spies about one's intentions and capabilities. Weapons

can be said to be more or less efficient or speedy than they actually are. This type of warfare is used to make the victims of IW accept their circumstances and not question the status quo.

2.3.5 Hacker warfare

The term hacker warfare is used to refer almost exclusively to attacks on computer networks (Libicki 2000). In contrast to physical combat, these attacks are specific to properties of the particular system because the attacks exploit knowable holes in the system's security structure.

Hacker warfare varies considerably. Attackers can be onsite, although the popular imagination can place them anywhere. The intent of an attack can range from total paralysis to intermittent shutdown, random data errors, wholesale theft of information, theft of services (e.g., unpaid-for telephone calls), illicit systems monitoring (and intelligence collection), the injection of false message traffic, and access to data for the purpose of blackmail. Among the most popular devices are viruses, worms, logic bombs, trojan horses, and sniffers (Haeni 1997:11-13; Libicki 2000; Vatis & Gallagher 1998).

Although attacks on civilian and military targets share some characteristics of offense and defense, military systems tend to be more secure than civilian systems, because they are not designed for public access. Critical systems are often disconnected from all others by a physical separation between those system and all others (Harrett n.d.).

Hacker warfare can be further differentiated into defensive and offensive operations. The debate on defensive hacker warfare concerns the appropriate role for the Department of Defence in safeguarding non-military computers. The debate on offensive hacker warfare concerns whether it should take place at all. In contrast to proponents of tank or submarine warfare, only a few hackers argue that the best defense against a hacker attack is a hacker attack (Libicki 2000; Vatis & Gallagher 1998).

The Internet provides facilities for extremely secure communication. It also provides a means of collecting or disseminating information about potential victims. Finally, it can be used as a source of information about hacking and virus writing. With the availability of such facilities, the potential 'cyber-terrorist' needs only one thing: the motivation to attack. Fortunately at present, the more extreme terrorist organisations are unlikely to resort to the use of hacking tactics, most obviously because the leaders of those groups are not sufficiently familiar with the prospects and capabilities of the new technology. They can be expected, however, to learn quickly. Because of this, it is becoming increasingly important for organisations which use computers and the Internet to ensure that their security is as tight as possible (Anderson & Hundley 1994). Hacker warfare is primarily based on the attacks on the Internet.

2.3.6 Economic information warfare

As outlined in the previous chapter, the marriage of IW and economic warfare can take two forms: information blockade and information imperialism. The effectiveness of an information blockade presumes an era in which the well-being of societies will be as affected by information flows as they are today by flows of material supplies. Nations would struggle for access to external data and, to some extent, would find it difficult to maintain their ability to earn currency by exporting data services. Cutting off access to information would cripple the economies of those nations, bringing them to their knees (Libicki 2000).

Information blockades can be understood as a variant on economic blockades. Cutting off trade in goods can affect the well-being of a country by disrupting production flows and, in the long run, eliminating the benefits of foreign trade. An information blockade works similarly by forcing the target country to work in the dark, eventually removing the benefits of information exchange. It also limits the ability of the blockaded country to engage in psychological warfare (Harknett 1996; Vatis & Gallagher 1998).

An information blockade would interrupt real-time interactions and restrict access to very large information flows. It would be both easier and harder than blocking the country's supply of goods. With less opportunity for physical confrontation, the odds of violence are less. For the most part, information conduits are vulnerable. Physical linkages, such as copper or wire, can be cut off at the border, in the waters, or at the nearest switch. During World War I, England severed Germany's cable links to the United States (Harknett 1996).

Terrestrial radioelectronic connections can be silenced either by silencing the nearest transmitter (e.g., microwave towers) or by selective jamming. Space-based communications pose a bigger problem. Even if all sources uploading to geosynchronous satellites ceased transmissions, some services such as direct broadcast satellite would be nearly impossible to block (Libicki 2000).

For an information blockade to have power similar to that of an economic blockade, the target nation would need to be dependent on external information flows, although information exchange is only one component of trade. A nation that loses access to electronic information exchange could be hindered although not prevented from conducting trade. Iraq, for instance, could still sell oil. Without real-time access to commodity exchanges or the ability to tap databases on usage patterns, a targeted nation might find it more difficult to write the most advantageous contract for itself (Harknett 1996).

Conversely, dependence could arise more from importing information than from exporting it. The growth of computers, communications, and simulation suggests the growing attractiveness of offering services, especially expert services, over the Internet. If the threat of an information war is present, few countries might allow themselves to become so vulnerable. Yet, under peaceful conditions, the prospect of a blockade may seem remote. Dependence on global information links will increase, and even leaders with hostile intent may not perceive that such dependence leaves them vulnerable to retribution if and when the leadership carries out hostile acts (Harknett 1996; Libicki 2000).

To believe in information imperialism means believing in modern day economic imperialism. Thus, trade is war. Nations struggle with one another to dominate strategic economic industries. Nations specialise in certain industries; some industries are better than others. The good industries command high wages and usually feature high growth rates. They tend to be knowledge-intensive; they require and reinforce skills against other nations, particularly those with low-wage workforces that cannot easily compete. Acquiring and maintaining a position in these industries is a reinforcing process. National policies may reinforce virtuous cycles (Libicki 2000).

Intellectual property products such as patents, trademarks, copyright and trade secrets produced by the developed nations from their innovative research are not readily available to the developing world due to the high prices they fetch. Some indigenous knowledge (IK) artefacts that are indigenous to the developing world are being patented by the developed world. This may be seen to constitute IW against the indigenous communities because they cannot afford the patented products and it therefore becomes illegal for the original communities to use their traditional resources. Thus information warfare also results in economic warfare against the developing nations.

The main cause for IW as discussed in the background to the previous chapter can be translated into economic ambitions. The information possessed by the powerful has some economic value. Poor communities can seldom afford to pay for this. This therefore constitutes a form of economic warfare.

2.3.7 Cyber warfare

Cyberwar refers to the execution of military operations according to information-related principles. It means disrupting or destroying information and communications systems; and trying to know everything about an adversary while keeping the adversary from knowing much about oneself. It means turning the balance of information and knowledge in one's favour, especially if the balance of forces is

against one. It means using knowledge to prevent the expenditure of capital and labour (Arquilla & Ronfeldt 1993).

The main difference between cyber warfare and hacking is that hacker warfare concentrates on infiltrating computer networks and system security structure (or rather spying) whereas cyber warfare concentrates on corrupting data and impairing communication networks and even rendering the victim's system totally dysfunctional. This form of warfare may involve diverse technologies, notably for command-and-control, for intelligence collection, processing and distribution, for tactical communications, positioning, identifying friend or foe, and for smart weapons systems. It may also involve electronically blinding, jamming, deceiving, overloading and intruding into an adversary's information and communications circuits. Today, on personal level for example, files cover health, education, purchases, governmental interactions (e.g., court appearances), and other data. Some are kept manually or are computerised but inaccessible from the outside, yet in time most will reside on networks. Many people, for instance, might be embarrassed if the information in their collected datasphere was opened to public view; even though that does not necessarily make them good objects for blackmail (Arquilla & Ronfeldt 1993; Libicki 2000; Vatis & Gallagher 1998).

Cyberwar may also imply developing new doctrines about the kinds of forces needed, where and how to deploy them, and how to strike the enemy. How and where to position certain kinds of computers, sensors, networks and databases may become as important as the question of how to deploy bombers and their support functions. The problem in conducting cyberwar is knowing what to do with the information collected (Anderson & Hundley 1994; Bey n.d; Devost et al. 1997; Libicki 2000).

As an innovation in warfare, cyberwar may be to the 21st century what blitzkrieg was to the 20th century. At the very least, cyberwar represents an extension of the traditional importance of obtaining information in war, namely, having superior command, control, communication and intelligence and trying to locate, read, surprise and deceive the enemy before they do the same to you (Arquilla & Ronfeldt 1993).

States that acquire dominance in cyber warfare could make the whole prospect of challenging them seem prohibitively costly. The problem, of course, is that such dominance can be contested, both before and after war begins. Command, control, communications, computer, and intelligence (C4I) assets are susceptible to disruption and failure. The employment of computer viruses, electronic disinformation, or direct destruction of sensing equipment could therefore become increasingly prevalent as the importance of connectivity increases (Libicki 2000).

Interconnected systems are vulnerable to increased connectivity. Haeni (1997:15) notes that systems are mainly vulnerable to the following reasons:

- High-tech equipment is available all over the world (for both friend and enemy).
- The awareness of the danger of IW is mostly absent at the executive level.
- Many computer systems are poorly managed and poorly equipped to prevent intruders.
- Attackers use sophisticated tools to break into systems or to obtain desired information.
- Attacks over the Internet can originate from places that are physically located on the other side of the globe.
- It is impossible to make a system absolutely secure.

2.4 Summary

In this chapter, the various popular forms of IW were identified. In its wider sense, IW is used daily amongst individuals and nations. Almost all other types of IW identified in this chapter, namely, intelligence-based warfare, electronic warfare, psychological warfare, hacker warfare, economic IW and cyber warfare, owe their origin to militaristic warfare. An understanding of IW is therefore limited without an understanding of military tactics, namely, attack and protection.

It can thus be concluded that all forms of IW entail an attempt by a stronger party to subvert a weaker party. This prominent characteristic of IW will be used as a basis for

determining whether the problems faced by the developing world in the appropriation of their IK are really a form of IW.

The scope of IW can be expanded to concentrate on controlling minds, knowledge and information. IW as discussed in the above section does not seem to address these issues. It is very important to determine and understand what an Information Science perspective of IW entails before a perspective can be adopted for this thesis on IW. Therefore, the following section aims at achieving an understanding of IW within an Information Science perspective to facilitate an informed choice on the IW perspective to be adopted for this thesis.

2.5 Information Science perspective on information warfare

2.5.1 Background

IW seems to be mostly defined from a military perspective. This leaves some restrictions in the definition and application of what happens in the information world today – specifically regarding IK and intellectual property rights (IPRs) around the globe.

This necessitates a new look and perspective on IW. The new approach that will followed in this thesis will be explained in this section. It will be an Information Science perspective. The reasons for this choice are as follows:

- Such an approach puts the flow of information into perspective.
- It identifies main role players in the access to, use and control of information.
- It allows a discussion on ownership of information with regards to power and dependency.

Before elaborating further on the Information Science perspective of IW, it is important to provide some theoretical background to this field. This will not only permit an understanding of an Information Science perspective but will also promote

an understanding of the relationship between power (possessors of information) and dependency (those who need information). All these factors are important in understanding IW within the Information Science perspective.

Figure 2.3 illustrates that all human beings have needs. In order for these needs to be satisfied, resources are required. Information is an example of such a resource. Information or access to information is instrumental in satisfying people's needs. It is essential that users have relevant information about a particular resource that is required to satisfy needs, as well as the information on where to find such a resource.

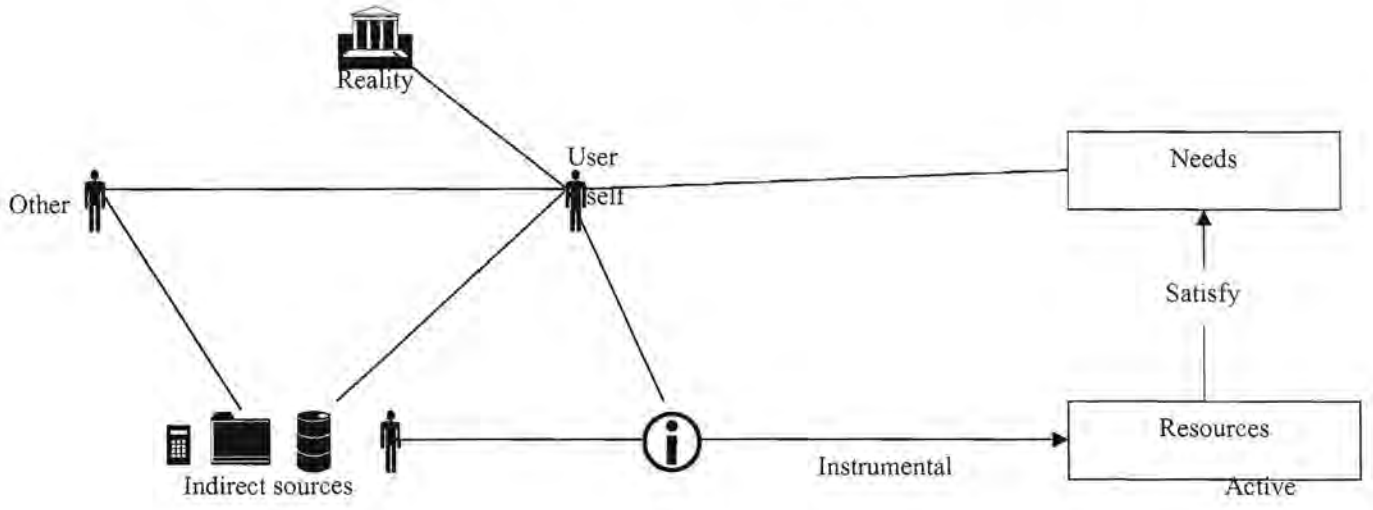


Figure 2.3 Information sources diagram

Access to essential information to activate resources to satisfy a need is a basic human right. The main question regarding the satisfaction of needs is where to find relevant information. Figure 2.3 depicts that most information originates from four main sources, namely:

- oneself
- other people
- reality
- indirect sources

Before we define the relationship between IW and Information Science, it is important to take a brief look at the origin of Information Science as a discipline. The next section therefore examines how Information Science is defined as a discipline.

2.5.2 Information Science as a discipline

Information Science has its origin in the successful scientific and technical collaborations of the Second World War. Information Science developed historically, not because of a special phenomenon which has always existed and has now becomes an object of study, but because of a new need to study a problem which has completely changed its relevance for society. For professionals in the field of information, transmitting information to those who need it is a social responsibility (Paisley 1990:4; Saracevic 1990:2; Vickery & Vickery 1992:1).

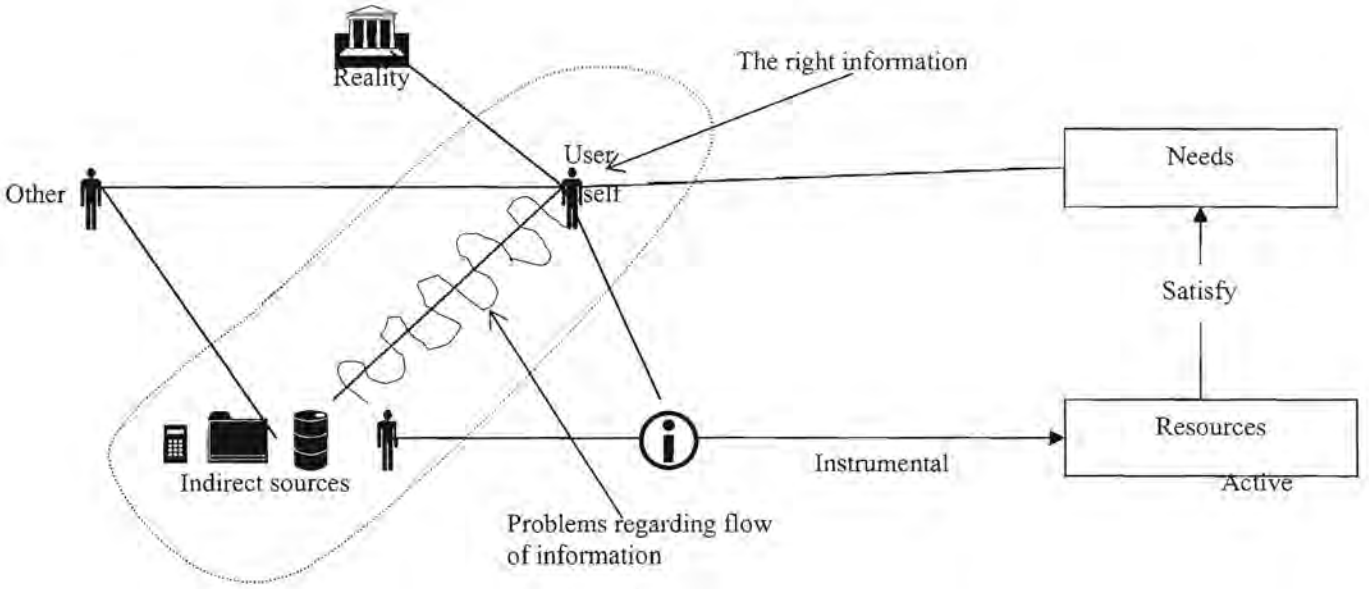


Figure 2.4 Problems with information flow diagram

Based on figure 2.4, the main objective of Information Science is to study the problems pertaining to the flow of information between indirect sources and end-users.

There are several main problems associated with indirect sources (Barker 1992:139):

- They are not always easy to update.
- They are usually expensive to disseminate.
- They can be reproduced.
- Information is more expensive.
- It is difficult to access unorganised information.
- Unknown language is a serious barrier.
- There may be too much information.
- A single copy cannot easily be shared.
- Such sources are easily damaged and vandalised.
- They are sometimes bulky to transport.
- Information is usually scattered among various sources.
- Embedded material is unreactive and static in some sources.
- Some resources cannot utilise sound.
- Some cannot utilise animation or moving pictures.
- It is not always possible to monitor readers' activity.
- Readers' understanding not always possible to assess.
- Some material cannot be dynamically adapted.

The problems listed above may present serious limitations in making information accessible to both the public and the information professional. These problems are prominent in information contained in indirect sources such as published information. As happens in other fields, a number of definitions of Information Science have been offered. The classic definition derived in the early 1960s and formally synthesised by Borko (1968:3) is a good starting point:

> Information Science is that discipline that investigates the properties and behaviour of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. It is concerned with that body of knowledge relating to the origination, collection, organization, storage, retrieval, interpretation, transmission, transformation, and utilization of information...

It has a pure scientific component, which inquires into the subject without regard to its application, and an applied science component, which develops services and products (Saracevic 1990:4).

Machlup (in Saracevic 1990:6) expresses the belief that Information Science is a part of a constellation of disciplines and interdisciplinary research areas that have information and communication as a common focus. He chooses to call this constellation the 'discipline of information'. In order to avoid confusion he suggests that these disciplines be assembled under the banner of Information Science (Saracevic 1990:6; Paisley 1990:5; Vickery & Vickery 1992:11).

The economic realities of the day make it compulsory for those who have generated information contained in indirect sources to be adequately remunerated for their efforts. The laws and IPR regulations accord these generators rights of ownership to the information they generated. Access to the information contained in indirect sources is priced and this accords the generators a measure of power and control over such information. Information and communication technologies are used to protect proprietary information to better control it. One characteristic of the information age is that all communities are more dependent on information than before. All communities, including the poorer communities of the developing world, can only access this information at a cost. This makes access to information for poorer communities very limited because their resources are already over-stretched by other factors.

2.5.3 IW defined within Information Science

The Information Science perspective on IW allows us to address three important topics that have a direct bearing on IW against developing nations. These topics are:

- The commoditisation of information
- Barriers of access to information
- Current trends in IPR regimes

2.5.3.1 Commoditisation of Information

Information professionals are faced with the task of making information available to end users in the right format, at the right time, and in the right context. The problems listed in the previous section sometimes prevent them from effectively performing this function. On the other hand, information users need information to satisfy their needs. Laws in a country, economic conditions of the day, IPRs and censorship are barriers faced by information professionals in their job of disseminating information and by people who wish to access information. These barriers lead to the exclusion of those who desperately require such information. The control over information by its owners accords them the power to restrict, deny or allow access to information. This power may then be used as a form of IW against developing nations.

Schiller (1984:103), and later Lyotard (1993:136), pointed out that this control over information has resulted in commoditisation of information that poses a serious threat to the information commons and the public sphere in general, where information is shared freely between people.

When information is recognised as a commodity, its management becomes paramount. The meaning of the expression "knowledge [information] is power" becomes obvious. If an individual or organisation has sole possession of a particular body of information, that information may enable whoever holds it to achieve objectives. As more information becomes commoditised, the economic value of such information becomes more important to the owners. This is likely to prompt them to lobby for the strengthening of the countries' laws, especially those related to IPRs. This power and control over access to information would further curtail access to protected information. Protection of this information is further enhanced by information and communication technologies available in the information age (Debon et al. 1988:2).

Herbert Schiller (Schiller 1984:81), a neo-Marxist thinker, acknowledges the importance of information in the current era, but also stresses its centrality to ongoing developments. He argues that information and communications are foundational

elements of established capitalist endeavour. Webster (1995:74) summarises Schiller's studies of other scholars such as Peter Golding, Graham Murdock and Nicolas Garnham in Britain, and Vincent Mosco and Steward Ewen in the United States, who offer a systematic and coherent analysis of advanced capitalism's reliance on and promotion of information and information technologies.

Schiller draws attention to the pertinence of market criteria in information developments. In his view, it is essential to recognise that information and communications are decisively influenced by the market pressures of buying, selling and trading in order to make a profit. To Schiller, the centrality of market principles is a powerful impulse toward commoditising information, which means that it is being increasingly made available only on condition that it is sellable. He further posits that private firms and institutions are making information a merchandisable good, a commodity produced for profit and sale. Information is something which is increasingly being bought and sold (Schiller 1984:102; Webster 1995:75).

The second argument insists that class inequalities are a major factor in the distribution of, access to and capacity to generate information. Bluntly, class shapes who gets what information and what kind of information they may get. Thereby, depending on one's location in the stratification hierarchy, one may be a beneficiary or a loser in IW.

Schiller further argues that one society that is undergoing momentous changes in the information and communications areas is corporate capitalism. Contemporary capitalism is dominated by corporate institutions, which are concentrated, chiefly oligopolistic organisations that command a national and generally an international reach (Schiller 1984:120; Webster 1995:75).

The pivotal role of the market in the information realm means that information and information technologies are created for and made available to those who are able to pay for them. This does not necessarily mean that they are totally exclusive. In other words, class inequalities exercise a central pull in the information age. Schiller (Webster 1995:91) mentions Vincent Mosco who describes 'pay per society' as the

ability to pay as a determining force in the generation of and access to information. The higher one is in the class system, the richer and more versatile the information to which one has access. This creates a class of the 'know' who are the rich and powerful. The quality of information they have enriches their knowledge and status. As one descends the social scale, one gets information of an inferior kind. Those who are at the lower level of the scale are disadvantaged and remain being the 'know-nots' because they are too economically poor to afford or access quality information (Schiller 1984:103).

Based on the above discussion, it is concluded that IW entails a situation whereby people do not have access to information to enable them to exercise their basic human rights. IW from an Information Science perspective can therefore be defined as *a deliberate or non-deliberate attempt to restrict and control access to information.*

2.5.3.2 Barriers of access to information

Coinciding with the commoditisation of information are the various barriers of access to information. It is important to briefly identify these barriers because they will form part of the IW argument later in this thesis. These barriers are:

- Patent protection of products derived from IK resources
- Unauthorised use of tribal names
- Tourism as a means to commercialise indigenous people
- Restricted access to healthcare and healthcare information

2.5.3.3 Current trends in IPR regimes

Multilateral institutions such as the World Trade Organisation, the World Bank, and the International Monetary Fund create global economic policies, including those related to IP, with input mainly from multinational corporations and very little input from the grassroots citizenry. Currently, IP accounts for more than 20 per cent of world trade (Ganguli 2000:167).

Meanwhile, the introduction of the IP system in industrialised economies coincided with the growth of industry, publishing and commerce. On the other hand, the introduction of the IP system does not seem to have made much impact to technological progress in many developing economies (Hoekman & Kostecki 1996:149; Stiglitz 2003:11).

Maskus and Lahouel (2000:595, 598) posit that competition law has emerged as an issue for the WTO because exporting firms in the high income, developed countries argue that anti-competition practices in foreign markets hinder their ability to penetrate those markets. Some observers in developing countries argue that competition law conflicts with the fundamental goal of industrialisation, because open competition favours efficient and established foreign enterprises over inefficient domestic firms.

Multinational firms operate their foreign subsidiaries either as a loose federation or nearly autonomously in order to be able to respond to local needs and national opportunities. In some instances they apply strict controls in order to coordinate worldwide activities and gains from standardised products, manufacturing processes and operations. These firms usually own and control information necessary to produce these products and processes. This valuable information is not readily available to the developing communities and this may ultimately remove their industries from the market (Avgerou 1998:22). The effects of the certain international organisations and conventions are included in this thesis to depict current trends in IPRs internationally. These include the World Intellectual Property Organisation, the General Agreement on Trade and Tariffs, the Trade Related Aspects of Intellectual Property and the Convention on Biodiversity.

2.6 Summary

In attempting to answer the main research problem statement, this chapter addressed the research sub-question:

What constitutes Information Warfare?

A definition of IW from an Information Science perspective was coined. This definition considers IW to be a deliberate or non-deliberate attempt to restrict and control access to information. People's dependency on information has resulted in stringent control over commoditised information being administered by its 'legal' owners by means of IPRs. This has accorded them power and control over information, and subsequently over those who require such information. As a result of the adoption of the Information Science perspective, the IW perspectives touched on in this chapter, namely hacker, cyber, psychological and economic information warfare, will not be examined in further detail.

The next chapter (chapter 3) will investigate the historical context of various types of IPRs and will examine how they are adopted and administered by various countries. This is important because, according to the Information Science approach, IPRs are used to control access to information and protect both societal and economic benefits.

Chapter 3

Historical framework of IP within the global context

3.1 Introduction

The previous chapter investigated various forms of information warfare (IW) and adopted an Information Science approach to this topic. Intellectual property rights (IPRs) are used to protect commoditised information on a global scale. This has led to less emphasis on information access, creating a form of IW. This happens despite the main aim of intellectual property (IP), which is to provide access to information but also to protect the economic interests of the owner. The issue of access is addressed in chapter seven. In order to understand the nature of IW perpetrated through IPRs, it is important to investigate the philosophy of different IP perspectives in the global context. In answering the main research problem statement of this thesis, this chapter answers the following research sub-question:

> *What is IP and the role it plays in globalisation?*

> Hofman et al. (1999:83) define IP as "that branch of the law that protects intellectual creation".

Although this definition does not address the issue of access, it will be used as the basis for an understanding of IP. IP is a legal phenomenon. Its practices are not uniform across the world even though there are efforts, through various international IP conventions, to unify IP practices and protection to ensure consistency among nations. The evolution of IP in most countries owes its shaping to the history of that country. This chapter discusses the philosophy and evolution of IP from the African, Eastern and Western perspectives. It also discusses various types of IP.

The aims of this chapter can be summarised as follows:

- To identify the philosophy and origin of IP and how it can be used as a form of IW
- To determine how IP evolved globally
- To identify various forms of IP

3.2 Philosophy of IP

The main aim of IP is to provide controlled access to commoditised information and to protect the economic interests of its creator. The rewarding of a discoverer or creator who provides society with a useful thing dates back to the fourth century BC. The earliest known example in this regard is Aristotle's philosophical concern that reward for revealing information to the state might give rise to fraudulent claims of discovery on the part of public officials (D'Amato & Long 1997:27; Granstrand 1999:23). For the purpose of this thesis, the philosophical approaches to IP of Locke, Hegel and Marx are used as a basis for discussion. These thinkers' teachings have been studied and interpreted by many philosophers. However, since these interpretations are not required to understand the original intentions of the three philosophers, they will not be featured in this thesis.

John Locke is a philosopher who wrote on the philosophy of property (not necessarily IP). Locke's analysis of property starts with the existence of the commons (common property). His philosophy takes the religious stance that property is a gift from God. Locke was concerned not with IP but with the ownership of physical rather than abstract objects. The relevance of Locke's writings to IP emanates from the link he makes between property and the idea of positive and negative community. Commmunity here refers to a state in which a common is owned by all, in other words, where a common is open to ownership by all. D'Amato and Long (1997:27) mention that Locke states that "if God gave the earth to mankind in common how can any individual have property in any thing?" IP is based on the assumption that abstract objects are the product of mental labour. Locke states that governments have

the power to regulate property. His solution to the problem of God-given commons and private appropriation starts with the assumption that every person has a property in his or her own person. This leads to Locke's claim that an individual's labour belongs to that individual (labour theory). The basis of Locke's theory of property is the special relationship between God and man (D'Amato & Long 1997:49; Drahos 1996:49; Granstrand 1999:23, 26).

In contrast to Locke, Friedrich Hegel is concerned about the evolution of property within the context of a social system. Hegel's analysis of property comprises parts of a metaphysical system. He posits that property is the means by which individuals may objectively express personal will (personality theory) (D'Amato & Long 1997: 35). He further declares that a community plays a pivotal role in the evolution of individual freedom. For him a community is an environment in which an individual aspires to establish a unique place and property is the vehicle by which one's self-identity is acknowledged by others. He sees property as a fundamental mechanism for the survival for individuals (Drahos 1996:8; Granstrand 1999:23).

Karl Marx (1848) offers an explanatory perspective on property forms. The key to understanding Marx is his class definition. He defines a class by the ownership of property. He proposes that ownership accords a person the power to exclude others from the property and to use it for personal purposes. In relation to property there are three great classes of society: the bourgeoisie (who own the means of production such as machinery and factory buildings, and whose source of income is profit), landowners (whose income is rent), and the proletariat (who own their labour and sell it for a wage) (Drahos 1996:8-9). Marx highlights the role of property ownership, whether of land or the means of production, in dominance and power. His understanding of capitalists as individual subjects of the competition assists in understanding the basis of IP (Granstrand 1999:46; Runnel n.d.).

The abovementioned three philosophers who wrote on property did not focus directly on IP. In 1711, the first IP legislation was published in the United Kingdom. By then, knowledge or information was generally used as a common good. Information was used to enable communities to sustain their subsistence and for developmental needs.

Commercialisation graded information into various categories and the law protected such information. The addition of the attributes of access to and protection of information eliminated free access and created a greater need for access to the protected information, resulting in IW against poorer communities. This was the first initiative taken in the existence of IPRs. Many owners of such information were from the developed nations or developed sections within developing nations. Both in the past and currently, those who most require the protected information for survival represent developing countries or developing communities within developed countries (De Castell 2000:369; Granstrand 2000:340; Hoekman & Kostecki 1996:144).

IP can be consumed by more than one consumer. For example, computer software, a website, or a sound recording can be used by many people at the same time. In many respects, the value of IP lies in its ability to be manipulated in identical copies. It is not always possible to place value on a single copy of computer software, a book or a digital photograph by looking at it as a single product (Harris 1998:53; Van Dulken 2000:275).

Developing communities are economically less viable and they cannot always afford to pay for commercialised or protected information. As a result, at times they utilize such information without approval from the developed nations, who are mostly the legal originators of such information. Some of this commercialised information is required for survival needs. Such exclusion from access to protected information by means of IPRs constitutes IW against the developing world. IP regimes originate in Western countries and are later exported to Africa, the Far East or Asia. In the following sections, the evolution and formalisation of IP are investigated in the Western, Eastern and African contexts.

3.3 Perspectives on IP

In the past, standards on property protection were territorial standards. The protection of IP at an international level can be divided into three periods. The first period (the territorial period) was characterised by the absence of intellectual protection. The second period (the international period) began in Europe towards the end of the 19th

century with some countries signing the Berne Convention in 1886 for the protection of the rights of authors in their literary and artistic works. The third part (the global period) has its origin in the links that the US began to make between trade and IP in the 1980s. A linkage emerged at multinational level with the signing of the WTO Treaty on 15 April 1994 (Drahos 1997:202).

Diversity in national innovation systems leads to diversity in national IPR systems. IPR system diversity comes at a price. International harmonisation of IPR systems regarding their key aspects, such as grounds for priority, is highly desirable because of costs that are incurred in the process. Grounds for harmonisation to be agreed upon are issues such as 'first to file versus first to invent'. International harmonisation of IPR is also increasing and is likely to continue. Regional harmonisation has advanced in Europe through the European Patent Office based in Munich. Harmonisation among the regions of Europe, Japan and the USA is progressing. Internationalisation of corporate and national economies is also important (Granstrand 2000:345).

North-South harmonisation is more of an open issue. It might further be argued that the current system of national patent offices could be substantially consolidated on a global basis. Competition among national patent offices is likely to emerge and is already underway in Europe. The national systems of patents have developed over decades. From time to time, they were considerably influenced by national protectionism, which is expected to be a significant hampering force (Granstrand 2000:346).

This section discusses various perspectives of IP based on the third period, namely, the global period. This is because globalisation affects IP and is discussed in detail in chapter four. Various IP perspectives are discussed in the following paragraphs.

3.3.1 Western perspective of IP

In the Western perspective, which is the dominant IPR perspective, IP was initially underlined by moral protection, access and economic interest. It was instituted for the moral protection of the rights and later for the reward of the authors, artists and the producers of knowledge. The protection of moral rights was ensured by regulating access to the produced information. Later, the main aim of IP was to provide access to commoditised information but also to protect the economic interests of the owners of such information. As time went by stricter IP focussed on protection rather than access to information.

People try to establish and protect their self-identity through the exchange of property representing the individual's will. Society is limited in its rights to prevent an individual from accumulating, holding and dispensing property. The need of the society cannot justify taking an individual's property without fair compensation. IPRs lagged behind the evolution of the incorporeal property rights of the European legal traditions. During the Renaissance, patent rights were bestowed by royalty through the ruling of the aristocracy. The European trading powers entered into pacts which provided for mutual recognition of each other's patents. The European tradition of honouring patents was also internationalised through colonialism. It was commonly believed that a state could not grow rich except by a respect for property. This confirms Locke's statement that governments have the power to regulate property (D'Amato & Long 1997:35-6; Drahos 1996:53 & 200).

IP laws in Western economies were founded on policies that were aimed at resolving challenges faced by traders, guilds and governments in different territories. Almost every trade was regulated and controlled by a guild. Their goal was to foster the interest of trade by controlling the activities of their members, and by lobbying for measures which could guarantee their monopoly over the trade. The intention of traders was to protect their goods so that they would be accessed only through their permission (Lehman & Brown 1995:148; Sodipo 1997:25; WIPO 1999:16).

The period after the traders was succeeded first by industrialisation and subsequently globalisation, which emanated from the technological advancement of the Western world. The Western world attributes its economic development to the policies that enable its industries to depend increasingly on the creation, access to and use of the IP system. The digital era, which is characterised by the rapid development of information technologies, has revolutionised the way business is conducted. The Internet has become the most prominent form of communication and piracy is not excluded. This has sparked more interest from the developed world to require IP protection in the developing world in order to protect their registered inventions against infringement. The regimes include various conventions of which the most significant are tabulated in table 3.1 (Graham 1999:502; Idris 2000:63).

Table 3.1 Major international conventions on IP

Agreement	Description	Administrator
Paris Convention (1883; 129 signatories; revised in 1967	Protection of patents, trademarks and service marks, trade names, utility models, industrial designs, indications of sources or appellation or origin and the 'repression of unfair competition'. Allows for compulsory licensing.	WIPO
Berne Convention (1886; 111 signatories; revised in 1971	Basic copyright treaty based on principles of non-discrimination and national treatment (like the Paris Convention).	WIPO
Madrid Agreement (1891; 31 signatories)	Allows imported goods bearing a false indication of origin to be seized on importation.	WIPO
Universal Copyright Convention (1952; 17 signatories)	Copyright treaty accommodating US statutory requirements and based on principles of non-discrimination and national treatment.	UNESCO
Lisbon Agreement (1958; 17 signatories)	Protection of appellation of origin.	WIPO
Rome Convention (1961; 47 signatories)	Protection of neighbouring rights (performers, producers of phonographs, broadcasting organisations).	ILO, UNESCO and WIPO
Geneva Convention (1971; 52 signatories	Protection of producers of phonographs against the manufacture of duplicates in another country.	WIPO, ILO and UNESCO
IPIC Treaty (1989; 8 signatories)	Treaty on Intellectual Property in Respect of Integrated Circuits.	WIPO
TRIPS (1994)	Trade related aspects if intellectual property (TRIPS) adopted the obligations of the Berne Convention and added more protection to cover all aspects of IP.	WTO

Source: Hoekman & Kostecki (1996:150, table 6.1) (adapted)

The increasing interest in the protection of IP prompted the developed world to expand their business across the world. This was highlighted by the United Kingdom when they abandoned autonomous IP systems in some of its colonies and opted for re-registration systems. Under the re-registration system, patents which were already granted in the UK could be automatically registered and enforced in most of the former colonies as if they were directly granted by those nations. The reason for the adoption of the re-registration system was attributed to lack of skilled examiners, and the huge capital outlay required for fully-fledged patent offices. Autonomous patent systems succeeded in other Commonwealth nations such as Australia, Canada, New Zealand and later South Africa (Lehman & Brown 1995:148; Sodipo 1997:30-1; WIPO 1999:16).

Multilateral cooperation in the field of IP dates back more than a century. Although the issue has been of some relevance to the multilateral trading system, largely in terms of the trade in counterfeit goods, cooperation existed long before the creation of the World Trade Organization (WTO). Several international conventions laid down standards for the protection of IP. These include the Paris Convention (on patents and trademarks), the Berne Convention (on copyright) and the Rome Convention on neighbouring rights (see table 3.1). These and other conventions are administered by the World Intellectual Property Organisation (WIPO), a Geneva-based UN body. GATT, which includes TRIPS, is administered by WTO. TRIPS, which was incepted in 1994, imposes upon its members most of the provisions of Berne Convention in addition to imposing quite substantial minimum requirements for patents, trademark and copyright. The next section discusses the international conventions that are of importance to this thesis (Hoekman & Kostecki 1996:149; Miller & Davis, 2000:437; Tikku 1998:97).

3.3.1.1 Origin of copyright

Copyright emerged largely in response to the problems created by the invention of the Gothenburg printing press in 1450. The earliest known infringement of copyright was Hermodorus' theft of Plato's speeches. In the UK, copyright laws date back to 1476

when the first printing press was introduced to England, when the need to control unauthorised reproduction of creative work arose. The production and printing of books in England was carried out by a craft guild known as the Stationers. By 1534, no one could publish without a licence. In 1709 the Parliament of England passed the first copyright statute, the Statute of Anne. By 1711, this was the world's first true copyright law. The growth in literacy and technological change brought a huge demand for books and other publications (Litman 2001; Drahos 1996:22; Gurnsey 1995:7, 10; Harris 1998: 114; Lehman 1995:7; Litman 2001; Morris, Mowatt & Reekie 2001:9; Wallis, Baden-Fuller, Kretschmer & Klimis 1999:13).

The Statute of Anne laid down penalties for infringement, including the forfeiture and destruction of offending material. In the developing world, common law copyright was first introduced to some former British colonies (G1 nations) through ordinances which imported the common law from England. The English Copyright Act, 1911, became the first copyright legislation to be extended to most parts of the Commonwealth. While some G1 nations continue to apply the 1911 Act, others apply the 1956 Copyright Act of the UK. The English Copyright Act of 1991 was primarily aimed at protecting the trade in British books, art, music, films and broadcast. This Act was expected to result in reasonable trade interest in G1 nations as a result of the British culture that had long existed in those countries. However, the low level or absence of piracy by local authorities in G1 nations has led to a failure to appreciate the need to revise or enforce copyright laws (Lehman & Brown 1995:148; Sodipo 1997:26; WIPO 1999:16).

The first copyright act was not actually concerned with authors, but was primarily concerned with securing the rights of the publishers. Only in 1814 did the Copyright Act of the UK set the copyright term at the author's lifetime. Copyright consists of various aspects, each of which may be owned by a different person, or may be licensed by way of exclusive or non-exclusive licence to people other than copyright owner. A licensee does not transfer copyright in the work, but gives permission only to use and exploit it in a specific manner as described in the licence and only for the duration of the licence. As soon as the licence terminates, such exploitation rights revert to the copyright owner. The invention of new technologies during the twentieth

century led to a new demand for the protection of creative works. Amendments to local legislation were incorporated into international agreements such as the Universal Copyright Convention, the Berne Convention and the TRIPS (De Villiers 2000:40, 43; Gurnsey 1995:9; Litman 2001:18; Lloyd 2000:301; Wallis et al. 1999:13).

3.3.1.2 The Paris Convention of 1883

The Paris Convention of 1883 for the protection of industrial property was signed by 156 states, and has subsequently been amended since its inception. All the European countries are signatories of the Convention which has the effect of harmonising patent law to a considerable degree in Europe. The Paris Convention was the first attempt to adopt a common approach to IP. The fundamental principle of the Paris Convention was that member states were not allowed to discriminate among their own nationals and nationals of other member states. One of the principles of the Convention was that nationals of a country that belonged to the Convention must enjoy the same IP rights in any other member country (D'Amato & Long 1997:17; Bently 1997:30; Tritton, Davis, Edenborough, Graham, Malynicz & Roughton 2002:54; WIPO 2000:101).

The Paris Convention established international patent protections that were not geared to a country's domestic development needs. The Convention enabled the filing of patents for the same invention in more than one country. It also stated that the conditions for filing and registration of trademarks were determined by national laws. WIPO, which is an organ of the United Nations, has a task to administer numerous treaties in the field of IP. The Paris Convention provided the framework to deal with the infringement of IP on an international level. Goods infringing a registered mark can be seized on importation. The same mark can be concurrently used by more than one commercial institution (with some understanding between such institutions) and they shall be considered to be co-proprietors (Bettcher, Yach & Guindon 2000:526; Ganguli 2000:169; Maskus & Lahouel 2000:603; Tritton et al. 2002:192-3).

3.3.1.3 The Berne Convention of 1886

The Berne Convention was adopted in 1886 and has been revised several times to take into account the impact of new technology. It is administered by the WIPO, one of the specialised international agencies of the United Nations. According to the Berne Convention, authors of literary and artistic works shall enjoy the exclusive right of authorising the broadcasting of their works or the communication thereof to the public by any means of wireless transmission. The adaptation into any other artistic form of a cinematographic production derived from literary or artistic works shall remain subject to the authorisation of the authors of the original works. The Berne Convention was created to help harmonise laws and to ensure that copyright owners had protection in all signatory states (Gurnsey 1995:11; Lehman 1995:150; Salokannel 1997:97).

The Berne Convention states that in the case of an alleged infringement of copyright, the extent of protection, as well as the means of redress afforded to authors to protect their rights, shall be governed exclusively by the laws of the country where protection is sought. This creates some confusion when it comes to the cinematographic work where the country of origin of the work differs with the country of registration. The protection of copyright and neighbouring rights covers a wide array of human creativity. The Berne Convention is the most important international copyright convention whose copyright protection covers all literary and artistic works. This term encompasses diverse forms of creativity, such as writings, including both fiction and non-fiction, as well as scientific and technical texts and computer programmes; original databases; musical works; audiovisual works; works of fine art, including drawings and paintings; and photographs. Neighbouring rights protect the contributions of others that add value in the presentation of literary and artistic works to the public. This includes performing artists such as actors, dancers, singers and musicians; the producers of phonograms, including CDs; and broadcasting organisations (Kumar 2002:22; Salokannel 1997:101; WIPO; 2000:19).

The monetary value and huge returns on IP investments are the motivating factors for the countries producing IP to protect their interests by spearheading the establishment of protective organisations. The piracy and counterfeiting of IP cannot be permitted by the countries producing IP irrespective of the moral and humanitarian issues surrounding such infringements. Article 6 of the Berne Convention outlines moral right as the right to have one's name associated with a work, and the right not to have a work manipulated or distorted to the prejudice of the author. The Berne Convention seeks to protect authors based on mutual recognition. In other words, each signatory must protect foreign works and authors to the same extent as it does its own. The protection would be automatic which nullifies re-registration. The Convention also defines minimum standards for the duration and scope of the copyright holder's right. It prescribed the lifespan of a protected material to life plus 50 years after the death of the author (Gurnsey 1995:27-8; Hofman, Johnston, Handa & Morgan 1999:86-7). Since most work is produced by the developed world, this benefits them more than it does the developing countries.

3.3.1.4 World Intellectual Property Organisation

The WIPO was officially established by a convention in 1967. Its origins can be traced to the Paris and Berne Conventions adopted in 1883 and 1886 respectively. IP laws are the laws that governments enact to make these international treaties part of national law. Table 3.1 depicts international treaties that are administered by WIPO. WIPO's primary objectives are (McKeough & Stewart 1997:476; Posey & Dutfield 1996:77):

- to administer international treaties on IP laws
- to provide instances to signatory nations in promulgating IP laws
- to seek harmonisation of national laws, aiming to promote the protection of IP throughout the world

The adoption of subsequent treaties governing performance rights and cyberspace under WIPO auspices suggests that WIPO may continue to play a pivotal role in the

establishment of international IP standards for emerging technologies. In March 2000, the Copyright Council approved WIPO treaties adopted in Geneva in 1996. Such treaties include the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty (WPPT). These treaties include new rights of distribution and electronic making available of the provisions on copy-protection devices and unauthorised removal of rights management information. The WIPO treaties represent a significant step in terms of the international protection of copyright and related rights, particularly with regard to the digital agenda (D'Amato & Long 1997:282; Finger & Schuler 2000:513; Seville 2001:715-6).

Patent laws and practices vary widely throughout the world. The consequence of such diversity is that in certain countries a patent application may lead to the grant of a patent, whereas in others, a patent may not be granted for the same invention, or the patent may be invalidated after the grant. The need for further harmonisation beyond the Patent Law Treaty (PLT), concluded in May 2000, arises from the fact that the PLT only harmonises patent procedures relating to national or regional patent application and the maintenance of patents. Member states of WIPO launched discussions on harmonising the substantive requirements of the patent law. The Standing Committee on the Law of Patents (SCP) met in September 2000, and its members agreed that the harmonising of patents was a prerequisite to reducing the cost of obtaining international patent protection (Claus 2001b).

In a country without an early publication system, an applicant may be unaware of earlier applications for identical or similar inventions and might, therefore, duplicate research and development as well as patent filings, leading to unnecessary costs. Sodipo (1997:31) posits that in most developing countries, including the G1 nations, the number of local patents is less than 10 per cent of the total filings in those countries. Another reason for low local level of patent registration is that it is also possible that patents could be erroneously granted for an invention that was not patentable. This makes it necessary to harmonise IP laws, especially those pertaining to patents.

Claus (2001b:90) outlines some advantages of harmosnising substantive patent laws. These benefits include:

- a reduction in direct costs resulting from the need to prepare totally different patent documents for different patent offices
- increased predictability in the process of obtaining and using patents in different countries
- a reduction in the unpredictable risk of losing patent rights
- facilitation of mutual recognition of search and examination results between patent offices

This will avoid duplication of work, reduce the workload at patent offices and eventually lower the costs of patenting for the benefit of users.

One of the most serious problems pertinent to the filing of patents is high filing fees. Consequently, patent registration from poorer parts of the world have dwindled. This has resulted in WIPO member states approving reductions in the filing fees for international patent applications under the Patent Cooperation Treaty (PCT). Member states also approved a proposal to launch a special programme of activities to promote the wider use of the IP system by small and medium enterprises (SMEs). The aim is to enhance the competitiveness of SMEs worldwide and to help them better exploit their niche positions, which includes using electronic commerce. Member states have reviewed WIPO's work in the field of Internet domain names and IP and have noted the success of the WIPO Arbitration and Mediation Center in providing online resolution of Internet domain name disputes. Domain names may be registered in spaces known as generic top-level domains (gTLDs), such as .com, .org or .net, or in the country code top-level domains (ccTLDs), such as .ch (Switzerland), .fr (France) or .za (South Africa) (Claus 2001b; Harris 1998:200-1; WIPO 2000:45).

April 26 has been designated as World Intellectual Property Day. Each year, this day is observed by WIPO and its member states by means of various activities. The day serves as a special occasion to heighten public awareness about the role and contribution of IP in the economic, cultural and social development of all countries. Member states took note of the World Intellectual Property Declaration that was

adopted by the WIPO Policy Advisory Commission (PAC) early in 2001. The declaration, which seeks to expand awareness about the universal value of IP, affirms the universal relevance of IP in today's knowledge-based society. It highlights the importance of strategies to enhance the importance of global cooperation in implementing and further developing the IP system for the benefit of all (Claus 2001b).

The technological advancement of the information age has revolutionised the conventional format of IP. IP needs to be protected to enable WIPO to deal with this advancement. Due to the fact that IP in the information age is preferred in an electronic format, advances in technology lead to advanced ways of infringing IPRs. The next section looks into some global measures implemented to protect IPRs.

3.3.1.5 The General Agreement on Trade and Tariffs

The General Agreement on Trade and Tariffs (GATT) was drawn up in 1947 at Marrakesh to deal with the economic order created by the Second World War. One hundred and eleven countries signed the GATT agreement. GATT was designed to foster a reduction in tariffs and quotas and to arrive at ground rules for an effective trade liberalisation agreement. In the 1970s this agreement expanded to include in its scope and coverage matters such as technical standards and regulations, subsidies, anti-dumping and government procurement. The Uruguay round in 1994 resulted in the formation of the World Trade Organisation (WTO) in 1995, even though its existence could be traced to an earlier period. WTO elaborated on many prior GATT obligations, extended its mandate to service industries (such as banking, securities, telecommunications and insurance) and formulated substantive rules of IP laws (Adeloye 1994:44; Drahos 1995:6; Ganguli 1998:178; Maskus & Lahouel 2000:600).

Since GATT has a dispute resolution mechanism, a proposal to extend GATT to IP led to the introduction of an anti-counterfeiting code at the Uruguay Round in 1986 (see also table 3.1). Contrariwise, there has been significant technological progress in the Far East, where piracy and counterfeiting are rife and where IPRs have been

disregarded. Despite opposition by developing economies, GATT was extended to cover other aspects of IP under the Trade Related Aspects of Intellectual Property (TRIPS) section that came into being in 1995. This section of GATT was concluded on December 15, 1993 and was opened for ratification on April 14, 1994 (Finger & Schuler 2000:519; Hoekman & Kostecki 1996:149; Sodipo 1997:24).

The 1993 GATT negotiation proposed the establishment of global IPRs for technology involving all forms of life, plants, animals and microorganisms. This global framework for IPR calls for a major change in the patent laws that exist throughout the world. Many developing countries currently do not recognise any form of patent on biological resources and related technology. The proposal to introduce IPR into the GATT framework has evoked resistance from many developing countries. They fear that conferring IPRs on generic resources and their derivatives to foreign investors will have adverse economic consequences for themselves in general and for research and development in agriculture in particular (Bhat 1996:205).

However, IPR has been made a component of GATT and countries have no choice but to implement regulations or otherwise face international trade sanctions. Due to increasing population and the scarcity of any given nation's resource endowment, a constant flow of knowledge-based innovation which substitutes human intelligence for scarce resources is essential for steady economic growth. New processes and products created through these innovations provide new opportunities for economic activity, and promote income and employment growth. Modern technology is becoming increasingly intellectual rather than material in nature. The development of new sources of production material, energy substitutes, computers, efficient industrial equipment, chemicals based on renewable resources, and biotechnology are some examples of technologies with a high degree of intellectual content (Bhat 1996:205; Finger & Schuler 2000:511; Ostergard Jr. et al. 2001:644).

Developed nations argue that, due to inadequate IPR protection in the Third World and the resultant intellectual piracy, they lose millions of dollars in trade. Although developed or industrialised countries signed the WTO agreements, the organisation has no enforcement mechanisms against IPR violators. For this reason, the developed

nations resorted to GATT in the Uruguay Round. GATT makes provision for trade sanctions to punish the violators of its agreement. Rules governing international trade are embodied in the GATT agreements and have been refined and developed through successive rounds of negotiations with the ultimate goal of eliminating barriers and distortions to international trade. It is thus argued that all countries in the world must adopt common IP laws (Bhat 1999; Bettcher et al. 2000:527; Doyle 1995:182; Finger & Schuler 2000:520; McCalman 2001:174).

USA was not initially a GATT signatory. After a year of US political discussion and months of media attention, GATT was approved by the US Congress. Proponents of the trade pact argued that hundreds of thousands of new jobs could be created and American IP would enjoy increased protection. Critics of the agreement argue that multinational corporations would shift jobs to low-wage countries, higher US tariffs would increase the budget deficit, and certain industries in the developing world would be crippled (Doyle 1995:182; Wallis et al. 1999:6).

GATT was seen by the US administrators as a vehicle to assist US computer companies and protect US technology. The US computer industry was instrumental in including a provision in the GATT designed to reduce piracy to its lowest levels and generally strengthen IPRs. The provision was designed to enhance copyright, trademark and patent protection for manufacturers of software, semiconductors, and multimedia products in all the signatory countries. GATT as part of the WTO include TRIPS which imposed some substantial requirements for patents, trademarks, and copyright. On the contrary, opponents of the WTO want to ensure that all global citizens are democratically represented in the formulation, implementation, and evaluation of all global social and economic policies of the WTO, the International Monetary Fund, and the World Bank. According to them, the WTO must immediately halt all meetings and negotiations in order for a full, fair, and public assessment to be conducted into the impact of the WTO's policies to date. They propose that the WTO be replaced by a body that is fully democratic, transparent, and accountable to citizens of the entire world instead of a body made by and for corporations with inside access to negotiations (Adeloye 1994:45; Doyle 1995:182; Ten Ways To Democratise n.d, Miller & Davis 2000:437).

GATT was extended to include IPRs using TRIPS as a vehicle for advancing IPR protection in the developing world and for standardising provisions of the IP legislation across the globe. GATT has now been succeeded by WTO (in 1995) and the intellectual property-related issues have been incorporated into and replaced by TRIPS. This makes it important to discuss TRIPS in the next section.

3.3.1.6 Trade Related Aspects of Intellectual Property (TRIPS)

Trade Related Intellectual Property Rights (TRIPS), a subsection of GATT, was finally concluded in 1995. It is integrated into the international trading system. It outlines the minimum standards for protection and enforcement of IPR in the member countries of the WTO. The agreement leaves scope for the member nations to develop their IPR laws (but staying within the spirit of the agreement) to promote their national interests. The basic approach of any IPR system is to balance interest between various contrasting parameters. One of the major grievances from the developing countries was that the Paris Convention established international patent protections that were not geared to their domestic development needs (Adeloye 1994:45; Bettcher et al. 2000:526; Ganguli 2000:169; Maskus & Lahouel 2000:603).

The pre-TRIPS era (i.e., before 1995) saw the world divided into groups:

(1) a set of nations allowing product and process patents in all fields of technologies without discrimination
(2) another group with restrictive and discriminatory patent laws providing for process patents in all fields of technologies but not for product patents in selected fields such as foods, agrochemicals, drugs and pharmaceuticals, chemical entities, specialty materials, and so on

Other features related to the term of patents, conditions for compulsory licensing, and clauses such as whether importation would be considered as infringement of patents, varied at the national level. TRIPS brought such issues into focus. The scope of the

TRIPS agreement is much broader than any previous international agreement in the IP field (Bettcher et al. 2000:526; Ganguli 2000:168-9).

There is a need to improve the existing legal, administrative and judicial processes. This can be done by simplifying ways of doing business on a global scale, encouraging cross-border investments, and creating a positive climate for diffusion of technology. Harmonisation and the enforcement of laws to protect IPRs, and simultaneously creating effective international competition policies, would strengthen IP protection. Ganguli (1998:173) posits that the areas of IP covered by TRIPs are the following:

- copyright and related rights (i.e., the rights of performers, producers of sound recordings and broadcasting organisations)
- trademarks, including service marks
- geographical indications, including appellations of origin
- industrial designs
- patents
- protection of new varieties of plants
- protection of the layout designs of integrated circuits
- protection of undisclosed information including trade secrets and test data
- control of anti-competitive practices in contractual licences

Essentially, the main features of TRIPS, among others, are:

- the extension of patents to all inventions irrespective of areas of technology
- a minimum of a 20 year period for patents
- criminal sanctions against infringements
- the principle of national treatment
- the possibility of exempting moral rights
- the payment of reasonable fees for compulsory licences
- the protection of neighbouring rights
- a better dispute resolution and enforcement mechanism

Anti-TRIPS lobby groups urge that the WTO's dispute panels, which rule on whether domestic laws are barriers to trade and should therefore be abolished, consist of trade bureaucrats (which include the US) who are not screened for conflict of interest (Finger & Schuler 2000:521; Sodipo 1997:24).

Issues concerning property rights on global biological resources are becoming increasingly important to international policy. The negotiations on the UN Convention on Biological Diversity and the WTO agreement on TRIPs have demonstrated that the respective implementation and revision activities continue to show that large companies such as ICT and pharmaceutical companies depend on the protection of IP to ensure innovation (Bettcher 2000:526; Janssen 1999:313).

Corporations are reluctant to invest in biotechnologies discovered in developing countries due to poorly defined and enforced IP laws. This deficiency in IPR protection is currently being addressed by several nations who have signed two major international agreements: the Convention on Biological Diversity and the TRIPS. These agreements call for the establishment of a set of suitable IP laws in each nation, depending on the type of intellectual material in question and the economic and technological background of the nation itself. This is considered important even though such measures may lead to a monopoly (Bhat 1999:392).

Monopolists earn profits that exceed the ordinary rate of return on an investment. These monopoly profits are the inventor's reward supplied by the patent system. However, monopolies impose social costs in that too few of the monopolised goods are produced and the prices are too high. Specifically, a patented good typically sells at a higher price and in lower quantities as long as the patent lasts. The price falls and the quantity increases as soon as the patent expires. Hence patents create a temporary monopoly which rewards invention and product distribution. Developing countries are characterised by small markets and elastic demand (Janssen 1999:318; Maskus & Lahouel 2000:606).

Domestic and foreign pressure convinced some developing countries to agree to grant product patents in advance of the GATT treaty. Two other considerations affect the timing of the availability of legal protection for pharmaceutical innovations. The first is the extent to which new patent legislation includes so-called pipeline protection. Pipeline protection stipulates that during the phase-in period of a new product patent regime, innovations which have not been marketed in the country are eligible for protection even if they have been patented, and sometimes even marketed, elsewhere. Pipeline protection is not, however, required under the TRIPs agreement, and many countries, such as India, will not grant pipeline protection. In these countries, only innovations which have followed the treaty agreement are eligible for protection. Opponents of TRIPS argue that it lacks the flexibility and sensitivity to make major contributions in the publishing area (Gurnsey 1995:32; Lanjouw & Cockburn 2001; Tikku 1998:97).

The second feature of the TRIPS agreement that affects timing is that developing country signatories have been allowed a 10-year grace period to adjust to the regulations, and are not required to grant product patents until January 2005. They must, however, accept applications (the "mailbox" provision) and, beginning in 2000, they must offer "exclusive marketing rights" to any inventor with a patent in a WTO member country and marketing approval for the new drug in the inventor's home market. Exclusive marketing rights are very similar to patents in offering monopoly marketing rights to the inventor. Protection for product innovations has been available in all member countries since the end of 1999. TRIPS clearly states that original ownership of rights in literary and artistic works belongs to the physical persons who create the works (Lanjouw & Cockburn 2001; Salokannel 1997:114; Tikku 1998:106).

TRIPS is a vehicle used by WTO to monitor and manage IP. The protection of IP started in the developed world and later expanded to the developing world. The developed world tried to standardise all the IP laws across the world and implemented trade sanctions against countries that did not comply.

3.3.2 Summary

The Western perspective of IP is a fairly internationalised one. Philosophers such as Locke, Hegel and Marx have influenced this perspective in their writings on property, although their works did not deal directly with IP. Marx's philosophy of property helps us to understand the transition from the origin of property to IP based on a class structure. The Western perspective of IP was initially mainly based on principles of the moral protection, access and later economic interest of the owner. The main aim of IP was to facilitate access to commoditised information. With the advent of a money-based economy, the emphasis shifted to IP protection rather than access. The creators of innovative information had to be protected by national IP laws. The UK Statute of Anne was the first IP law to be implemented. National laws were not always effective because of various infringements and so a move was initialised to protect IP on a global scale.

This move led to the conclusion of the Paris Convention in 1883 in an attempt to harmonise patent laws. In 1886 the Berne Convention was concluded to harmonise copyright laws. WIPO was conceived in 1967 and inherited tasks of both the Paris Convention and the Berne Convention. GATT was created in 1947 in reaction to the legacies of the world wars to promote trade among nations. In 1995, TRIPS was concluded and it carried over the intellectual property-related aspects of GATT. Globally, more emphasis is being placed on protection of IP.

3.3.3 Evolution of IP in other parts of the world

Many non-European cultures do not assume an adversarial relationship between an individual and society. Islamic and African cultures define self-identity according to the individual's relationship with and contribution to society. In most African countries, many indigenous societies consider tribal land and other economic resources the property of the tribe's ancestors. An individual may become involved in agriculture or other economic activities that benefit the extended families and the community in general. Historically, most non-Western cultures did not have property or knowledge attached to an individual to the exclusion of the rest of the community.

IP was not relevant because most of the information was available for common good. Only specialised information such as healing secrets was exclusive to the individuals who were trained within these fields. After independence from colonial authorities, these nations were faced with managing IP that was not produced locally. Replicating such information was ideal for them because it was viewed as essential for their survival (D'Amato & Long 1997:36; Drahos 1996:172).

Infringement of copyright for the West has always been a problem for publishers, despite the fair dealing in the copyright law. In the developing world, photocopying has been seen as major opportunity for both users starved of information and for prospective piraters, who see it as an opportunity for an easy-to-use replication technology. IW was introduced into IP when access to it focussed more on the protection of products and services, which excluded those economically less able to access and use such information. The greatest generation, protection and commercialisation of IP occurs in the developed world. For various reasons, interest in and demand for protected information from the developing world increased, and the latter felt more marginalised. Some of the developing world went the route of ignoring the international conventions that governed the protection and management of IP (Drahos 1996:200-1; Gurnsey 1995:12).

In the following section, the Eastern and the African perspectives of IP are investigated.

3.3.3.1 Eastern perspective of IP

East Asian economies (the so-called Asian Tigers) have showed remarkable growth since the 1990s. Apart from Japan, these economies include South Korea, Taiwan, Hong Kong and Singapore (first Asian tier); Malaysia, Thailand, and Indonesia (second Asian tier); and China (known as the 'the miracle of East Asia'). Amongst others, the economic advancements of these countries could be attributed to relaxed IP systems (Kumar 2002:4; Tikku 1998:88).

A considerable number of the indigenous plant species with medicinal value in Asian countries has been patented in foreign Western countries. India for instance started preparation of village-wise Community Biodiversity Registers for documenting all IK, innovations and practices. India has 45 000 different plant species, of which 15 000 are medicinal plants mostly used in the preparation of drugs. Some of these are patented in developed countries. Several Asian countries have generally ignored the patents registered in developed countries and continued to exploit available knowledge without having to make huge payments to the patentees. Asian countries thus benefited from IP generated in other developed countries during their development. The Japanese IPR system, for instance, encouraged the improvement or adaptation of imported machinery or imported goods by domestic inventors. The weaker patent system employed by Japan facilitated the absorption, transfer and diffusion of technology that contributed to economic growth experienced between 1960 to 1963 (Kumar 2002:4-5; Shiva 1996:1; Protecting Indigenous Knowledge: 3-4).

3.3.3.1.1 China

China has never been colonised and the evolution of IP in that country has been guided by its development. The Trademark Law of China was enacted in 1982 and came to force in 1985. China enacted its Copyright Law in 1990 and accepted the terms of the Berne Convention and the Universal Copyright Convention in 1992. The Patent Law was amended in 1992 to extend protection to pharmaceutical products. The government of China entered into an agreement with the US regarding the protection of IP rights in China. The agreement allowed US-based companies to enter into exclusive licensing arrangements with publishing houses in China. This makes China an example of a country that has achieved enormous outcomes in science and innovation without really relying on IPRs. The lack of IP management regimes in China fuelled the number of counterfeit products produced in that country. The US continues to closely monitor China's efforts to enforce its IP laws (D'Amato & Long 1997:220-221; Drahos 1996:14; Gutterman & Anderson 1997:262-263).

3.3.3.1.2 India

The context of property in India has been shaped by conquest, feudalism and colonialism. With its traditional forms of land ownership, India had to rely on political dialogue to shape its philosophy of property. Three distinct political ideologies that were commonplace in India defined the relationship between the individual and the state. Such ideologies were Western-style market liberalism, Soviet-style centrally-planned socialism and Mahatma Ghandi's vision of decentralised village-based social reform. Ghandi, as the first postcolonial Indian leader, believed that the alleviation of poverty was more important than the individual right of property. He therefore co-opted property classes to partake in social reforms. India did not have good protection for many kinds of patents, trademarks or even copyrights. As a result, pharmaceuticals and other intellectual property were freely copied in India. This resulted in medicine prices being too low compared to similar drugs produced in countries such as the US because no royalties had to be paid (D'Amato & Long 1997:37).

India proved the idea that piracy is transient. In the 1950s, the Indian market was dominated by book piracy. At various successive international conventions, the Indian government called for and won major copyright concessions with regard to translations and compulsory licensing. The Indian publishing industry benefited from this move and began to impose firmer copyright laws. India later became the eighth largest country in the world and a significant exporter of books and other literary material. India has been challenged to undergo a transition to provide product patents. It has been recognised that the abolition of product patents in chemicals and pharmaceuticals has facilitated the development of local technological capability in the chemicals and pharmaceutical industry. This has encouraged domestic firms to engage in innovative activities. Kumar's (2002:6) quantitative studies have shown that the innovative activity of Indian domestic enterprises was facilitated by the softer patent regime under the 1970 Patents Act. The gradual build-up of technological capability of Indian enterprises is visible from a rising trend of domestic patent ownership (Gurnsey 1995:34; Kumar 2002:6).

India inherited the Patents and Designs Act of 1911 from colonial times. This act provided for the protection of all inventions except those relating to atomic energy. India obtained its independence in 1947 but continued to rely on the developed world for most of its IP. The Indian government of the day (under the leadership of Ghandi) started nationalising major industries and socialising large sectors of the economy. The Western world has always been very interested in India because of its huge market and labour source (its population stands at approximately one billion people). Some domestic chemical and pharmaceutical enterprises that tried to develop their own technology in the 1960s ran into trouble with foreign patent owners. A number of legal cases highlighted the fact that foreign patent owners were neither using their patents for domestic manufacture nor allowing them to be used by local firms. That led to a build-up of pressure in the late 1960s for a new patent law (Kumar 2002:4; Tikku 1998:88).

India was not a signatory to major international treaties regarding patent creation and protection, with the exception of TRIPS. Rather, it entered into bilateral treaties with various nations. A new Patents Act was adopted in 1970 that reduced the scope of patentability in food, chemicals and pharmaceuticals to processes only, and not products. The Indian Patents Act of 1970 continued to govern the IPR regime in India over a number of years except for amendments providing for exclusive marketing rights in tune with India's obligations under WTO's TRIPS agreement. Critics claim that the real independence of India came about in 1991 when it introduced economic reforms that opened its doors to the outside world. Despite this, its laws continued to cater only for the unique needs of India. It joined the Paris Convention and the Patent Cooperation Treaty only in 1999 (Gutterman & Anderson 1997:397; Kumar 2002:6).

3.3.3.1.3 South Korea and Taiwan

South Korea adopted the patent legislation only in 1961. However, the scope of this legislation did not cover the patenting of products and processes to manufacture food products, chemical substances and pharmaceuticals. The South Korean patent law was amended in 1981 to conform to the Paris Convention that provided for multiple claims

for related inventions in a single application. Pressure from the US pushed South Korea to strengthen its IPR regime in 1986 and extend product patent protection to new chemical and pharmaceutical products. After this, South Korea adopted a comprehensive copyright law, and extended the patent term from 12 to 15 years. It also implemented an IPR regime that facilitated adaptations and imitative duplication of foreign technologies by domestic enterprises through utility models and industrial designs. The soft IPR regime adopted initially was a part of a conscious policy by the government to facilitate imitation by domestic enterprises (D'Amato & Long 1997:66; Kumar 2002:24).

Taiwan's IP laws were first promulgated before 1949 when the Republic of China governed both Taiwan and mainland China. Like South Korea, the government of Taiwan also employed a weak IPR policy to facilitate local absorption of foreign knowledge through reverse engineering. In fact, Taiwan's government seemed to openly encourage counterfeiting as a strategy for developing local industries. In the mid-1980s it is alleged that an estimated 60 percent of the world's pirated or counterfeit goods originated in Taiwan (Gutterman & Anderson 1997:282-283; Kumar 2002:25).

The lax treatment of IPRs in Taiwan attracted the attention of the US government. In March 1983, the US government initiated bilateral consultations on IPRs with Taiwan. As a result of growing US pressure, Taiwan amended its copyright law in 1985 to strengthen penalties for piracy. They provided some criteria for recognising foreign firms' standing before the Taiwanese judiciary in copyright cases, and extended protection specifically to new media, including software. This followed the enactment of a new patent law in 1986 which provided protection for chemicals and pharmaceutical products. However, this legislation and its enforcement were considered inadequate by the US government. Under heavy pressure from the US, Taiwan passed its new Patent Law on January 21, 1994. This allowed patents on food, beverages, micro-organisms, and new uses for products, all of which were previously excluded under the government's social policy. In addition to this, the duration for new patents was extended from 15 years to 20 years (D'Amato & Long 1997:68-69; Kumar 2002:25).

In conclusion, the East Asian countries, namely, Japan, Korea and Taiwan, absorbed a substantial amount of technological learning under weak IPR protection regimes during the early phases of IP introduction in those countries. These patent regimes facilitated the absorption of innovation and knowledge generated abroad by their indigenous firms. They also encouraged minor adaptations and incremental innovations on foreign inventions by domestic enterprises and developed a patent culture through utility models and design patents.

3.3.3.2 African perspective of IP

African countries had indigenous law-making and enforcement institutions long before the arrival of the colonial powers. IP was not relevant for the African context because the African tradition had no need for it. European patent laws were introduced to most of the African continent during colonialism. This move was largely viewed as serving the interests of European companies. After independence, most of the former British colonies discarded their inherent British-style patent laws and adopted new ones based on principles more consistent with their traditional values. The Nigerian patent law, for instance, was adopted in the 1970s and excludes biological products and processes from patent protection. Some products were deemed not patentable by decree in the interest of society as a whole (D'Amato & Long 1997:37).

The developing countries, majority of which are situated in Africa, have been classified into three groups. These include the so-called G1 countries, which comprise developing economies with a common-law background, namely, the former colonies of Great Britain; the G2 countries, made up of developing economies with a civil-law background, consisting of the former colonies of European countries with civil-law regimes; and the G3 countries, which make up developing economies which were never colonised. The developing countries are characterised by having their profitable IK systems, especially plants with medicinal value, patented in the developed world. Most of the developing countries have insisted that there should be no patenting of plants without prior informed consent of the government and communities in the

country of origin (Blakeney 2000:14; Lehman & Brown 1995:148; Sodipo 1997:25; WIPO 1999:16).

The African Industrial Property Organisation (ARIPO) was established on 9 December 1976. The objective of ARIPO was to establish a common information service for the coordination, harmonisation and development of industrial property affecting its members. Members were mostly English-speaking African countries. The African Intellectual Property Organisation (OAPI), made up mainly of former French colonies, was established at Bangui on 22 March 1977. The member states undertook to subscribe to all international conventions in IP. The IP groupings (OAPI and ARIPO) that emerged in sub-Saharan Africa had the undisguised objective of maintaining the interests of colonial powers, and did not transform into vehicles for indigenous economic and technological transformation. (Endeshaw 1996:162, 164, 175; Gutterman & Anderson 1997:412; McKeough & Stewart 1997:474–475). Consequently, they will not be discussed in depth in this thesis.

African countries offer IPR protection in particular patent rights, not so much to encourage inventions in their countries, but rather as incentives to the development of trading advantages. When these countries do grant IP protection for items not available in their countries, the socioeconomic burdens incurred outweigh the benefits. Five countries, Kenya, Tanzania, Uganda, Zambia and Zimbabwe, started a regional collaborative initiative called Farm-level Applied Research Methods for Eastern and Southern Africa (FARMESA). Other countries associated with this initiative included Botswana, Malawi, Mozambique and South Africa. The FARMESA initiative aims at improving food security, incomes and resource management of farm families in the region (Torkelsson & Anandajayasekeram 2000). The initiative did not achieve much and thus will not be discussed further here.

To explore the African perspective on IP in more detail, the situations in South Africa and Nigeria are selected for this discussion. The reason for this choice is that South Africa holds the biggest IP market in Africa, followed by Nigeria.

3.3.3.2.1 South Africa

Property protection in South Africa is entrenched in both the Bill of Rights and the country's constitution. The South African property law is based on the Roman-Dutch law that conceptualises property as a legal relationship between persons and corporeal things. However, the South African Bill of Rights makes no mention whatsoever of IP. By implication then, IP is not considered a basic human right in South Africa, and disputes depend on the interpretation of the courts. The position of the Bill of Rights on property is that individuals must be given constitutional assurance that their property will not be nationalised, confiscated or have its value destroyed by the state in the name of economic reform without compensation (De Waal, Currie & Erasmus 2000:382).

South African IP laws are statutory and are based mainly on the British model. The South African patent law, the Patents Act No. 57 of 1978, was modelled on the British Patents Acts. South Africa is a signatory of the Paris Convention. The principal law governing copyright in South Africa is the Copyright Act No. 98 of 1978. South Africa is a signatory of both the Paris Convention and the Berne Convention. The South African Trademark Act, enacted in 1993, supplemented the Trade Marks Act of 1963 (Gutterman & Anderson 1997:414-418).

The majority of information in digital format is transmitted through digital technologies. This includes IP. This fact prompted the South African government to pass legislation in an attempt to protect information in electronic format, the Electronic Communications and Transactions Act 25 of 2002 (ECTA). The ECTA and other related legislation, such as the Promotion of Access to Information Act (PROATIA), have ushered a new age of maturity and sophistication for the law as it applies to electronic business. This has had profound implications for businesses which own websites or which use electronic media. Proprietary websites mostly contain information which is IP in nature (Electronic law consultancy 2003).

South Africa will have to make do with its existing legislation to deal with its Internet-related problems. This legislation includes the Copyright Act 98 of 1978, the

Trade Marks Act 194 of 1993, the Patent Act 57 of 1978 and the Designs Act of 1993. Although the Internet can be seen as another medium of communication, it does present unique problems, and most of the IP legislation was not drafted for the digital age (De Villiers 2000:39).

The South African parliament passed the National Environmental Act: Biodiversity Bill in 1998. The Act was passed for the management and conservation of South Africa's biodiversity, and the protection of species and ecosystems that warrant national protection. It also catered for the sustainable use of indigenous biological resources, and the fair and equitable sharing of benefits arising from the bioprospecting of genetic material derived from indigenous biological resources. The South African National Biodiversity Institute was established to deal with matters connected to indigenous resources (South Africa, 2003).

3.3.3.2.2 Nigeria

The Registration of United Kingdom Patent Ordinance Act of 1925 was applicable to most of the former British colonies in Africa (G1 nations), including Nigeria. Despite the sovereignty of the G1 nations, they could not grant compulsory licences under the re-registration system of the UK patent system. After independence, Nigeria adopted the Patent and Designs Act of 1970. Although this Act was passed, it was accompanied by limitations on its budgetary and policy formulation powers. The absence of qualified examiners and trained patent attorneys created a serious limitation in the Nigerian IP system (Azmi, Maniatis & Sodipo 1997:141; Sodipo 1997:33).

Nigeria agreed to honour patents issued in member states of the Organisation of African Unity, predecessor of the African Union, as well as in member countries of the Commonwealth of Nations and certain nations such as the USA. The Nigerian Trade Mark Act came into effect in 1967. Nigeria is also a signatory of the Paris Convention. Registered trademarks in Nigeria are valid for seven years (Gutterman & Anderson 1997:414-418).

3.3.4 Summary

This section explored some of the IP perspectives that emanate from the East and Africa. The discussion of the Eastern perspective included the evolution of IP in countries such as China, India and South Korea. All these countries implemented lax IP laws that led to industries which flourished in part because of the manufacture of counterfeit products.

In terms of IP in Africa, it was noted that both the South African and Nigerian IP laws are based on the British IP laws because they are former British colonies. South Africa has gone a step further by passing a bill on the protection of biodiversity. The Western perspective is dominant in the field of IP, which is strengthened by the fact that almost all the other perspectives discussed emanated from it.

3.4 Forms of IP

IP can be said to be information with a commercial value. IPRs can be defined as a mix of ideas, inventions, and creative expressions on which there is a public willingness to bestow the status of property. IPRs comprise industrial property as well as copyright and related rights and other forms of IP. IP principally concerns the protection of inventions through patents and trademarks. The greatest problem experienced by the developing world is the issue of access to protected IP which is required for their survival needs (De Castell 2000:369; Granstrand 2000:340; Hoekman & Kostecki 1996:144).

Woodward (1990:14) defines the right of access to information as:

> "the [right of access] to the intellectual efforts of others and a right to distinguish one's own intellectual efforts. This right is especially valued in democratic societies. It implies not only freedom of expression, but also other people's intellectual products. The

assumption is that knowledge is a common good, which must remain accessible for the benefit of society."

There are some limitations to this interpretation because various types of IP apply only within the borders of the country in which the rights have been granted. For instance, the holder of a US patent can preclude others from using, making or selling the inventions only in USA, because protection in foreign countries may not be derived from a US patent grant if such a country is not a signatory to the IP conventions. If a foreign country has established a patent regime that covers the subject matter of the invention, the inventor may be able to apply for a patent in that country. IP laws across the world are not uniform. This reflects the differences and inconsistencies that exist between developed and developing countries regarding the benefits and perceived dangers of imbalances in property rights (Gutterman & Anderson 1997:4-5; Lloyd 1997:353).

Lack of access to IP by the developing nations has led to piracy and counterfeiting. The statistics from the developed world allege that such practices account for five percent of the world trade. In the following sections, various forms of IPRs, which are also required for development, are discussed. Such rights are: copyright, trademarks, inventions/patents, designs, and plant breeder's rights (Clare & Detore 2000:286; Finger & Schuler 2000:519; Lloyd 1997:353; Sodipo 1997:9).

3.4.1 Copyright

The term copyright is usually used to denote the right that a creator vests in his or her work. In cases of joint authorship involving multiple authors, each author or artist owns copyright to the work. With the advent of the digital age, corporations (e.g., publishers) became the copyright holders. In the context of the digital age, copyright comes into existence when work has been written down, recorded, represented in digital data or signals or otherwise reduced to a material form, except in the case of a broadcast or programme-carrying signal, which must have been broadcast or

transmitted via satellite. Documents written on patented IP are also copyrighted (De Villiers 2000:41; Klopper & Van der Spuy 2000:10; Lloyd 1997:299).

The recognition of copyright means that authors are granted a restricted monopoly to exploit their original work provided that such original work is of a recognised category. For copyright to exist, a work has to be original. Hard work alone does not necessarily produce an original work. Copyright is also said to serve as an incentive to employ the patentee's talent and mental labour to create more and better works. The Western view of copyright is that it is a qualified monopoly that is instrumental in making it more attractive for the author to be creative, which in time will benefit society in the sense that society is enriched. It also ensures that existing knowledge and technology are expanded (De Villiers 2000:41; Hofman et al. 1999:84-86; Klopper & Van der Spuy 2000:10; Lloyd 1997:299; Search 1999:192).

The underlying philosophy of copyright is to protect the economic interests of authors and to provide the recognition that will inspire people to create IP. The categories or neighbouring rights of work covered by copyright are: literary works, musical works, artistic work, sound recordings, cinematograph films, broadcast, programme-carrying signals, published edition and computer programmes. There is no uniformity regarding the duration of copyright protection, although the Berne Convention establishes a copyright term of the life of the author plus fifty years. The protection of originators was incorporated into international conventions such as the Universal Copyright Convention, the Berne Convention and the TRIPS agreement (D'Amato & Long 1997:4; De Villiers 2000:42; Hofman et al. 1999:84; Lloyd 1997; Morris et al. 2001:10; Search 1999:193; Smith 1995:5).

3.4.2 Trademark

A trademark is a mark used by a person in relation to goods or services for the purpose of distinguishing it. Thus, a trademark is a mark, sign or symbol applied by entrepreneurs to distinguish their products or services from those of other traders. A mark may be any sign, including a device, name, signature, word, letter, numeral, shape or design, configuration, mottoes and slogans, packaging, ornament, colour or

container for goods or any combination of the aforementioned (De Villiers 2000:71; Doyle 1995:184; Klopper & Van der Spuy 2000:1; Williams, Calow & Highman 1998:92).

Trademarks are an important tool in commerce. A trademark enables consumers to identify or link the product with its manufacturer in widely distributed markets. The exclusive right to the use of the mark enables the owner to build goodwill and reputation in the expression of its identity. It is also used to prevent others from misleading consumers into wrongly associating products with an enterprise from which they do not originate (Sodipo 1997:35; Williams et al. 1998:92; WIPO 2000:38).

The fact that a trademark distinguishes one product from another makes it possible for a consumer to prefer one product to the other. Because a trademark creates a custom, it enhances the ability of the entrepreneur to attract even more customers and in this manner it strengthens goodwill. For this reason a trademark is economically valuable, and because of this value, the law affords entrepreneurs protection against the unlawful use of their trademark by other entrepreneurs (De Villiers 2000:74; Doyle 1995:184; Klopper & Van der Spuy 2000:5).

There is a growing international consensus that trademark protection should extend to the Internet. The existing national or regional legal systems would apply, together with the relevant international treaties. Before a trademark can be protected by the law, such a mark should be registered as a trademark. Trademark protection lasts as long as either the registration or use of the mark on the goods or services is in force (Klopper & Van der Spuy 2000:2; WIPO 2000:38).

3.4.3 Patents

Inventions are characteristically protected by patents. The invention is one of the acknowledged types of IP. The three characteristics of a patent are novelty, utility and non-obviousness. A patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something, or offers a new

technical solution to a problem. The earliest known patent on an invention was awarded in Florence in 1421 to Filippo Brunelleschi for a barge with hoisting gear capable of transporting marble. Patents and inventions are associated with each other and thus the law regulating inventions is referred to as the law of patents. A patent may be granted for any new invention which involves an inventive step and which is capable of being used or applied in trade, industry or agriculture (Klopper & Van der Spuy 2000:1; Lloyd 1997:247; Miller & Davis 2000:40; Morris et al. 2001:6; WIPO 2000:34).

The use of the word patent as a nomenclature denoting the right of an inventor is due to historical reasons. In England in 1632, the Statute of Monopolies was passed by which the monarch afforded protection to an invention by means of a 'letter patent'. Eventually patents and inventions were associated with each other and thus the law regulating inventions was referred to as the law of patents (Klopper & Van der Spuy 2000:1; Lloyd 1997:247; WIPO 2000:34).

Patented inventions have pervaded every aspect of human life, from electric lighting (patents held by Edison and Swan) and plastic (patents held by Baekeland), to ballpoint pens (patents held by Biro) and microprocessors (patents held by Intel). Inventors may apply for a patent jointly even though they did not physically work together or at the same time, and even though each did not contribute an equal amount of work, perform the same kind of work or make an equal contribution to the subject matter of every claim of the patent. Countries may exclude inventions from patent eligibility for the purposes of maintaining public order, national defence, and environmental protection. They may exclude therapeutic, surgical, and diagnostic techniques and patents need not apply to discoveries of nature, scientific principles, and mathematical formulas and algorithms. Patents need not pertain to higher life forms, and plant varieties may not be patented if they are protected by another system (Haile 2000:7; Maskus & Lahouel 2000:602; Spruill 2000:4).

In order to be eligible for patent protection, an invention must fall within the scope of patentable subject matter. Article 27.1 of the TRIPS agreement provides that, subject to certain exceptions or conditions under that agreement, patents shall be available for

any inventions. This applies to any products or processes, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application. The Internet has become an important marketing tool (which is self-evident in the right of the proprietor to use a domain name) which incorporates trademark. Trademark is very important for any business that the proprietor intends to conduct on the Internet. A domain name is a business asset. The basis for the recognition of a right to inventions to be found in the notion that it is to the advantage of society and public interest that industrial invention be improved. In order to encourage improvement, inventors are granted restricted monopoly or exclusive rights in respect of their inventions for a limited period. When this period elapses, the invention becomes public domain (De Villiers 2000:71; WIPO 2000:34).

The term of patent protection varies. TRIPs established a patent term of at least twenty years from the date of filing. In the event of an existing patent being improved by the amendment of or addition to such an existing patent, the patentee may apply for such addition or amendment to be patented. The patent of addition will lapse together with the original patent. WIPO and GATT have attempted to harmonise patent laws internationally (D'Amato & Long 1997:4; Klopper & Van der Spuy 2000:21-22; Lloyd 1997:246; Maskus & Lahouel 2000:602; Morris et al. 2001:6; Williams et al. 1998:99; WIPO 2000:36).

3.4.4 Plant breeders' rights

The granting of plant breeders' rights affords the creator (breeder) of a new plant variety protection irrespective of the method of the creation of such a new plant variety. Because a patent is only available in respect of the method of production of a new plant variety, a need arose in the 1930s to protect breeder's rights in respect of new plant varieties. This development initially had its origin in the USA and Europe. The law provides for the acknowledgement and protection of the rights of breeders/nursery workers in respect of new plant varieties (plant breeders' rights). In order for such rights to be protected, the law must be complied with, irrespective of whether the method of creation of the new plant had been previously patented. A

breeder can also issue licences to others to exercise the entitlements of a plant breeders' right (Drahos 1996:210; Ducor 1998:144; Klopper & Van der Spuy 2000:3).

In order to determine the nature of a plant breeders' right, an understanding of three concepts is essential, namely, plant, variety and prescribed kind of plant. A plant includes a tree, shrub, vegetable and any living part of the aforementioned. The distinctiveness of the variety will not be detrimentally affected by the fact that the breeder's own variety is common at the time of the application for plant breeders' rights. Variety means any plant growing within a single botanical taxonomy of the lowest known classification, irrespective of whether or not the conditions for the grant of a plant breeder's rights are met. Prescribed kind of plant refers to plants that are eligible for the creation of new varieties for the purpose of the recognition of plant breeder's rights. Both the US Plant Patent Act (PPA) and the Plant Variety Protection Act (PVPA) of 1970 are examples of IPRs created to protect the generation of new plant varieties (Ducor 1998:145; Klopper & Van der Spuy 2000:3-4).

In the event of two applications being received for the registration of the same variety, the application that is received first has priority except where one of the applications is in respect of a variety previously registered in a convention country. The duration of plant breeders' rights is linked to the kind of plant in respect of which the new variety has been developed. The patent period for plants in the US is 20 years, except in the case of vines and trees where the period is 25 years, calculated from the date on which the certificate of registration was issued (Ducor 1998:145; Klopper & Van der Spuy 2000:3-4).

Most IPR laws have developed to a reasonable extent to deal with non-living materials and the processes which produce them; however, to date few laws have been established for living organisms. The laws governing proprietorship and trade of knowledge related to animate or biological matter such as genes and DNA, microbes and biodiversity are still considered by many to be very rudimentary and to need further refinement. Nations have been intensely debating the ownership of national biodiversity, traditional knowledge of communities and the rights associated with such ownership (Ducon 1998:38; Ganguli 2000:168). Similarly, communication

using cyberspace and a range of novel storage and transfer media for information and knowledge, coupled with high performing robotics, have already posed unforeseen and difficult issues for IPR.

3.5 Summary

This chapter investigated the philosophy and various perspectives of IP, namely, the Western, Eastern and African perspectives. Different forms of IP were also discussed. It was found that IP laws exist in both the developed and developing countries. This chapter answered the following research sub-question:

What is IP and the role it plays in globalization?

In an attempt to answer this research sub-question, it was discovered that various international conventions on the harmonisation of IPRs were concluded. These conventions were geared to harmonise IP laws across the globe, and were heavily influenced by the developed world. This is the reason why the IP laws adopted by the developing world resemble those in the developed world. Colonialism also contributed to the Western influence on the IP laws adopted by the developing world. Because developed countries never had legislation on IK, this has until recently not enjoyed protection in developing countries.

It is very expensive for the developing world to register an international patent or to acquire a product protected by an internationally registered patent. This is due to higher fees linked to patent registration. The initial intention of IP was to provide access to products and information but also to protect the economic interests of the creator. The advent of the monetary economy created a shift towards a focus on protection of IP, and less emphasis on access to it. Increased IP protection curtails access to IP by the developing world, increasing the economic disadvantage faced by these nations. IK has begun to fall within the realm of IP because there are several patents registered on IK resources.

Consequently, the following chapter (chapter 4) will discuss various forms of IK systems to better understand IW faced by the developing world.

Chapter 4

IK within the global IPR context

4.1 Introduction

The previous chapter investigated the origin of intellectual property (IP) and the evolution of various forms of intellectual property rights (IPRs) and their influence on various societies. This chapter determines what indigenous knowledge (IK) is, its various types and its contrast with Western science. The influence of IP on IK is also investigated. This chapter does not seek to identify a universally acceptable definition of IK, nor does it distinguish between IK and IK systems. Rather, this chapter aims to understand what IK is in a global context. The concepts of IK and IK systems are used interchangeably.

Various communities have their own forms of IK. This chapter concentrates only on IK within developing communities. In an attempt to answer the main research question, this chapter addresses the following research sub-question:

What constitutes IK and how is it treated in the global IP regimes?

The main purpose of this chapter is to determine what IK is and to identify the various factors that shape its evolution. The impact of IP regimes on IK is also investigated.

Consequently, the main aims of this chapter are to:

- understand the concept of IK and its relationship with Western science
- determine the value of IK in various communities
- assess the influence of various forms of IP and related international conventions on IK
- determine the current status of IK

4.2 The concept of indigenous knowledge

The dilemma facing the concept of IK and what it means to the millions of indigenous people of the world is central to the postmodern and postcolonial debates on the origin of this knowledge. The concept of IK has often been associated in the Western context with the primitive, the wild and the natural. Some, especially within the Western context, have called it the native way of thinking. This elicited little appreciation for the insight and understanding IK might have provided. For the millions of indigenous people of Africa, Latin America, Asia and Oceania (non-Western people), IK is about understanding themselves in relationship to their natural environment, and concerns the way that people organise the folk knowledge of flora and fauna, cultural beliefs, and history, to enhance their lives. IK has been assembled by past generations and passed down to following generations. IK can be defined as "the knowledge that people in a given community have developed over time, and continue to develop based on experience, often tested over centuries of use, adapted to local culture and environment" (Semali & Kincheloe 1999:3). It is dynamic and changing (Greaves 1996:26; Le Roy 2000).

It is argued that IK should not be confined to tribal groups or the original inhabitants of an area. It is thus proposed that any community possesses IK, including rural and urban, settled and nomadic, original inhabitants and migrants. Other names for IK or closely related concepts are local knowledge, indigenous technical knowledge, lay beliefs, common sense beliefs, and traditional knowledge. These terms are used to denote the knowledge that evolved in a particular societal context and which is used by lay people in the daily course of their lives. For the purpose of this thesis, IK refers to unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area. It is noted that this type of knowledge must also exist in all communities, including within Western settings (IIRR 1996; George 1999:80; Grenier 1998:1).

The World Bank defines IK as being local knowledge that is unique to every culture or society. It is said to be the basis for local-level decision making in agriculture, healthcare, food preservation, education, natural resource management and a host of other activities in communities. It is also said to provide problem solving strategies for local communities, especially for the poor, and it represents an important contribution to global development knowledge. IK systems are at risk of becoming extinct. It is relevant for development processes but is said to be an underutilised resource in the development process (World Bank 2002). The characteristics of IK discussed by the World Bank represent the essence of this chapter.

IK evolved as a result of the people's interaction with nature in a common territory. Indigenous people have a fairly common history of colonisation by Western culture. The result of this was a constant regeneration of IK. The basis of regenerating IK is that it is local, holistic and *agrapha*. IK is local because it is the result of the daily interaction in indigenous peoples' territories. These interactions occur among families, communities and indigenous people through various means such as daily oral stories in indigenous language, in the daily agrarian work on the land, and in daily medicinal treatment with indigenous plants. The essence of IK is that it is alive in the culture of indigenous people. Property exists as a communal property in indigenous communities. What is considered proprietary in the developed world is considered communal in indigenous communities (D'Amato & Long 1997:36; Maurial 1999:62-3; Mays et al. 1996:266). This has a profound impact on the difference in thought patterns and worldview between IK and Western societies.

One important basis of an indigenous worldview expressed through IK is holism. Ideas and practices are one. There is no division among disciplines of knowledge. What Western thinking calls religion, law, economics, arts, and so on, in indigenous communities are united as whole entity within their worldview. Oral tradition expresses this holistic worldview, especially through indigenous people's mythical narration, in which the complexity of this view becomes understandable. Dividing intellectual, cultural, and scientific property into three separate areas is strange and unwelcome to indigenous people who see these areas as part of a whole. The holistic basis of IK is produced and reproduced within human relationships as well as in

people's relationship with nature. Therefore, a real understanding of IK occurs in its cultural wholeness. This has been supported by studies conducted in Swaziland of linking science to everyday life (Maurial 1999:66; Rains 1999:309).

IK is basically transmitted through oral tradition in societies that are *agrapha*, not written down. *Agrapha* is a word used in Hispanic anthropology. It refers to societies that did not invent or incorporate originally written expression in their culture. These societies maintained a complex oral tradition which was recreated daily from parents to children and from elders to youngsters. Through oral tradition, indigenous people transmit their holistic culture to their fellow human beings. According to the current IP regimes or legally defined systems, IK exists in the public domain. Those who wish to use it owe nothing to those from whom it was learned. Western IP protection does not only fail to protect IK, it in fact protects its appropriation by others (Greaves 1996:26; Maurial 1999:66-7).

The definition of IK remains dictated by the context within which it is studied. Most of the formal definitions of IK are described outside the scope of normal IK practices. Some research currently being undertaken within indigenous communities is guided by the scope of such studies in terms of what to include and what to exclude. A uniform approach and definition of IK should be standardised by the existing intercollegiate IK institutions. The appendix to this thesis contains a list of some of the IK institutions that may assist in standardising its definition. In order to best understand the concept of IK, it is important to discuss various types of IK that exist.

4.3 Types of indigenous knowledge

Shared knowledge is held by many but not all community members, for example, villagers who raise livestock will know basic animal husbandry. Specialised knowledge is held by a few people who might have had special training or an apprenticeship. For example, only a few villagers will become healers, midwives, or blacksmiths. The children within a rural developing community who have had very little or no contact with Western modes of thought are perceived to have the most

privileged exposure to authentic, relevant, and functional science as far as IK is concerned. Every day they witness the hatching of lizards, snakes, birds, cockroaches, and so on. In some cases their relationships with parents or grandparents who are village doctors, medicine men or women, or midwives give them unparalleled exposure to and hands-on experience in medicine. Among other daily chores, children participate in the local fabrication of hunting and farming implements, and help their grandmothers mix ash and palm oil for soap making. These chores can be said to introduce the children to engineering and technology although they are not performed in a formal laboratory context (IIRR 1996; Jegede 1999:128).

IK encompasses more than just technologies and practices. The following are examples of various types of IK (IIRR 1996):

Information

- Trees and plants that grow well together
- Indicator plants (plants that show the soil salinity or that are known to flower at the beginning of the rains)

Practices and technologies

- Seed treatment and storage methods
- Bone-setting methods
- Disease treatments

Beliefs

Beliefs can play a fundamental role in people's livelihood and in maintaining their health and the environment. Beliefs may entail the following practices:

- Holy forests are protected for religious reasons
- Religious festivals provide an important source of food for people who otherwise have little to eat

Tools

- Equipment for planting and harvesting
- Cooking pots and implements

Materials

- Housing construction materials
- Materials for basketry and other craft industries

Experimentation

- Farmers' integration of new tree species into existing farming systems
- Healers' tests of new plant medicines

Biological resources

- Animal breeds
- Local crop and tree species

Human resources

- Specialists such as healers and blacksmiths
- Local organisations such as kinship groups, councils of elders, or groups that share and exchange labour

Education

- Traditional instruction methods
- Apprenticeships
- Learning through observation

Communication

- Stories and messages carved on palm leaves
- Folk media
- Traditional information exchange mechanisms

Enthusiasm for IK has grown rapidly in recent years. This enthusiasm is unfortunately not reflected in an increased understanding of indigenous cultures. Since ethnic diversity corresponds to habitat diversity, each group of people has developed an individual understanding of the natural world. The important task facing ethnic groups is to ensure accurate recording, sorting and synthesis of this vast body of knowledge. IK includes both explicit and implicit knowledge, some of which is intuitively practised through cultural rituals or revealed through stories and legends. Local knowledge may not be apparent to outsiders or explicitly articulated by local residents, making it difficult for outsiders to understand, record, interpret, or apply (Blench 2001:3; Goodchild 2000:344; Patel 1996:307).

IK is often contrasted with Western science. However, this is not always done with an understanding or knowledge of all essential factors. It is imperative to compare these concepts to clarify any misconceptions or untrue assumptions that might exist between them. The following section therefore presents a comparison of IK and Western science.

4.4 Indigenous knowledge versus Western knowledge

Many of the challenges of IK interpretation relate directly or indirectly to the difficulty of studying IK using the Western scientific approach. Most IK practitioners interact with people from the Western world and the influence brought by such contact necessitates this discussion. Although the two knowledge systems are considered worlds apart, they share similarities that suggest that they may in fact be closer than they seem. Agrawal (in Grenier 1998:49) states that the critical difference between IK and scientific knowledge lies in their relationship to power. Western knowledge is said to be self-contained, self-sustaining, handy, convenient, and even embellished with a sense of righteousness. IK on the other hand is expressed in the existence of a whole set of knowledge that has been disqualified as inadequate to the task or insufficiently elaborated (Grenier 1998:49; Rains 1999:317).

IK is often contrasted with scientific, Western, international or modern knowledge. IK is generated by indigenous people in seeking to find solutions to problems in their day-to-day lives. They draw on existing societal wisdom and other local resources that may be available, and by using a fair amount of intuition and creativity. Modern knowledge is developed by universities, research institutions and private firms using a formal scientific approach. IK has been portrayed as closed, pragmatic, utilitarian, value laden, and content driven. This implies that IK may not have the same authority and credibility as science because its localness is restricted to the social and cultural circumstances of its production (George 1999:80; IIRR 1996; Watson-Verran & Turnbull 1995:116).

In reality, there is a lot of overlap between indigenous and Western knowledge, and in a certain sense and in terms of certain aspects it can be very difficult to distinguish between them. Because some aspects of IK change over time, it is sometimes difficult to decide whether a technology or practice is indeed indigenous, adopted from outside, or a blend of local and introduced components. For a development project, however, it does not matter whether a practice is really indigenous or already mixed up with introduced knowledge. Instead of only looking for technologies and solutions from outside the community, it is important to first look at what is in the community. IK is said to be more concrete while Western, modern knowledge, is built on more general abstractions (IIRR 1996; Rains 1999:317).

IK is more than science. If science is just a small part of knowledge, treating IK as a science diminishes its breath and value. Science and IK interact in certain subject areas, such as technology, resource management, ecology, and the classification of living organisms. IK did not evolve on its own into the modern IP system. The IK system has functioned satisfactorily and has met the needs of the society in general. IK has been developed over millennia and has been dismissed by those with the dominant intellectual authority of the time (Grenier 2000:47-48; Rains 1999:319; Sodipo 1997:47).

The West has disqualified IK as a category. The magnitude and extent of the conflict resulting from the interaction between Western and indigenous people is

immeasurable. The American conflict for example, began some five hundred years ago, with the first encounter the West with the American Indian civilisation. In Africa and elsewhere, Europe imposed completely different worldviews, languages, political, religious, and economic ways of living, despite the resistance of the indigenous people to their Western conquerors. Far from being static, however, indigenous people and their knowledge have continued to evolve between conflict and dialogue with Western people (Maurial 1999:67; George 1999:80).

The indigenous system is based on communal or group ownership whereas the Western system is based on individual ownership. No other society could have copied the laws of medieval Europe without knowing the laws or appreciating how systems had succeeded in Europe. This has been done by the modern day indigenous communities. The evolution of IP regimes within the developing world was not a voluntary exercise; it was forced down on them by governments in the developed world through international IP conventions. A modern copyright system could not have emerged in the absence of local technological advances, like printing, which gave rise to copyright in medieval Europe. In traditional communities, most artistic works were not produced for sale or export. For example, it was not until the first contact with the Portuguese in Benin that blacksmiths and sculptors began to make goods for sale. Before then, it was compulsory to make such things only for the king or for religious festivities or rituals. Most of such activities declined because of Christian beliefs against idolatry (Drahos 1996:171; Mays et al. 1996:267; Sodipo 1997:48).

According to Maureal (1999:63), the difference between indigenous and Western knowledge is that IK is developed or found neither in archives nor in laboratories. It is not separated from practical life. Thus, indigenous people are the actors of their knowledge and there are no positive repositories of knowledge separate from people's everyday lives. Table 4.1 presents a comparison between these two types of knowledge.

Table 4.1 A comparison of indigenous and Western systems of thought

Indigenous	Western
Anthropomorphic	Mechanistic
Monistic-metaphysical	Seeks empirical laws and principles
Cosmology with religion as an important focus	Public property minus religion
Oral tradition predominates	Documented
Sage practice	Truth can be challenged
Learning is communal	Learning is an individual enterprise

Source: Jegede, 1999:125, table 1 (adapted)

IK has been classed as inferior to Western knowledge within the Western world and its institutions of power (State, Academy, market, etc.). Those institutions of power have certainly interacted with indigenous communities. IK has managed to survive in spite of the different forms that have resulted from the interaction between indigenous and Western knowledge. All knowledge systems have their limitations, and IK is no exception. For instance, IK is passed on from one generation to the other in an oral mode. This can lead to some distortion over the course of time. Neither IK nor modern science will be appropriate and accurate in all circumstances. IK may also be scientifically less precise than Western science, as the latter can measure or statistically verify phenomena to a high level of precision (George 1999:80; Grenier 1998:55; Maurial 1999:62-3).

In summary, IK was not accorded the recognition it should have been given during colonial times. This led to a poor understanding of what it entails. It is seen to be different from Western knowledge, and although it is considered by the West to be inferior, this is an unfounded assumption. It does not distinguish between disciplines, as all disciplines are holistically integrated. Western science on the other hand categorises disciplines separately. Points of convergence between the two disciplines exist, but they are separated by the issue of power, usually because Western knowledge is regarded as precise and accurate as opposed to the vague and unscientific nature of IK. This is due to the fact that Western knowledge is generally

accepted worldwide, whereas IK is rejected to some extent even by the élite in indigenous communities who become influenced by the Western way of thinking. This is to a larger extent the result of globalisation. IK thus needs to be understood within a global environment.

4.4.1 Globalisation and its impact on IK

Avgerou (1998:20-21) defines globalisation as "processes operating on a global scale, which cut across national boundaries, integrating and connecting communities in new space-time combinations, making the world in reality and in experience more interconnected". Globalisation is therefore a process of denationalisation of markets, politics and legal systems. This is also called the rise of the so-called global economy. The consequences of this political and economic restructuring on local economies, human welfare and environment are the subject of an open debate among international organisations, governmental institutions and the academic world. Globalisation is thus concerned with the endeavour of business practices and processes to take a business or a product to a global level (Globalization.com (See http://www.globalization.com/)).

IK does not exist in a vacuum. It is part of the globalised world because most indigenous communities who practise IK interact with people in various parts of the world, especially since colonisation. The trend towards a "global village" has influenced the evolution of IK. This makes it important to discuss IK within the global context. One of the more uncomfortable and seldom discussed consequences of globalisation is the erosion of ethnic diversity. It is paradoxical that the levels of resources that can be mobilised for the conservation of biological diversity far exceed those for human cultures. Biodiversity and indigenous people's knowledge are inherent in the idea of indigenous territory (Blench 2001:2; Viergever 1999:335).

IK systems can be complex. For instance, maintaining biodiversity at the farm level includes maintaining the different varieties and the management processes to which these activities are subject. Attempts to 'scientise' IK by removing it from its owners

will tend to compromise the subtle nuances of this knowledge. International agreements such as GATT and TRIPS have been concluded by various national governments. This makes such treaties global. Development agencies, especially bilateral donors, have historically displayed limited interest in indigenous peoples. They gave low priority to the preservation of traditional cultural values (because of their oral nature) compared to the conservation of biological resources. The United Nations, perhaps because of the internal diversity it represents, is more advanced in this area; it initiated the *International Decade of the World's Indigenous People* in 1995 and is about to create a permanent forum on indigenous rights. The World Bank, under pressure from indigenous organisations and NGOs, especially in South-Central America, has adopted a policy on the rights of indigenous peoples (Blench 2001:2; Grenier 2000:47; Hoekman & Kostecki 1996:10).

IK from the developing nations, especially the healing properties (medicinal value) of their flora and fauna, are being patented by multinational pharmaceuticals located in the developed world. Various interests emerged in the area of IK and it faced appropriation into patents by those involved in bioprospecting. Bioprospecting means searching for commercially viable genetic and biological resources, with particular reference to pharmaceutical, biotechnological, and agricultural industries. Companies patent the procedures or properties of such medicine without rewarding the indigenous population for such knowledge. In fact, they are expected to purchase such medication at a high price. This could, to a certain extent, be regarded as modern biotechnological colonisation. Over the years, the interest in IK systems has grown beyond the anthropological documentation of cultures. This is clear by the increasing amount of literature on the subject published in fields outside of the discipline of anthropology. Recently, attempts have been made to document and store IK. This could be related to the growing concern regarding environmental decay (Blench 2001:3; George 1999:79; Reynar 1999:287; Viergever 1999:333).

Environmental management is one of the areas in which good use can be made of IK. Interest in IK in this field may be purely academic, but is also sparked by the possibility of application in the field. The knowledge of traditional and indigenous communities concerning characteristics of plants and herbs, particularly medicinal

plants, is considered useful in promoting sustainable use of biological resources. The exploitation of biotechnology for commercially valuable genetic and biochemical resources is a possible key to biodiversity conservation. IK is said to acquire more value when it is taken out of its natural setting and commercialised in a proprietary manner (George 1999:79; Mays et al. 1996:266; Reynar 1999:287; Viergever 1999:333).

Indigenous communities have recently tried to protect this knowledge from appropriation by others. Most strategies for protection of IK concentrate on documentation rather than patenting. Documentation of IK is one means of giving recognition to knowledge holders. But mere documentation is unlikely to result in the sharing of benefits arising out of the use of such knowledge, unless it is backed by some kind of mechanism for protecting the knowledge. Documentation of traditional knowledge may only serve the purpose of preventing the patenting of this knowledge in the form in which it exists. This is a direct consequence of the fact that most scientists do not acknowledge IK as a product of a dynamic and creative system to resolve perceived problems. Most scientists and policy makers perceive the collected information of indigenous communities to be the result of passive, even accidental, accumulation. They assume that indigenous communities have gathered knowledge in about the same way as they would gather stones (Protecting IK 2002:5; Viergever 1999:338).

A number of universities and large multinational corporations have recently engaged in a huge effort to find new products through traditional knowledge. In terms of this initiative, for instance, a shaman is no longer considered a witchdoctor, but is someone who possesses knowledge valuable to business. Within traditional societies, certain forms of knowledge are restricted to certain sectors of the population, such as healers, men who have been initiated into a certain position, or women only. Various agreements have been drawn up between indigenous communities and industries such as pharmaceuticals in the hope that some of the IK held by indigenous people may lead to commercial applications. As soon as the corporations are granted patent to indigenous products, they automatically obtain exclusive rights to the products and procedures to process them. As soon as these corporations patent products in multiple

countries, the possibility exists that indigenous groups will be prohibited from using their own cultural heritage and knowledge. The fact that IK is of critical importance to the survival of indigenous communities is often ignored (Carruthers 1996:1017; Greaves 1996:29; Haile 2000:7; Maskus & Lahouel 2000:602; Mays et al. 1996:266-7; Ostergard 2001:650; Shah 2001; Spruill 2000:4; Viergever 1999:333).

Donors have few frameworks for funding projects relating to indigenous activities. In addition, the funds available are small and often discretionary, in marked contrast to the large sums available for the infrastructure projects that act to erode ethnic minority culture. There are two possible explanations for this. The first is that most donor countries have limited experience in managing ethnic diversity, as in Europe, which has strikingly low ethnic diversity. Secondly, donor countries generally have a poor record of managing their own diversity, as has been seen in Australia, the United States and Japan (Blench 2001:3; Nabhan et al. 1996:190).

The dilemma of indigenous peoples should be well known amongst international audiences, especially as it has been raised in the UN. Issues relating to culture, tradition and IP have acted as a catalyst for those who seek support from international forums for their local goals. Information technology is now an essential component of self-determination and development. It is the new and hidden tool for colonisation as IK and IP are increasingly misappropriated. Access to infrastructure, skills, and a voice in global dialogues and debates are crucial for indigenous people across the globe. Within the global context, it is important to discuss the importance of IK for both indigenous and Western people because it is through globalisation that both communities are brought into contact with IK. This also renders IK important for sustainable development.

4.5 Importance and value of IK for the world

Knowledge and traditional resources are central to the maintenance of indigenous people's identity. IK is the basis for self-sufficiency and self-determination because indigenous people are familiar with indigenous practices and technologies. Before the expropriation of IK or any form of IW against IK may be discussed, it is important to first consider how IK is valued by both indigenous and Western people. Indigenous people can understand, handle, and maintain IK better than introduced Western practices and technologies. IK can provide effective alternatives to Western know-how. It gives local people and development workers extra options when designing projects. Instead of searching only among Western technologies for feasible solutions, they can choose from IK or combine indigenous and Western technologies. Indigenous technologies and practices are often cheaper than Western options as they rely on locally available skills and materials (IIRR 1996; Rains 1999:317).

In traditional societies, the right to livelihood resources, such as trees, crop species, and medicinal plants, are not usually exclusive. Such rights are considered inalienable; they cannot be transferred, either as a gift or through a commercial transaction. Today, indigenous societies find themselves poked, probed and examined more than ever before. IK is the cultural heritage that gives indigenous people their identity. It has been subjected to potential assault from people who gather it up, strip away its honoured meanings, convert it to a product and sell it. Each time this happens, the cultural heritage dies a little. To a certain extent, some forms of IK have been an open treasure box for unfair appropriation by Western civilisation. When IK is appropriated, it is transformed into a constituent of the commercial process. As such, IK has been acknowledged as a resource and is exploited for economic growth. This constitutes a form of IW against indigenous communities because they do not actually benefit from the appropriation of their heritage (Reynar 1999:293; Greaves 1996:25; Posey & Dutfield 1996:54). This will be discussed in greater depth in chapter five.

The creators of IK are a chain of people who are linked through a shared oral transmission of their collective observation, trial and error tests and informal

experiments. Governments, corporations and others have deemed the traditional lifestyles, knowledge and biogenetic resources of indigenous or local people to be of commercial value. This renders IK a kind of property that might be bought and sold. IK itself is a commodity and it needs to be protected. It has been suggested that the existing legal regimes, the IPRs, should protect it. Chapter three discusses in detail the applicable IPRs and the problems associated with using these in an indigenous context. Filing for a patent, for instance, involves extensive paperwork that would be too expensive for a tribe to afford. Indigenous communities fear that documenting IK may ultimately lead to their control by others. The limitations of existing mechanisms of IPR therefore outweigh their potential for protecting IK. Should monopoly rights be granted to an individual or organisation for traditional information, the common benefit derived from its exploitation would be lost (Nabhan et al. 1996:190-2; Viergever 1999:338). As such, the common benefit denominator inherent in IK is ignored or discarded.

IK is not only important to indigenous communities. Within the global context, IK has been reshaped by the influence of the global role players who interact with it. As such, IK is not static, but has evolved so that it no longer reflects its original form. The changing dynamics of IK are discussed in the section that follows.

4.5.1 Dynamics of indigenous knowledge

Indigenous communities have always reinvented technologies useful for their daily needs and production systems. They should be supported and given opportunities to experiment and adapt what is most appropriate for themselves. IK research can foster local empowerment. Host governments might view local empowerment as a subversive challenge to existing political structures. Schools as an institution can create cultural change in a community. Schooling, if thoughtlessly administered, can undermine IK in three different ways. Firstly, it can fail to present IK as worthwhile subject matter for the learning process. Secondly, it can limit children's exposure to the local knowledge of their communities. Thirdly, it can create attitudes in children that militate against the acquisition of IK. On the other hand, the effect of exposure to

formal education might help households generate the most appropriate knowledge to solve their problems (Mwadine 1999:259; Rains 1999:309).

Figure 4.1 Factors in the generation of new indigenous knowledge

Resource availability	Perceived problem	Ecological factors
	New indigenous knowledge	
Formal education	Changing perceptions & desires	Cultural/social networks & beliefs
Access to relevant information and technology	Historical experiences and knowledge	

Source: Mwadine 1999:259, figure1

Figure 4.1 shows that IK can be used in problem identification and prioritisation, identification of (perceived) causes of the problem(s); resources available in the community; generation of alternative solutions to common problems and sources of alternative technology; management and implementation of programmes; and monitoring and evaluation. IK is considered to be confined to a small area, and limited to what rural people can sense, observe, and comprehend using their own terms and concepts. Care must be taken when intending to transfer the information to other locations as it may not be applicable elsewhere. That is why schools are not considered to be ideal institutions for teaching and researching IK if they are poorly administered. IK needs to be managed with sustainable development in mind.

4.5.2 IK for sustainable development

Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. Sustainable agricultural and natural resource development means utilising, managing and conserving natural resource bases. It involves the orientation of technological change to ensure that human needs, such as food, water, shelter, clothing and fuel, are obtained and maintained for the present and future generations. According to the World Commission on Environment and Development, sustainable development has the following objectives (Grenier 1998:8):

- reviving growth
- changing the quality of growth
- meeting essential needs for jobs, food, energy, water and sanitation
- ensuring a sustainable level of population growth
- conserving and enhancing the resource base
- reorienting technology and managing risk
- merging environmental considerations and economics in decision making
- reorienting international economics relations
- making development more participatory

Sustainable development can be measured by means of productivity and yield. Productivity is defined as the capacity to produce, and yield is the amount produced. The spread of a monoculture of high yielding varieties and fast-growing species in forestry and agriculture has been justified on grounds of increased productivity. Knowledge about biodiversity and agricultural practices is often the basis of the indigenous people's food security, health care and livelihood. At an international level, there is no consensus on the criteria and indicators for sustainable development. There is agreement, however, on the need to develop country-, region-, and sector-specific indicators and criteria for sustainable development (Grenier 1998:8; Viergever 1999:333).

Development of such indicators would assist developing countries which have a rich variety of plant species to exploit the medicinal value found in such plants. This may be possible should these countries obtain some economic and technological capacity for exploiting and profiting from the transformation of such plant species into a profitable commodity. When IK resources are exploited, the notion of sustainable development and the sustenance of future generations must be kept in mind (Drahos 1996:65; Posey & Dutfield 1996:14). In this instance, it seems that sustainable development may only be achieved if IK is regarded as a part of IPRs. Even though current IPRs do not protect IK as it is deemed to be in the public domain, it is important to investigate the existence of the link between the two.

4.6 Links between IK and IPRs

IP laws vary from country to country but international treaties like the Paris and Berne Conventions give them a common basis. In some cases, IK is regarded as a property in the public domain. The problem facing IK is not only that it is not adequately protected. It is also that protection can lead to the exclusion of the people to whom the knowledge belongs. There are some registered patents that originate from the IK-based resources (originally from the developing nations) and this justifies the need to investigate the link between the existing IP regimes and IK products. In essence, there are four forms of IP, as discussed in chapter three: patents, plant breeder's rights, copyright, and trademarks. The mainstream IPRs and their conventions do not explicitly include IK as a form of IP but products derived from IK are protected by IP regimes. This makes it important to discuss the way IK is perceived under the well-established IP regimes. Patents and plant breeder's rights are the two common forms of IP most relevant to IK. Some existing IPRs are not geared to recognise IK contributions but legalise the rights of inventors and innovators of modern technology. The fact that most of the inventors and innovators who have registered their discoveries hail from the Western world increases the inequalities between the developed and developing countries. Inequalities in IPRs have been aggravated by the TRIPS provisions and GATT in general. The provisions of these conventions run

counter to the hopes enshrined in the Convention on Biodiversity adopted in 1992 (Grenier 1998:13; Le Roy 2000; Patel 1996:306).

In the 1800s, most national patent laws in Europe excluded living materials, food, and medicines from protection. Much has changed since then. Groups of living things first came under IP with the US *Plant Patent Act* of 1930, which targeted some asexual plants. In the early 1960s, the United States passed a law granting plant breeders the right to patent seeds, preventing others from selling the same variety. Since 1980, when the US Supreme Court ruled that an oil-eating microbe was patentable, a trend has been established to extend patent law to many life forms. The US Patent and Trademark Office ruled in 1985 that a plant could qualify for a patent under industrial laws and in 1987 animals became patentable. Currently, there are a number of IPR regimes in operation that cover life forms in Europe, the United States, and elsewhere. The newer laws tend to cover a broad spectrum of life forms and grant an astonishing degree of ownership to the patent-holder. Moreover, when IPR laws are amended, the scope of protection and the degree of parent holders tend to be extended (Grenier 1998:13; Lanjouw 2001:2).

At the international level, the question of what is patentable is both unsettled and controversial. On 18 June 1997, the European Parliament Legal Affairs Committee voted to allow industry to patent living organisms, overturning its previous patent law. Concerned groups are lobbying against the proposal, arguing that the proposal addresses only the interests of the biotechnology industry. Corporations are well aware of how cost-efficient it is to tap the knowledge of communities that live with and depend on biodiversity for survival. Multinational pharmaceutical corporations have taken plant samples from tropical forests to use as raw materials in developing new drugs. Agricultural companies took disease resistant seeds identified by indigenous peoples and genetically manipulated the seeds. After some modifications, this genetic material was patented, mainly in the United States, and the resulting seed or product was marketed. Corporations have realised enormous benefits from their free access to genetic materials, especially in the case of crop plants from developing countries. The indigenous people who contributed to the drug discovery process have

largely remained without compensation for their contribution (Grenier 1998:13; Mays et al. 1996:263).

Countries such as Brazil, Argentina, and India have allowed patents on processes but not products and have compelled patent holders to make socially useful products available in the domestic market. The US Utility Plant Patent is the most powerful protection available for plant and related protection. A single application may cover multiple varieties or even an entire genus or species. These applications can cover biological material, processes, genes, protein, recombinant processes, culture techniques, plant parts, and seeds. The Utility Plant Patent is often used to cover genetically engineered materials, whether whole organisms, tissue cultures, cells, or DNA sequences, and transgeneric materials (D'Amato & Long 1997:36-37; Grenier 1998:13).

TRIPS and GATT confer creators exclusive rights over the use of their creation for usually 17 to 20 years. It does not matter whether or not inventors have used public knowledge for the purpose of their invention. Inventions and knowledge that have collectively been shaped through the years by communities can be appropriated by a single person, eventually changing an originally public good into a private one. The current legal mechanisms for the harmonisation of IP are not in line with the indigenous perceptions of ownership. Some indigenous ownership rights do not translate well into existing IP regimes. This is because most of the underlying indigenous ownership lies in artefacts or oral tradition. IK is thus easily appropriated into the commercial context (Britz & Lipinski 2001:235; Le Roy 2000).

A patent system cannot be developed in the absence of skills for writing, documentation and administration. Competition from foreign goods and works in many instances has led to the demise of local industry; thus there have never been incentives to develop any protection for local industries. Some researchers from the developed world have made discoveries using material or information from the developing world. This led to commercialised IK where trademarks are used by the patentees to market and identify products across the world. This process includes the commercialisation of culture through the manufacture and sale of souvenirs,

entertainment of tourists through bastardised rituals and the use of cultural rituals in commercial endeavours. This commoditisation has resulted to some extent in the dilution of indigenous rights and culture. The majority of patents derived from the commoditisation of IK are registered in the United States, Western Europe and Japan, and profits from patented products generally go to Western industry such as pharmaceutical firms in those countries involved in bioprospecting (Britz & Lipinski 2001:236; Mays et al. 1996:263).

Through this process, IK products become divorced from their original owners and the trademark makes the patentee the only known legal owner of the product. Indigenous communities do not attach monetary value to the indigenous information. Individual discoveries are available for the benefit of humankind. With the advent of the monetary economy, however, information or knowledge has been attributed to individuals or organisations as inventors and owners. A critical dilemma surfaces when one attempts to place some monetary value on IK or its contribution to the pharmaceutical products originating from it. The indigenous communities who owned some of such information were ignored and not recognised as the original owners of that created information. A developing country cannot be expected to protect IK in the way that a multinational pharmaceutical firm can. Financial value has been linked to various categories of information and the financial benefits go to those in the developed world. Figure 4.2 presents a comparison between the IK system and IPRs (Drahos 1996:171; Mays et al. 1996:267).

In traditional societies, trademarks could be used to determine the origin of work because the market structure featured the sale of goods either through markets or middlemen. All inventors had a mark to identify their products. In a sense these marks belonged more to the community than an individual. These marks are comparable to the modern day trademark. Goodwill was attached to the middlemen or markets more than to the marks themselves, thus the role of marks in these communities was different to what it is in modern society today. In traditional communities, the use of a mark belonging to another community was rare. A community would copy the mark after being influenced by its owners as a sign of superiority over the latter. Such marks were regarded as communal property. Most preliterate communities had lost

their sovereignty with the advent of Europeans, so they could not prevent the influx of foreign goods. Discussions on the protection of IK were generated by causes such as fundamental unfairness of the appropriation of IK, and the acceleration of the global pursuit of useful knowledge. This led to a struggle by indigenous communities for their cultural existence. This struggle has fuelled the worldwide concern for human rights (Greaves 1996:26; Sodipo 1997:48-9).

Table 4.2 A comparison between IK and IP systems

IK system	IP system
Preliterate system functioned satisfactorily and met needs of the creator and society.	No evidence that it is better than preliterate system.
Based on communal and or group ownership.	Individual ownership.
Copied modern system from Europe.	Medieval Europe had IP laws.
Modern copyright used is linked to modern technological advances.	Medieval Europe had laws pertaining to copyright.
Artistic works were not produced for sale or export.	Market-driven economies.
Artistic works and activities declined during colonial era.	Exported technology and religion to the preliterate world.
When markets emerged, marks were not used, markets and middlemen identified goods, thus they acquired goodwill.	Goodwill was attached to marks themselves.
Copying of marks was a sign of superiority over the owner. Marks are communal property.	Copying of marks is regarded as IP infringement.
Patent system could not be developed in the absence of writing, documentation and administration.	Comprises about 90 percent of the world's patent filing.
The advent of Europeans and their goods led to the demise of local industry.	European nations prevented competition within national borders.

Source: Sodipo 1997:47- 48 (adapted)

The Convention on Biodiversity and GATT are the most prominent IP regimes relevant to a discussion on IK. TRIPS, which emanated from GATT, serves to protect most IPRs as it stipulates the minimum period for patent protection as being 20 years (Ganguli 1998:173). The Convention on Biodiversity is the only international convention that attempts to protect indigenous resources. These factors make it necessary to discuss the link between IPR conventions with IK, GATT and the Convention on Biodiversity.

4.6.1 General Agreement on Tariffs and Trade (GATT) on IK

IPRs were subject to national legislation before the conclusion of the General Agreement on Tariffs and Trade (GATT) that forged the international harmonisation of IP legislation. International conventions such as GATT and TRIPS are at the forefront of the protection of IP. IK has never been regarded as proprietary, which is why most of the international conventions have not considered its protection. The purpose of discussing the international conventions is to demonstrate that they never included IK in its traditional context in their protection stipulations. Nations were free to determine whether and how they would recognise IP. In 1994, negotiators of the Uruguay GATT agreement agreed that member countries would bring national IPR laws in line with the new agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). Effective 01 January 1995, TRIPS obliges member countries to implement patent coverage for micro-organisms and essentially biological processes for the production of plants (other than non-biological and microbiological processes) (Grenier 1998:13; Hoekman & Kostecki 1996:1).

TRIPS provides for a 20-year product protection period, after which protection for the manufacturing process is extended for another 20 years if the process is new. The South (predominantly the developing countries) was given until 2000, and the least-developed countries until 2004 to either adopt an existing international IPR convention or develop their own IP legislation. However, IK in its traditional context did not form part of most of the international conventions and issues regarding IK were relegated to the Convention on Biological Diversity. It is now sold for pharmaceutical products in some instances.

The Convention on Biological Diversity was called following pressure from lobby groups for the protection of the environment, which encompasses IK. The United States has interpreted the provisions of the Convention on Biodiversity as being subordinate to those of GATT. How the GATT provisions are interpreted and implemented is important. The World Trade Organisation (WTO) panel rules on whether member states are complying with the rules, with other issues being subordinate to their ruling. Environmental and human rights groups will therefore

have to make significant lobbying efforts to steer the discussion toward a more sustainable future that includes IK protection (Grenier 1998:13; Gutterman & Anderson 1997:18):

GATT and, more recently, TRIPS are dependent on the ruling of WTO. This allows the strong and developed nations to dominate the direction during decision making. Neither of these agreements makes specific reference to the protection of IK and the reimbursement of indigenous communities. The issue if IK was dealt with chiefly through the Convention on Biological Diversity. For this reason, the following section discusses this agreement in more detail.

4.6.2 The Convention on Biological Diversity

The term biological diversity (biodiversity) is used to describe a variety of living organisms such as genes, species, ecosystem and others. Most of our planet's plant resources (two thirds of all plant species) are located in developing countries; these regions' tropical forests in particular are known to be rich in biodiversity. It is very important to determine the place of IK within the provisions of this convention because it is the only international convention that recognises the existence of IK as a form of property owned by the people in the developing world. The Convention on Biological Diversity, a legally binding international agreement, was concluded at the United Nations Conference on Environment and Development in 1992. It came into force in December 1993. The 150 signatories to the Convention made a commitment to the conservation of biological diversity, the sustainable use of its components and fair and equitable sharing of the benefits arising from the utilisation of generic resources. The convention is not explicit on how the local people should be compensated for the commercialised IK. It only espouses the equitable sharing of the benefits of resources (D'Amato & Long 1997:86; Grenier 1998:16; Le Roy 2000).

Botanists, biologists and others with technical taxonomic training seek out specific plants based on information provided by indigenous people or traditional healers whose knowledge of the use of certain plants derives from unrecorded knowledge

handed down orally from generation to generation. Only a few drug companies have started to make payments to some research institutes or governments, in other words, the owners of IK. No benefits have been returned directly to indigenous communities. Although the Convention recognises the importance of biological IK, more often than not this knowledge has been used without the approval and involvement of the holders of such knowledge. National governments should adopt legislation specifying patentability criteria in order to ensure the protection of real inventions and to ensure a balance of rights and obligations of the patent holders and the end-users. These criteria should be applied strictly (Grenier 1998:16; Mays et al. 1996:265).

According to the Convention, farmer's rights are privileged for being plant breeders, conservers and consumers. In addition, national interests take priority, namely, the sovereign rights of states to their biodiversity. The Convention encourages developing countries to preserve their diminishing rain forests, wilderness areas and wetlands. It also calls for equitable sharing of the economic benefits from patented processes using rare plant and animal species found in developing countries. Generic resources like minerals and oil resources are subject to national legislation, meaning that nation states have a right to set conditions and limitations on access to generic resources. Although the Convention on Biological Diversity affirms the sovereignty of nations over their biological resources, it encourages bilateral arrangements between those who want access to resources, knowledge and local government. The Convention does not define protection at the level of the community. Overall, the Convention lacks teeth, it has no mechanisms to control outsiders' access to indigenous bioresources (for example, a binding code of conduct) and no mechanisms to determine the equitable sharing of benefits (D'Amato & Long 1997:84; Grenier 1998:13; Thomas 1999:228).

There is a strong correlation between the maintenance of ethnic diversity and the conservation of biodiversity, as well as a reservoir of IK about the environment which remains largely untapped. Ideas about the rights of ethnic minorities, especially in relation to control over natural resources, remain undeveloped and it is in the interest of powerful majorities that this should be the case. National resource centres (see the appendix for the most prominent national institutions around the world) also serve to

protect IPRs that could be used for the benefit of the country (Blench 2001:2; Greaves 1996:27; Semali & Kincheloe 1999:3).

The Convention on Biological Diversity does not address the problem of the unfair appropriation of IK. Domestic IP laws supersede the provisions of the convention, which allows countries to continue with their IK-unfriendly legislation. It does not bring a solution to the information warfare (IW) experienced by developing countries in terms of their biodiversity. Both GATT and the Convention on Biodiversity do not actually protect IK from exploitation. Consequently, it is important to discuss the current status of IK, especially within the broader research community.

4.7 Exposure of IK to Western researchers

Researchers such as anthropologists, archaeologists, and biologists may be involved in scientific or cultural investigations. They may be employed by companies, governments, universities, botanical gardens, NGOs, or conservation organisations. Some multinational companies invest enormous amounts of money in research activities such as bioprospecting. The most prominent and common way through which IK is appropriated is though the research endeavours of the research institutions of the world. Commercialised IK is well-researched before being processed into final products. As such, the exposure of Western researchers to IK is an important feature of understanding the current status of IK (Goodchild 2000:344; Ostergard 2001:644; Posey & Dutfield 1996:11).

Companies investigate the useful attributes of the biological substances known to a traditional community. Although normally a product patent cannot be obtained for a naturally occurring organism, chemical or gene, patents can be obtained in some industrialised countries for one that has been altered in some way. For instance, research identifies plant varieties used by the locals and analyse the properties of such species in the laboratory. Discoveries with profit potentials are transformed into commercial products that are protected by IP regimes such as patents. The sudden interest in IK is caused by the fact that most IK has been ignored by researchers and

much knowledge remains unexplored. It is also assumed that medication for incurable diseases such as cancer and AIDS could lie in the unexplored biodiversity of the developing world. This makes it important to investigate the exposure of Westerners to IK (Goodchild 2000:344; Ostergard 2001:644; Posey & Dutfield 1996:79).

Because knowledge is power, individuals are not always willing to share knowledge among themselves or with outsiders. Knowledge is a source of status and income and is jealously guarded. A related issue is that some indigenous people fear that their IK will be misused, and lacking power to prevent such abuses, they choose to keep quiet. The quality and quantity of information resulting from a particular research activity depends on the trust established between researchers and participants. IK research presents a challenge to researchers to be patient, sensitive, open-minded, and cautious. A commitment to positive social change and to conducting enriching research is needed. Extractive research provides information to outsiders, whereas enriching research benefits local communities. Enriching research is infinitely preferable for IK research than extractive research (Grenier 1998:46-8).

Indigenous people have tried to formulate their own definitions of IK in order to identify strategies to conserve the social structure through which IK is generated. For some years, the definition of IK has preoccupied the members of the Inter-institutional Consortium for Indigenous Knowledge (ICIK) based in Pennsylvania State University. ICIK is one of over 50 growing networks of national IK resource centres that serve as local clearinghouses. (See appendix for various national IK institutions around the world.) Most of the efforts applied to indigenous IPRs are expended by non-indigenous individuals (Greaves 1996:27; Semali & Kincheloe 1999:3; Viergever 1999:333).

Foreign scientists who conduct IK research do not always understand IK from the viewpoint of the indigenous communities. Some are only interested in information about their specific areas of interest. IK must not be used as a source of information which, in the long run, does not economically and politically benefit the indigenous populace in whose environment it originates. Proponents of IK are already becoming biased to research elements that are based on methodologies, analysis techniques,

theories, and preconceived solutions that are similar to established Western research techniques. A good sampling strategy or an effective way to identify knowledgeable individuals is needed. It may also be difficult to differentiate traditional knowledge from random local views. If IK is to be used or replicated, there is a need for critical analysis of the situation in which it originated. IK will also face competition from more acceptable and better financed models promoted by international institutions, bilateral agencies or multinational companies (Mwadime 1999:265; Nabhan et al. 1996:193).

International scientific methods are too simple to capture the complexity of an IK system. IK research must capture both the tangible and the invisible. Despite the methodological challenges for IK research, very little attention has been given to the specific requirements of IK research. Whelan (in Grenier 1998:53) captures the core values associated with doing IK research in terms of three Rs: respect, reciprocity, and relationships. Values for IK research can be outlined as the following:

- *Appropriate attitude* – IK researchers need to be self-critical and must recognise their own bias toward formal scientific, urban, high-tech knowledge. It is the responsibility of the researchers to remember that IK systems may be just as valid or useful; as Western systems; and that a low-tech solution can be highly appropriate.
- *Appropriate methods* – The researcher must ensure that the research methods are tailored to people's cultures, abilities, and requirements and effectively represent local people's point of view.
- *Multiple methods* – IK research requires a mixture of techniques that together facilitate the collection of different types of data and help confirm or reject findings through a process of cross checking or triangulation. A good combination of methods can access knowledge concealed in cultural norms or political factors.
- *Broad participation* – Participation means involving women, men and children of all classes and requires both the researchers and the informants to do more than merely attending or answering questions.

One way to elicit the IK of a community is by participating in its work and leisure activities over a period of time. It would then be important to diligently observe the interaction of all factors that are at play. This leads to a need to understand the current status of IK.

4.8 The current status of IK

Researchers are generally the most important agents in investigating and improving an existing knowledge base. Their attitudes and research methods need to be appropriate when conducting research into IK. It is therefore very important that researchers understand the current status of IK in a global context.

IK is dynamic and influenced by environmental changes. The issues on IK discussed above warrant an analysis regarding the current status of IK on a universal context. Foreign institutions, such as powerful governments and their multinationals, influence the way IP is perceived and this necessitates an investigation of this issue. To identify strategies for the conservation of IK, there should be consensus on the importance of IP in terms of its role for the world as a whole and for the livelihood of indigenous communities. The decisions by the US Patent and Trademark Office to grant monopoly rights over plant, animal, and human generic materials have led to a rush to collect, map, and patent genes, based largely on their future profit potential. Despite the pressure from trade agreements such as GATT, few governments endorse the IPR system accepted by US courts. Meanwhile, the US has accused the developing world of engaging in unfair trading practices when they fail to recognise US patents within their own national boundaries. For example, there has been a strong US lobby to force all countries to recognise patents on seeds (Grenier 1998:19; Viergever 1999:338).

The corporate demand for IPRs on biodiversity is based on the premise that only their investments need to be rewarded. The existing IPR agreements fail to recognise the rights of indigenous and local communities to their own knowledge base and innovations. There are various ways of compensating indigenous communities for their contribution to IK-related research and discoveries. Individuals or tribes can be

compensated through material means that may include (but are not limited to) royalties, partnership in production, packaging or sale ventures. Compensation can also be made to the descendents of knowledge creators through scholarships. Various compensation mechanisms are discussed in chapter six (Grenier 1998:19; Nabhan et al. 1996:191).

Developing countries have strongly argued that some multinationals from the industrialised world exploit their biological wealth and then sell the patented products back to them at high prices. With the growth of the biotechnology industry, in combination with the loss of biotechnological diversity worldwide, the access to and control of genetic resources have attracted the attention of governments, corporations and others, mainly because of the tremendous potential for commercial profit. The traditional lifestyles, knowledge, and biogenetic resources of indigenous peoples have become commodities to be bought and sold. TRIPS and the Convention on Biological Diversity have made it clear that IPR is an important issue for all, and particularly indigenous people, to consider. If corporations can secure IPR protection for their inventions, then indigenous peoples, too, should be entitled to protection for their IP (D'Amato & Long 1997:87; Grenier 1998:20).

For example, within the US regime, farmers have to pay royalties on patented seeds, even they themselves were the source of the original stock. Under GATT rules, these farmers may not market or use their seeds. Commercial plant breeders, in the employ of a few multinational corporations, control all the significant gene banks. Multinationals are developing plants that respond to their own agrochemicals. The cost and administrative implications of adopting some of the new IPR systems for each patent are significant. The Convention on Biological Diversity found the following issues to be significant (Grenier 1998:21-2):

- How can a country restrict access to its genetic resources?
- If access is granted, how can traditional IK genetic resources be protected?
- If access is granted, how can law and policy be used to ensure that a fair share of the benefits from any products derived from genetic resources is returned to local communities?

If access is granted, one approach to protecting people's genetic resources is to have governments prohibit multinationals from patenting materials found on indigenous people's land. Indigenous peoples around the globe have made their position clear on many of these complex IPR questions and issues. Appropriate arrangements need to be made for the recording, storage, application and transfer of local IK within and between national and international communities (Grenier 1998:21; Semali & Kincheloe 1999:3). Most of the pharmaceutical companies come into contact with indigenous people through their researchers. In order to better understand the current context of IK, the way in which these researchers interact with indigenous people and with IK needs to be discussed.

4.9 Summary

The definition and various characteristics of IK were investigated in this chapter. It was discovered that IK is also affected by the global influence that resulted from contact between the locals and the rest of the world. IK solutions and products can be applied to appropriate situations irrespective of whether these are modern or traditional. It is also argued that Western science is not superior to IK. This chapter answered the research sub-question:

What constitutes IK and how is it treated in the global IP regimes?

International IP regimes such as TRIPS were investigated to determine how they influence IK. Due to the effects of globalisation, IK has evolved and undergone various metamorphic stages and is no longer reflects its original form. It should be appropriately used to ensure sustainable development. The current IPR regimes have proven to be insufficient to protect IK. This has led to the ownership and control of some IK products by those who have the potential to register patents for them. In some cases, these patents render it illegal for the locals to use the traditional products that they have employed for centuries. Some Western researchers see IK as an

unexplored area and conduct their research in accordance with Western principles that are not always applicable to IK.

Chapter five investigates various cases of IK infringement perpetrated against indigenous communities and how these communities could be compensated for their IK resources.

Chapter 5

IW perpetrated against the developing world

5.1 Introduction

Chapter two examined the nature of information warfare (IW) and adopted an Information Science perspective or approach in investigating IW in this thesis. Chapter four determined that indigenous knowledge (IK) is a form of intellectual property (IP) which is more prevalent in the developing world. This chapter builds on the previous three chapters and links with them in that it determines the extent to which IW is perpetrated against IK. Issues discussed in this chapter are therefore limited to the subject of IW as it related to IK. This chapter further illustrates how IW is being perpetrated against the developing world through the presentation of various cases. In an attempt to answer the main research problem statement, this chapter answers the following research sub-question:

What is the current state of IW against IP?

Several international conventions have attempted to harmonise IP throughout the world. The 1993 UN Declaration on Human Rights of Indigenous Peoples recognizes the urgent need to respect and promote the inherent rights and characteristics of indigenous peoples. This pertains particularly to their rights to their lands, territories and resources, which they derive from their cultures, spiritual traditions, histories and philosophies, as well as from their political, economic and social structures. This declaration supports the importance of investigating the issues that reflect IW against indigenous people. These issues centre on the process through which indigenous people are denied access to products originally derived from their own indigenous resources.

The aims of this chapter are to:

- prove that IW is being perpetrated against IK
- investigate various IW-based cases where IK has been appropriated without compensation to the locals
- advance some reasons for a need to protect IK

The need for a proper IK protection system go beyond the harmonisation of IP laws. It is thus very important to understand IK as property, irrespective of whether it is a communal or personal good, before discussing its commercialisation or appropriation.

5.2 IK as property

The concept of property centres on a person's rights to something owned. Property may be tangible such as land, natural resources, and goods, or intangible like services and knowledge. In the world view of indigenous people, property has intangible, spiritual manifestations. Although, in their view, property is worthy of protection, it may belong to no specific individual. As discussed in the previous chapter, IK is a property that exists within communities. The privatisation of indigenous resources is not only a foreign idea, but is incomprehensible or unthinkable to traditional communities. Communal property is the system used in most traditional societies to control access to basic resources. Traditional resources include plants, animals and other material objects, minerals and cultural artefacts. Some of these objects may have intangible qualities. The term 'property' is said to be inappropriate since traditional resources have intangible, spiritual manifestations, which are not considered to belong to any human being. IK is said to occur in the public domain mainly because it is oral and intangible. At the interface with modern society, knowledge in the public domain can be used by any person as soon as it leaves the community, and there is no clear obligation to return benefits to the community. The term 'traditional resource rights' emerged to define a bundle of rights that can be used for protection, compensation and conservation but should not be seen in isolation from IK (IUCN 1997:74-75).

The notion of individual ownership of patent rights arising from a product developed on the basis of IK is foreign to the values of indigenous populations. Property exists predominantly as a communal resource in many indigenous societies. Much of what the Western world would consider proprietary is considered communal in an indigenous society. IK may acquire further value when it is taken out of its natural setting and commercialised in a proprietary manner. It would be contrary to the accepted values of an indigenous population for one person in their community to be named the inventor or owner of what is considered to be communally held. The position of respect and leadership is generally attributed to the traditional healer or shaman. The problem arises when one attempts to place a monetary value on IK or its contribution to the natural drug product discovery effort (Mays, Mazan, Asebey, Boyd & Cragg 1996:266-267).

One of the dangers that may face an indigenous community that has obtained a patent is that others may infringe their patent right. The community may not know about it, and even if it finds out, legal action can be very expensive. Large corporations have their own lawyers and financial resources to provide legal support, while local communities rarely have such resources and advocates. There are some technological innovations derived from IK that preceded the industrial revolution and which are not recognised as proprietable because they exist in the public domain. They include fire, domestication of animals, irrigation, smelting of ores, geometry, architecture, and others. Some of these forms of knowledge are also relevant to the developed world. Also, older people have different types of knowledge to the young. Common knowledge is held by most people in a community; for example, almost everyone knows how to cook the local staple food (Goodchild 2000:344; Klopper & Van der Spuy 2000:1; Oddie 1999:239; Ostergard 2001:644; Patel 1996:307).

The fact that a trademark distinguishes one product from another makes it possible for a consumer to prefer one product to the other. Indigenous communities cannot always afford to market their products across the world and some multinational corporations may take advantage of this by marketing indigenous goods under their own trademarks. For this reason a trademark is economically valuable. Because of this value, the law affords entrepreneurs protection against the unlawful use of their

trademark by other entrepreneurs. The goods and products from any emerging markets would be disadvantaged by strong and well-established products, which are usually sponsored by the multinationals (De Villiers 2000:74; Doyle 1995:184; Klopper & Van der Spuy 2000:5; WIPO 2000:38).

Traditional products and the healing properties of the flora and fauna found in the African continent are regarded as an inheritance. In the African milieu, traditional medicine occupies the same position as pharmaceutical medicine in the modern world. However, pharmaceutical products are regarded as proprietable commodities whereas traditional medicine is regarded as part of common knowledge within the developing communities. For this reason, they are said not to satisfy the requirements of novelty and non-obviousness, but they satisfy that of utility. Transmission of knowledge within the indigenous fraternity is thus threatened. In addition to these threats, the voluntary nature of traditional education and social disturbances greatly affect essential cultural values such as traditional medicine. IK in Africa was not explored during colonialism because it was believed that Africans had little knowledge to impart and that African land-use practices were primitive and destructive compared to European techniques. Postcolonial educated Africans supported Western models of development. Only recently has there been substantial interest in IK and skills among the African élite and Westerners (Aboubacrine & Hinan 1998:121).

Some indigenous practices adapted or improved with available technology and have been registered as patents. For instance, the healing power of some plants has long been known and used by traditional communities. Knowledge of the healing properties of such plants was passed down from generation to generation. Such knowledge of healing resided in the community, and every community member could benefit from it. In addition, traditional healers benefited from the recognition and acknowledgement they received from fellow tribesmen. Some of this medicine was further processed and patented by individuals from the developed world, most of the time at the expense of the developing world (AEFJN 2002:1; Republic Act No. 8371).

It is evident that even though IK is not formally recognised as property, it is a commodity that is very profitable to those who derive economic benefit from it. IK is protected as a legal commodity and is recognised as such by those who discovered its commercial value. The value of IK within the developed world must be extended to cover the unexplored IK that still exists within developing communities.

5.3 Effects of biopiracy on IK

Biopiracy, which is closely related to bioprospecting, originates from the discipline of biotechnology. Both biotechnology and biopiracy are relatively recent terms in the English language. The original Greek word 'bio' pertains to life and living things. Biotechnology combines technological processes with living things. The term 'biotechnology' developed alongside increased research into processes for manufacturing or manipulating the development of various plants and animals. Such research includes the ability to manipulate gene sequences to create plants and animals with characteristics different to those existing in nature (Lipton 2000:204).

Bioprospecting is defined as the exploitation of natural resources for commercial purposes. Opponents to this practice refer to it as biopiracy, as it "steals" the resources from the developing countries and does not recognise at any moment the economic and cultural value of these resources for local people, or the latter's contribution to their conservation (Le Roy 2000). For the purpose of this thesis, the term biopiracy is preferred to bioprospecting. Biopiracy is the unauthorised appropriation and commercial exploitation of IK. According to Shiva (Shah 2001),

> Biopiracy and patenting of IK is a double theft because first it allows theft of creativity and innovation, and secondly, the exclusive rights established by patents on stolen knowledge steal economic options of everyday survival on the basis of our indigenous biodiversity and IK. Over time, the patents can be used to create monopolies and make everyday products highly priced.

Since biopiracy is mostly perpetrated against IK, it is important to discuss how it affects the latter. Following this, various cases on its appropriation will be discussed.

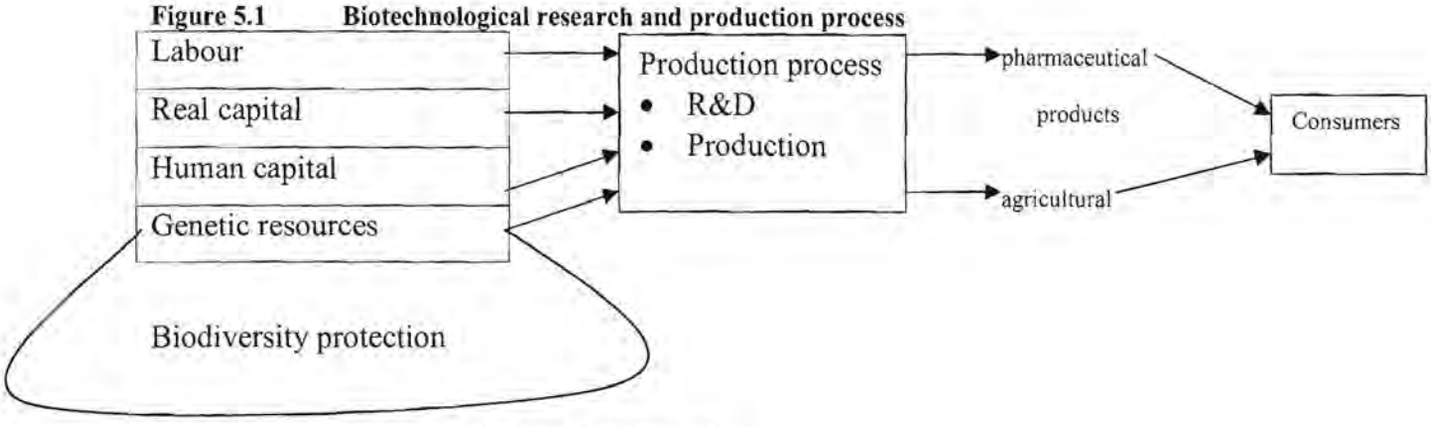
According to TRIPS, many commercial high-yielding seed varieties may be patented. This will not allow plant breeders to use protected seed for further research on development. However, farmers are allowed to save protected seed varieties from a current year's crop and use or sell them as stock for subsequent years. Approximately 80 percent of seed requirements in India are met by sales between farmers. It is feared that, over time, multinational seed companies will slowly patent the most useful genetic seed materials that exist in the international gene bank. TRIPS opponents fear that seed monopolisation via TRIPS may increase seed prices. India is thus still considered to be a predominantly biodiversity-based economy (Bhat 1996:210; Shiva 1996:2). The patenting of the Neem is an example of a case where traditional resources are monopolised through patent protection by corporations without any benefit to the original holders of the knowledge.

There are 119 drugs with known chemical structures that are extracted from plants and used in industrialised countries. Over 74 percent were discovered by chemists attempting to identify the chemical substances in plants used in traditional medicine. Certain problems are created when exclusive property rights are granted to the discoverer of genetic or biochemical information contained in genetic resources, or to the creator of knowledge about the utilisation or processing of this information. Such problems centre on the conflict between the social objectives of the efficient utilisation of already existing information and the provision of incentives for the creation of new information and knowledge. This conflict is demonstrated in the concern that granting IPRs like patents creates monopolies (Drahos 1996:65; Ganguli 2000:168; Janssen 1999:318).

A new trend exists whereby foreign countries or multinational corporations in developed countries have a huge interest in medicinal plants available in developing countries, such as India. Such information is sometimes well-documented, indicating the formulation in which they are used. It is a fact that to date, a number of medicinal plants and their uses have been patented in foreign countries. There has been criticism

pertaining to the growing trend of patenting indigenous medicinal plants and their uses. Some of the well-known plants indigenous to India such as Kala Zeera, Amaltas, Indian Mustard, Karela, Brinjal, Neem, Gudmar, and so on, have patents. Some of these patents have been successfully contested by India (Rawat 2002:1).

Figure 5.1 Biotechnological research and production process



Source: Janssen 1999:314, figure 1 (adapted)

In economics, genetic resources are considered to form part of natural resources that are defined as factors of production provided by nature. In combination with production factors such as labour, real capital and human capital, these natural resources are employed to produce goods that are of value to individuals and society. Genetic resources are especially used in agricultural and pharmaceutical research, development and production processes. The functional relationship between the input of genetic resources, labour, real and human capital on the one hand, and the agricultural or pharmaceutical output on the other hand, may be described by a production function (Janssen 1999:314). Figure 5.1 depicts the overall process of the biotechnological research and production process.

Indigenous people are becoming more aware of and concerned about the danger of biopiracy. The common danger is that indigenous people's territories are expropriated for ownership by corporations or by the state. Governments frequently claim ownership of indigenous people's land and then remove them or allow them limited usufruct rights. Without ownership rights, indigenous people cannot control access to their resources. The 4th International Congress of Ethnobiology, held in India in November 1994, considered the problem as being due to the failure of governments,

development agencies and other institutions to understand IK. They fail to respect its scientific basis and fail to recognise the IP rights of indigenous people (IUCN 1997:73-5; Shiva 1996:29).

With WIPO essentially overseeing the buy-in to the IPR system, and since its scope of work is determined by industries whose economic interests run counter to the rights of indigenous people, it is unrealistic to expect this organisation to work miracles on behalf of communities. Recognising this, anthropologist Darrel Posey (in Johnston 2000:94) has proposed a more viable concept called traditional resource rights (TRR). Many indigenous people find the TRR concept useful, and see it as a complement to developing protective mechanisms on the basis of their respective customary laws. Institutional support focuses on more generalised and exclusionary approaches, such as the Internet dialogue on IK moderated by the World Bank in 1998 and the new UNESCO work programme on IK (Johnston 2000:94).

US courts have ruled that genetic sequences can be patented even when the sequences are found in nature as long as some artificial means are involved in isolating them. This led to a race among companies to take out patents on numerous genetic codes. The lack of recognition of IK systems and lack of legal regimes to protect them led to the phenomenon of piracy. To stop this piracy and its destruction, IPRs and biodiversity legislation need to define and defend indigenous people's rights (Martin 1995:8-9; Shiva 1996:29-30).

Current patent laws are based on the assumption of the hero inventor or team hero inventorship programme. It has been argued that attempts to apply or adapt patent laws as a means to compensate indigenous populations are futile. There have been calls for the creation of a new legal concept that incorporates non-Western models of intellectual and cultural property. Such a legal concept would provide a broader scope of protection than is currently available under existing IP law (Mays et al. 1996:267).

Because of poor IP protection of patents in developing countries, individuals or corporations are met with no opposition when they plunder and export biological specimens and traditional knowledge from developing countries without due respect

for local communities' know-how or any equitable benefit sharing. Some developing countries argue, however, that the lack of adequate legislation allows their young industry to copy inventions and thus contribute to the emergence of a national industry at low cost (AEFJN 2002:7). Despite arguments that argue against IK as a form of property, it seems clear that it can indeed be considered property in its own right. Furthermore, it should be recognised as a property that can be linked to a community or individual. The next section considers cases in which IK was appropriated by the industries in the developed world without proper compensation, recognition or consultation of the relevant indigenous people.

5.4 Case studies

This section determines that IW has indeed been perpetrated against the developing world. This is done by investigating various cases that involve the appropriation of resources from indigenous communities. The cases investigated are more inclined towards the developing world because IK-based IW outside the developing world is not part of the subject of this thesis.

People can also be barred from information about indigenous resources. This fits properly in the Information Science perspective on IW. The Information Science approach to IW will be used to determine that IW has been perpetrated against the indigenous community under discussion. The aspects to be considered in each case in order of importance are biodiversity, traditional names and tourism. The following cases have been selected to prove the existence of IW against IK within the developing world.

5.4.1 Biodiversity

5.4.1.1 Thaumatin and Africa IP legislation

This section focuses on IW perpetrated against the developing world with an emphasis on the African context. African religious and cultural traditions regard the extension of patents to living organisms as intrinsically wrong. The claim to human

invention in relation to living material violates the belief in a divine creator and the notion that life is a gift, the shared inheritance of human kind. Patenting life forms reduces the value of life and nature to merely economic commodities. Many raise the question of whether patents on life forms is not an inappropriate extension of private ownership to resources that should be held in common. Unlike in industrialised countries, where the culture of profitability and production reigns, rural societies and African countries protect traditional communal rights and indigenous innovation and knowledge (AEFJN 2002:11). The case of thaumatin is discussed in this regard.

Thaumatin is a natural sweetener derived from the berries of a shrub called the Katemfe, *Thaumatococcus danielli*, which grows in the west and central African forests. This protein, which is 2000 times sweeter than sucrose, was discovered by researchers from the University of Ife, Nigeria. The berries were used for centuries by traditional people as a sweetener and flavour enhancer. In some areas the stalks and leaves are used while the berries are considered waste. Thaumatin was later used by food and confectionery industries in a number of countries. It was sometimes marketed as a low calorie sweetener and has been used to feed animals (IUCN 1997:76; Posey & Dutfield 1996:82).

A British sugar company, Tate & Lyle, has marketed the product under the name Talin. Since the plant could not bear fruit outside its natural surroundings, the company decided to import the fruit from its own plantations in Ghana, Ivory Coast, Liberia and Malaysia. The method of extraction is expensive and a number of companies attempted to apply recombinant DNA technology to the gene responsible for the thaumatin protein. Beatrice Foods obtained a patent in the USA for the process of cloning the gene in the yeast. Researchers from the Lucky Biotech Corporation and the University of California received a US patent for all transgenetic fruits, seeds and vegetables containing the gene responsible for thaumatin. The countries in which the Katemfe is grown do not benefit from the export of the berries (IUCN 1997:77; Posey & Dutfield 1996:82). If well-established IP laws existed in African countries, Katemfe might not have been exploited the way it has been. This makes it important to investigate the impact of existing IK-related legislation in Africa.

The Organisation for African Unity, predecessor of the African Union, was aware of the need for an IPR protection system compatible with WTO regulations, yet needed to consider the needs of African countries. Therefore, in 1999, it proposed a model law for the protection of the rights of local communities, farmers and breeders and for the regulation of access to biological resources. In their efforts to establish a WTO-compatible IPR protection law by 2006 at the latest, African countries are encouraged to incorporate into their national IPR legislation elements of this model law. Equitable IPR protection for African states is based on the African Model Law (AML) for the protection of the rights of local communities, farmers and breeders and for the regulation of access to biological resources (AEFJN 2002:12). Table 5.1 indicates the national legislation in some African countries in relation to the AML.

Table 5.1 National legislation in relation to the provisions of the African Model Law (AML)

Country	African national legislation approach
ALGERIA	Has legislation on environment and community rights, and government is very much aware of the AML proposals.
OAPI	The ministerial meeting of the *Organisation Africaine de la Propriété Intellectuelle*, that assembles 15 francophone African countries, agreed in 1999 to UPOV91. Pressure from the OAU and NGOs stopped its ratification in most countries and AML components are now being considered.
BOTSWANA	Legislation on access to biodiversity, farmers' rights and community rights is in process. UPOV91 rejected by ministries of trade and agriculture.
ETHIOPIA	Legislation on access and community rights has been submitted to parliament.
MADAGASCAR	A law on biodiversity access and benefit sharing has been prepared and is discussed by various ministries.
NAMIBIA	Has IPR legislation very close to the AML, most advanced pro-biodiversity and community law in Africa.
SOUTH AFRICA	Has legislation on community rights except for plant resources as its Plant Breeders'Act complies with UPOV91.
UGANDA	The OAU model is used to draft a law on biosafety, however community rights, plant breeders' rights and access are treated separately according to the South African model.
ZAMBIA	Legislation has been drafted and is awaiting discussion in parliament.

Country	African national legislation approach
ZIMBABWE	Ministries of Trade, Agriculture and Environment are studying guidelines to develop implementation of the AML.

Source: AEFJN 2002:13 (adapted)

This case of the protein plant in the central and western African regions explicitly proves the existence of IW in which appropriation of local resources resulted in a commercially viable product, but excluded poorer communities from benefits deriving from the products. Locals who purchased the products were not even offered discounts, because foreign companies controlled most of the forests where the protein plant was grown . To make matters worse in this case, the plant could not grow outside its natural habitat and the prospecting companies had to own farms in countries suitable to produce the berries. Despite this, the countries never benefited from the export of the plant product.

Not only do countries in which the Katemfe is grown not benefit from the export of the berries, but access to the berries by the indigenous people was seriously curtailed. This proves that commercialisation in the developing world which is orchestrated by multinationals is detrimental to the sustainability of indigenous resources of the poor.

5.4.1.2 India: Neem case

India is one of the biggest countries in the developing world, with a population of approximately one billion people, and an enormous number of plant species, including those with healing properties. It is therefore important to consider an Indian case study in terms of IW on its indigenous resources. Many people in India make a living through utilising the country's biodiversity. Approximately seventy percent of healthcare needs in India are based on the traditional use of medicinal plants. Research into biopiracy has provided many examples of how knowledge can be extracted from its local context and injected into Western knowledge systems. For centuries people have been collecting knowledge and biological resources from indigenous people for commercial ends (biodiversity prospecting) and this trend has

recently intensified. While Biodiversity prospecting may sometimes benefit the local community, it is rapidly becoming another form of exploitation (IUCN 1997:70; Shiva 1996:1-2).

Seeds of a species of Neem tree, *Azadirachta indica*, are scattered by Indian farmers to protect their crops from insect pests. The Neem tree also seems to possess properties that make it an effective treatment against malaria and internal worms. Its leaves are used to protect stored grain from pests and clothes from moths. Neem oil is used to make candles, soap and contraceptives and can even fuel diesel engines. Approximately 500 million Indians reportedly use Neem twigs as a toothbrush. Most of these discoveries were first made by members of the Indian rural communities (IUCN 1997:71; Posey & Dutfield 1996:80; Shiva 1996:12).

Two companies, W.R. Grace and Agrodyne, obtained patents in the United States for derivatives of Neem developed in their laboratories, even though the insecticidal, human non-toxic and biodegradable properties of Neem are far from novel and non-obvious to millions of Indian farmers. Another patent has been granted in the USA for an extract of Neem bark, which is effective against certain types of cancer. W.R. Grace and PJ Margo, an Indian company, undertook a joint venture to produce Neem-based pesticides. These companies required assistance from the Indian farmers to use the Neem. The Indian Agriculture Minister drafted the Plant Variety Act to fulfill the *sui generis* system to cover medicinal plants (IUCN 1997:72; Shiva 1996:3; Posey & Dutfield 1996:80; Shiva 1996:3).

The farmers are in a weak position to demand compensation because the knowledge of Neen's various healing properties is widespread and in the public domain. India too has weak claim because the tree is native to neighbouring countries and is now grown around the world. Many patents that are closely related to IK need to be challenged. Nature's diversity is undergoing a major process of destabilisation with the expansion of patents and IPRs into the domain of biodiversity via TRIPS and WTO (Ellen & Harris 2000:12; IUCN 1997:72; Shiva 1996:2).

IP issues in India were given wide recognition after farmers demonstrations in the early 1990s against the transnational seed company Cargill. Currently, the struggle continues against the introduction of genetically-modified terminator cotton seeds by the global life science movement. The culture of farming has been subverted in that seed breeders and providers were transformed to buyers of seed; and the traditional meaning of seed as a symbol of fertility was altered to a symbol of sterility. These processes have led to real human suffering (Thomas 1999:223).

Globalisation has resulted in the transformation of an indigenous plant, used by traditional communities for generations, into commercial products by foreign companies. This transformation has not been to the benefit of the local people because it is claimed that the information about its properties is in the public domain.

The fact that W.R. Grace and Agrodyne obtained patents in the United States for derivatives of Neem, despite the claim that this information is common knowledge in India, is not fair to the Indian farmers. A patent is a commercial commodity that gives the patent holder a legal monopoly over the exploitation of a product. This means that the indigenous communities could no longer exploit the Neem as they had traditionally done. This seriously restricted the access of the indigenous Indian community to the plant species they had used for generations. They now had to buy the products derived from the plant. Exclusion of the indigenous Indians from access to the Neem is a clear example of IW perpetrated against their biodiversity. This supports the Information Science definition of IW coined in chapter two.

5.4.1.3 Australian biodiversity and the Aborigines

The Australian aboriginal culture is one of the oldest living cultural systems on the planet. Their unbroken cultural tradition extends back over thousands of years. Their physical environment was blessed with richness in food and medicine, fresh water, and few predators. The Aborigines of Australia had little need for material possessions. Instead of material culture they spent thousands of years developing their ideas and belief systems. The dreamtime myths are far more sophisticated and

complete in their comprehension of creation than those in the Western tradition such as the Old Testament or the Ancient Greek mythology. The Aborigines had a lucid understanding of the power and significance of the natural environment. Every plant in their environment was known, catalogued, and understood for its role in life. They had numerous ways to use natural plants for medicine (Thursdayplantation 2003).

Traditional Aborigines had numerous intelligent methods for using natural plants as medicine. One recognised method was using tea tree leaf for medicinal purposes to treat skin infections, burns, rashes, and so on. The simplest use of tea tree was to strip off a handful of the leaf, crush this in the hand, and inhale the scent. This is effective for congestion and chest infections. A compress of hot mud was made from ashes and would be placed over some crushed leaf and bound onto an infected wound as a healing plaster. As the Aborigines did not have metal they could not boil water by simply placing a pot on the fire, but a simple process of boiling water was to place red-hot rocks from the fire into a bark vessel filled with water. Branches of *Melaleuca* leaves could also be pulled off and used as whisks to flick across the body to repel mosquitoes. In addition to physically chasing mosquitoes away, the slight trace of oil that was left as a result of beating the leaf against the body acted as an effective repellent. A company named Thursday Plantation registered a patent for products derived from the tea tree with no benefit to the indigenous communities. The Aborigines had to purchase the products as a price they could not always afford. This constitutes a form of IW experienced by the Australian Aborigines against their indigenous resources.

5.4.2 Names

The unauthorised use of tribal names is one of the examples of violations of indigenous people's rights. An automobile manufacturer, for example, named one of its trucks "Cherokee". Also the use of words "Hopi", "Navajo", "Sioux" and "Zuni" have been incorporated into tradenames without permission from the tribes concerned. Table 5.1 depicts various tribal names that have been used as domain names mostly by the institutions of the developed world. Through various forums, the international community must advance the debate on the consequences of

globalisation in its various dimensions, including the unauthorised use of tribal names. It is the responsibility of the international community to debate the means of protecting and preserving the IK resources of indigenous communities. In this regard, it is necessary to recognise and respect the holders of indigenous resources. The misappropriation of names erodes the rights of the owners of the indigenous names (Azmi et al. 1997:144; Britz & Lipinski 2001:236-7; Posey & Dutfield 1996:44; Protecting Indigenous Knowledge 2002:2). Table 5.1 depicts a clear example of IW in which indigenous people can no longer officially use their own traditional names as Internet domain names because they have already been claimed by foreign organisations.

Figure 5.1 Indigenous names used as domain names

Name of indigenous people	Region in which the indigenous people are located	Domain name	Name holder	Country of domain name holder	Activity
Aborigines	Australia and Pacific Islands	aborigines.com	Noname.com	United States of America	General information/portal unrelated to Aborigines
Ashaninka	South America	ashaninka.com	Ashaninka Imports, Inc	United States of America	Web site of Ashaninka Imports
Ashanti South	Ghana	ashanti.com	Ashanti Farm	United States of America	Web site of Ashanti Farm
Apache	Southwest of America	apache.com	Apache Digital Corporation	United States of America	Web site of Apache Digital Corporation
Bribri	Central America	bribri.com	Kathleen LaBelle	United States of America	Web site on bookkeeping in the restaurant industry (BRI)
Chakma	South Asia	chakma.com	J. Rick	Republic of Korea	Server error
Cherokee	North America	cherokee.com	Iklkii	United States of America	Official site of the Cherokee Nation
Chorti	Central America	chorti.com	J. Rick	Republic of Korea	Server error
Dayak	Australia and Pacific Islands	dayak.com	Dayak	United States of America	Domain Name Registration Service (referring to Dayak servers)
Fulani	Africa	fulani.com	Fulani Consulting Limited	United Kingdom	Server error
Gaviao	South America	gaviao.com	Goldnames, Inc.	United States of America	gaviao.com offered for sale
Haida General	Pacific Coast of America	haida.com	Geoff Tobiasson	Canada	Information/portal unrelated to Haida
Inuit	Arctic	inuit.com	Inuit Gallery	Canada	Web site of Inuit Gallery of Vancouver
Lisu	Asia	lisu.com	Lisu Zavidny	United States of America	Site under construction
Maasai	East Africa	maasai.com	1st Digital, Inc	United States of America	Information on Maasai
Maori	Australia and Pacific Islands	maori.com	Show-off New Zealand	New Zealand	Web site of Maori.com
Nuer	Sudan	nuer.com	Nuer.com	Maldives	Server error
Onondaga	North America	onongada.com	SaltCity.com	United States of America	Server error

Name of indigenous people	Region in which the indigenous people are located	Domain name	Name holder	Country of domain name holder	Activity
Quichua	South America	quichua.com	EcuadorArts.com	United States of America	General information/portal unrelated to Quichua
Secoya	South America	secoya.com	Rob Vickery	United States of America	Site under construction
Somali	East Africa	somali.org	Compusite	United States of America	Site under construction
Tuareg..	Africa	tuareg.com	CC Net S.L	Spain	Server error
Yanomami	South America	yanomami.com	Mercedes Meier	United States of America	Server error
Yaqui	North America	yaqui.com	Jose Mayaudon	United States of America	Server error
Yucatec Eric	Central America	yucatec.com	Swindell	United States of America	Site under construction
Zhuang	Asia	zhuang.com	Palameta Gord	Canada	General information/portal unrelated to Zhuang

Source: Draft Standard RFC 2616, The World Wide Web Consortium (W3C), http://www.w3.org

5.4.3 Tourism

Tourism can benefit indigenous communities in terms of employment opportunities, infrastructural improvement and income from trade. Tourists are usually short-term visitors travelling in groups or individually to enjoy leisure activities like sightseeing, walking, sunbathing and skiing. Tourism can have a profound impact on indigenous cultures. The sale of handicrafts and art by tourists can be a useful source of income for many communities. However, sometimes the demand leads to mass production, a deterioration of quality, and the production of imitations by outsiders who may deceive tourists about their source. The tourism industry often results in the exploitation of indigenous people, abuse of their human rights and erosion of their culture. In most cases the local people do not receive income generated from goods and services sold to visitors. Tourism has become one of the biggest threats to indigenous groups (IUCN 1997:68; Posey & Dutfield 1996:6).

A core concern of indigenous people is the commercialisation of sacred aspects of their cultures for tourism. Consequently, much energy is being directed toward the restitution of indigenous sacred sites, as provided for by the universal right to religious freedom and Articles 12 and 13 of the UN Draft Declaration on the Rights of Indigenous Peoples. Sacred sites are integral to indigenous cultural survival, IK systems and indigenous concepts of sustainability (Johnston 2000:94). The following sections discuss various cases of IW related to tourism.

5.4.3.1 Toraja case

A typical example of tourism exploitation is that of the Toraja people of Sulawesi in Indonesia who became a tourist attraction because of their spectacular funeral ceremonies, burial cliffs and architecture. Complaints were made to the government that the Toraja communities were too commercialised. In response, the government organised a team of non-Torajan consultants to plan a zoning system. One of their proposals was to preserve the traditional houses and graves in some zones. This would require the permission of the people affected; however, this permission was never sought. Another proposal was to establish a tradition-free area where the Toraja would perform their rituals and dances of life and death in front of an audience of tourists, even though the mixing of such rituals is forbidden according to tradition. The consultants' inadequate knowledge of the Toraja culture sparked resentment and stirred up rivalry between sections of Toraja society. In 1987, several communities refused to accept tourists. Some reopened to continue trade in souvenirs. Cultural exploitation in this case was so deeply entrenched that it became irreversible, contributing to loss of local autonomy (IUCN 1997:68-9; Posey & Dutfield 1996:7).

The contact of the Toraja community with outsiders brought them into the global village where they became accustomed to the monetary economy which they had never had before. In addition, the consultants' inadequate information led to poor decision making which directly affect the Toraja people. The people could no longer access their private burial sites and ceremonies without the presence of prying tourists

or researchers. This proves the existence of a warfare that destabilised this community.

5.4.3.2 Jivaro dance case

Another visible example of how the ecotourism industry may violate indigenous people's IPRs is through the appropriation of cultural expressions and symbols. During the 1998 World Conference on Adventure Travel Association and Ecotourism in Ecuador, organised by the Adventure Travel Association (an American industry group), part of the welcoming performance included a staged Jivaro dance. Part of the performance included a highly derogatory, sensational, and out-of-context costume featuring spears bearing shrunken human heads. This type of entertainment is regularly provided to ecotourists for profit, and indigenous people can neither object nor demand fair compensation through the international IPR regulatory framework.

Similarly, there is no way for the community or family of the indigenous child whose face appears on thousands of postcards, teatowels, or other souvenirs, to track the proliferation of these retail goods, let alone collect a portion of the proceeds to pay for the photographed child's much-needed education and healthcare (Johnston 2000:94). No compensation is effected to the community or individual whose faces are used in postcards and other souvenirs. Typically, such individuals and communities are so poor that they cannot contest the use of their souvenirs without their consent or proper compensation. This example proves that a form of IW is being perpetrated against the local community whereby they are excluded from the sale of their own attributes and indigenous property.

5.4.3.3 Sacred sites and trade issues

Unauthorised visits to sacred sites are a common trend in ecotourism. Multilateral talks between countries that have sacred sites are on the agenda at various forums. The Symposium on Sacred Sites, Biological Diversity and Cultural Diversity was convened by UNESCO in Paris, France in September 1998. Following this, the World

Bank hosted a Cultural Site Management Workshop in Washington D.C. in April 1999. These third party analyses can be helpful in mapping out some of the issues relating to IK. However, they are framed within a paternalistic development paradigm and the solutions generated are usually far from the needs and management traditions of indigenous people. Moreover, indigenous organisations usually hear about these events only after they have occurred; or else, they are informed that no funds are available to assist them to attend the symposiums. An illustration of this is the meagre funding that was made available for indigenous people to attend the intergovernmental negotiations on biological diversity in Nairobi, Kenya, in May 2000, where safeguarding IK was a major topic of discussion (Johnston 2000:95).

Connected to the above concerns is the appetite of ecotourists for mass-produced versions of indigenous art. Textile, printings, songs and other expressions of culture are a vital way for indigenous people to document and pass on their traditional knowledge. A chain of culture loss occurs when indigenous artisans shift away from traditional methods and principles of design to meet market demands, for example, using bright colours or generic images (Johnston 2000:94).

Health, food, security, and cultural identity are all put at risk by inconsiderate tourism. Yet to the industry, sales of such inventions are a lucrative value-added component of tourism. These types of scenarios dominated the submissions made by indigenous people to the Round Table on Intellectual Property and Indigenous People hosted by the World Intellectual Property Organisation (WIPO) in Geneva, Switzerland in July 1998. However, it appears that the most significant response indigenous people will receive in the foreseeable future is a sympathetic ear. The Global Intellectual Property Division, established by WIPO (which represents 123 countries), has launched a formal inquiry into four thematic areas identified through discussion with indigenous people. However, the level of funding for this process and means of channelling allocated funds are unequal to the task. Accordingly, its emphasis is on formulating external expert groups as opposed to empowering indigenous people to take any leading role in analysis (Johnston 2000:94).

Tourism within developing communities has become an IK asset that attracts foreigners to visit locations that are usually close to the hearts of the locals. Tourism imposes an outside influence on the local community. It can thus be said to be a factor that proves that globalisation of the locals and their IK is often accompanied by the commercialisation of IK. This translates into psychological and economic IW perpetrated against indigenous communities.

In the Toraja case, the trade in souvenirs and the performance of rituals and the dances of life and death in front of an audience of tourists depicts the highly commercialised nature of the indigenous activities of that community. In the Jivaro dance case, the appropriation of cultural expressions and symbols for commercial purposes disadvantaged the indigenous communities as they did not get any form of compensation. The commercialisation and protection of sacred sites for tourism without the consent of the traditional owners also violates the rights of the indigenous people. These three cases prove the relevance of the Information Science definition of IW coined in chapter two.

5.5 Health-related issues

The world is in the midst of a global expansion in the extent to which pharmaceutical innovations are protected by the patent system. Previously, most developing countries treated pharmaceutical innovations as non-patentable, or at best offered only minimal protection for new manufacturing processes. Growing international condemnation of the excessive price of patented HIV/AIDS medicines finally forced trade ministers to address the thorny issue of global patent rules at the WTO Ministerial Conference held in Doha in November 2001. NGOs had campaigned vigorously on the issue, arguing that the global patent rules known as the TRIPS agreement would exacerbate the health crisis ravaging poor countries. By obliging all governments to grant minimum 20-year patents, TRIPS shields pharmaceutical companies from generic competition globally. This results in higher prices for vital new medicines in both rich and poor countries. Poor people's access to new medicines for treating diseases such as HIV/AIDS, and to newly improved

medicines for drug-resistant versions of old killers such as malaria and tuberculosis, has become limited (Lanjouw 2001:2; Mayne & Bailey 2002:5).

Developing countries cannot afford adequate supplies of expensive patented medicines, and unlike rich countries, most cannot even produce cheaper generic versions. Currently, they can buy imports of generic medicines from a handful of other developing countries that have not yet fully complied with TRIPS, such as India. Many important medicines are off-patent and can be produced and sold freely. TRIPS not only stops competitors producing and exporting cheap generic versions of patented drugs, its rules also stipulate that compulsory licences can only be granted predominantly to supply the domestic market. So although India, once fully compliant with TRIPS, could issue a compulsory licence to address its own health problems, it could not grant a licence in order to address the health problems of other countries, however desperate their needs (Mayne & Bailey 2002:6-7).

Each year the US Trade Representative identifies countries without adequate protection. For example, in 1989, Brazil, India, Mexico, China, Korea, Saudi Arabia, Taiwan and Thailand were placed on the Special 301 Priority Watch List. The resulting pressure was successful in convincing several countries to change their patent laws regarding pharmaceutical protection as part of larger reforms to their IPRs systems. Korea introduced protection in 1986, and Mexico passed new laws in 1991. Brazil showed greater reluctance to follow suit, so in October 1988, the United States levied 100% tariffs on imports from Brazil in retaliation for its copying of patented drugs. In the early 1990s Brazil rescinded and in 1996 passed legislation creating pharmaceutical product patents. The United States applied similar pressure to Thailand, withdrawing its trade benefits in 1990 because of dissatisfaction with its lack of protection for pharmaceuticals (Lanjouw & Cockburn 2001:268).

TRIPS requires inventors to avail themselves for protection in the rich countries or, alternatively, in the poor countries, but not in both, whenever a product is patented for a global disease. Because the profit potential offered by rich countries' markets is far greater, firms will naturally relinquish their hold in poor countries. Almost all

developing countries rely on imported medicines to a lesser or greater extent, and will therefore be affected by the restrictions to be placed by TRIPS on generic exports. Only a handful of developing countries, including Argentina, China, Korea, and Mexico, have innovative capabilities and can produce new drugs by a process of reverse engineering. Brazil has a limited innovative capacity. For the rest, most developing countries have either insufficient or no manufacturing capacity to produce new generic equivalents themselves. In developing countries, a large proportion of the population lives below the poverty line, and most medicines are paid for by individuals. Consequently, higher medicine prices resulting from TRIPS restrictions on the production and export of cheap generic medicines will have grave consequences for people's health (Lanjouw 2001:7; Mayne & Bailey 2002:8).

Major causes of death in Colombia are cardiovascular disease and cancer. The medicines to treat these diseases are relatively costly in relation to average incomes, so that even modest increases in price have major implications for families and government health budgets. The Colombian generics industry can produce low cost versions of many basic anti-infective drugs. In addition, the government has encouraged the importation of low-cost generic drugs, which has drastically reduced costs in a number of areas. The price of a patented version of insulin, for example, fell by half in the early 1990s. With the progressive implementation of TRIPS around the world, such sources of new generic medicines will gradually dry up (Mayne & Bailey 2002:9).

The US is trying to rescind on the commitment of Ministers at Doha to find an effective solution to TRIPS restrictions on production for export. Both the US and European Commission are under pressure from powerful corporate lobbies to restrict solutions to a small number of countries, to health emergencies, and to narrow definitions of manufacturing capacity, and to introduce cumbersome procedures that could effectively make such solutions unworkable. In March 2002, the WTO TRIPS Council initiated discussions on a follow-up to Doha. At the meeting the US tabled a paper rejecting the proposed solutions put forward by the European Commission and developing countries. Instead it proposed a moratorium on WTO disputes in cases where a government allows compulsory licences for export to selected developing

countries. The US proposal is unacceptable as it provides a temporary rather than a permanent solution. As a moratorium can be ended at any time, such a move will increase rather than reduce current uncertainty, and inhibit generic production (Mayne & Bailey 2002:10).

For many reasons the current situation provides a unique opportunity to examine the research and development stimulus provided by patents. First, although the developing world already shares diseases that are important in the developed countries, there remains a set of diseases whose sufferers are found almost exclusively in less-developed countries (LDCs). Second, certain drug therapies might be particularly relevant to LDCs in their tradeoff between cost and effectiveness or other characteristics, such as patents to encourage private investment in vaccine development. Finally, establishing the empirical facts is important because patent protection is a tradeoff. The profits generated create the incentives necessary for firms to make the investments in R&D which lead to new drugs and better health, but this occurs at the cost of higher prices to consumers. It is relatively straightforward to obtain information on drug prices. In India, for example, there have been many inflammatory articles about drug prices in the popular press, both because of the GATT negotiations and in response to changes in the price control system. It is far more difficult to measure the positive effect of patents on innovation (Lanjouw & Cockburn 2001:266).

With the expansion of 20-year patenting to all countries, the generic production of new medicines for domestic use and export risks became dependent on a complicated web of compulsory licensing and exceptions. This is likely to be a nightmare of legal administration for poor countries and generic firms (although highly lucrative for lawyers). Many poor governments do not have the legal and administrative capacity to implement TRIPS or use the safeguards adequately, and all are vulnerable to diplomatic and economic pressure, especially from the US (Mayne & Bailey 2002:15).

The developing world is in desperate need of medicine produced and patented in the developed world to save the lives of millions of their inhabitants. Information on the production of life-saving drugs cannot be made available to the developing world due to the TRIPS stipulations. Access to the medical products or their patents are additional obstacles faced by the developing world. Some countries within the developing world resort to reverse engineering activities as a desperate measure to save the situation. However, such actions are highly punishable according to the stipulations of international conventions.

5.6 First World benefits

As chapter four pointed out, if IK existed in its full right in the developed world, it would not be the subject of this thesis. The purpose of a discussion on the developed world here is to explore the implication that the appropriation of IK has benefited the developed world. This section also aims to show how much these countries would benefit from revenues from the developing world should the latter be interested in their patented inventions and research findings.

Countries who are bound to benefit from the harmonisation of IP laws are primarily those whose domestic economies and exports are tied to the servicing of the 'life sciences' and information economy. For instance, the largest US trade export item in 1996 was software and entertainment. Some developing countries, including China and India, have strong information capacities in certain areas but not others. Ideally, these countries would have preferred a stake in the international information market before having to accede to IP rules, but have been forced to do so under the terms of multilateral trade negotiations at the WTO conventions (Thomas 1999:220).

The domination of developed countries in the field of technology generation is evident from the 95 percent ownership of patents by the US. (See table 5.1 for the domain names that are registered using traditional names that originate predominantly in the US.) The strengthening and harmonisation of the IPRs regime will lead to a substantial increase in the flow of royalties and license fees from developing to developed countries. McCalman (in Kumur 2002:40) has quantified the impact of patent harmonisation and

finds that it has the capacity to generate large transfers of income between countries, with the US being the major beneficiary.

There is a growing reluctance on the part of some developed countries (notably France and Canada) to accede to pressure to liberalise cultural goods and services. At the WTO, Canada moved recently to negotiate for an international instrument by which countries would agree to treat cultural goods and services as significantly different from other products. This points to the growth of a larger awareness towards curbing free trade in the interest of national and cultural priorities (Thomas 1999:227).

Technology-rich nations, generally Western nations, have to encourage the transfer of technology to underdeveloped countries who are rich in biodiversity. Those people who discover the potential of plants, such as healing potential, are acknowledged as pioneers and held in high regard when they patent such discoveries. This excludes the indigenous populace from the harvesting and utilisation of their indigenous plant species. In terms of IK, the Internet has become a tool for communicating information about biodiversity (Greaves 1996:27; Viergever 1999:333; Semali & Kincheloe 1999:3).

In the eyes of the developed world, IK lacks legitimacy and is perceived as being outside of conventional scientific understanding. Many environmental scientists regard traditional knowledge as anecdotal, non-quantitative, out of date, and amethodological; others argue that it lacks scientific rigour and objectivity. Related to this point is the way that some holders of traditional knowledge view their own knowledge. For example, some local people may view their own knowledge as backward (Grenier 1998:49-53).

Chapter three stated that the Western perspective of IP is the most dominant view. IK is seen as unexplored territory. Tribal names are appropriated and registered as domain names without compensation for or recognition of the indigenous communities who own such names. This constitutes a serious form of IW that is perpetrated against indigenous communities and their resources.

5.7 Reasons for protecting indigenous knowledge

The various cases mentioned above provide good reasons for the protection of IK. Because IK is a form of IP, it is required for appropriation. Biopiracy is the most common threat to IK experienced by indigenous people. It is therefore important to further explore the reasons for protecting IK. It is logical that if corporations can secure IPR protection for their inventions, even those derived from the IK systems of indigenous people, then the indigenous people should also be entitled to IPR protection. The more indigenous artefacts are used in commercial or entertainment settings, the greater the danger of exploitation through commoditisation or misrepresentation (Britz & Lipinski 2001:238).

IK has the potential to be translated into commercial benefits by providing valuable leads for the development of useful products and processes. The unauthorised commercialisation of the knowledge, seeds and plants of traditional communities, and the extraction of their own biogenetic material without their informed consent, undermines indigenous peoples. Due to the globalisation of production systems, the increase in population, and the destruction of forests for agriculture and timber purposes, biodiversity is declining at a rapid pace. Biodiversity and associated IK are also declining due to decreased motivation amongst the local communities to conserve and protect them. This is happening because of changes in traditional lifestyles as well as the misappropriation of the resources and knowledge of local communities. The misappropriation of IK does not only violate the rights of the communities who conserved IK, but also adversely affects the conservation and sustainable use of both the IK and biodiversity (Mulenkei 1998:125; Posey & Dutfield 1996:44; Protecting Indigenous Knowledge 2002:2).

On the other hand, public disclosure and the use of secret knowledge, images and other sensitive information are often perpetrated by tourists (as highlighted in this chapter) and by some researchers (discussed in chapter four). Filming and taking photographs without permission also undermines indigenous communities. Video

images of indigenous people are sometimes used for commercial purposes, especially advertising by multinational companies. Advertising and tourism promotion literature aimed at attracting foreign tourists to a country sometimes feature indigenous people. Guatemala, for instance, used photographs of Mayan people and their art to attract tourists in spite of the fact that these people have suffered brutal repression for many years at the hands of the Guatemalan governments (Posey & Dutfield 1996:44).

In order to prevent the violation of IK, it is imperative that indigenous resources be protected. The national biodiversity conservation regimes must comply with the objectives of the Convention on Biological Diversity. These regimes may provide legal protection for biological resources and associated IK at the national level. The WIPO Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore is in the process of working on issues relating to contractual practices, IK databases and the preparation of a document containing elements for a possible *sui generis* system for the protection of IK (Mulenkei 1998:126; Protecting Indigenous Knowledge 2002:3).

5.8 Summary

Indigenous communities are very dependent on IK resources for their survival. Kinds of IW facing IK resources, such as biodiversity, names and tourism, were discussed. Health-related issues and some of the First World benefits from IK appropriation were also discussed. On the other hand, more indigenous artefacts are sold commercially. The commercialisation of indigenous seeds and plants is a serious threat to the existence of indigenous communities. Globalisation has increased the number of people who are interested in IK and more incidences of IK appropriation have consequently occurred as highlighted by the case studies. The misappropriation of IK does not only violate the rights of communities but also affects the conservation of sacred artefacts in these communities. All these examples clearly illustrate that a concerted IW effort has been perpetrated against the developing world. In cases where IK is protected by IP, indigenous communities are no longer at liberty to exploit their

resources as they used to. Although newly patented products are made available to them, this is at a price that few can afford.

This chapter investigated various cases that prove that a form of IW is perpetrated against IK. Case studies illustrating biodiversity appropriation issues, indigenous names appropriation and tourism proved the existence of IW against IK. In an attempt to answer the research problem statement, this chapter answered the following research sub-question:

What is the current state of IW against IP?

It is necessary to determine what current measures are employed to promote and protect IK. Chapter six will therefore investigate various measures employed to promote and protect IK.

Chapter 6

Current measures employed to protect IK

6.1 Introduction

The previous chapter proved that IW is perpetrated against IK by investigating various cases in which evidence of IK appropriation could be found. Various measures are currently employed to protect IK and which are implemented in conjunction with the *sui generis* IP laws. It is imperative to investigate measures that are currently employed to promote and protect IK. In an attempt to answer the main research problem statement, this chapter answers the following research sub-question:

Which measures are currently used to protect and promote IK?

The measures investigated in this chapter include mechanisms through which indigenous people can be compensated for their appropriated IK. Such mechanisms depend on the recognition of the relevant indigenous groups as being the appropriate owners of the IK in question.

6.2 Recognition of IK and indigenous people

It is important to recognise the values of IK and the resource management abilities of indigenous people in order to promote sustainable development. This should assist such communities in recording and documenting their own knowledge, including their oral tradition. An interdisciplinary approach that integrates social and biological or natural scientists with indigenous specialists is required. IK cannot be fully understood when analysed independently of the social and political structure in which it is embedded (IUCN 1997:88-9).

A product patent cannot be obtained for a naturally occurring organism or gene that has not been isolated. This rules out the patenting of useful IK relating to naturally occurring organisms. Some traditional medicinal or preparations made from natural substances could be regarded as patentable modifications or combinations and thus process patents may be obtained for them. Indigenous people may be able to patent a certain amount of their knowledge but one major obstacle to this is that the process of acquiring a patent, which includes payment for filing, the examination, and the grant, is expensive and time-consuming. Community control over access to IK is seen as a basic right and is supported by international governments and conventions such as the Convention on Biological Diversity. Several mechanisms for securing community control over IK are the following (IUCN 1997:91-2; Posey & Dutfield 1996:37):

- establishing national IK resource centres to coordinate the exploration and use of IK for sustainable development in partnership with indigenous organisations and communities
- creating a network with appropriate protocols that would link national indigenous resource centres and indigenous organisations. The network should also regulate the transfer of technology and knowledge
- recognising IK holders as equal research partners
- using IPRs where appropriate
- encouraging ethnobiologists, university-based organic chemists and pharmacologists to act as neutral brokers in relations with pharmaceutical companies
- linking the marketing products derived from indigenous resources directly with indigenous harvests to increase both the indigenous share in the market and the benefit to local communities
- sharing income arising from the use of IK
- labeling sources of products and packages.

It does not seem possible to stop the international interest in IK. Rather, the above measures would help ensure that indigenous people are included in the process of the commercialisation of IK . A more realistic approach to this problem would be for

indigenous people to learn to live with and manage this process. This begins with recognising the role of indigenous people in this regard. To begin with, an inventory of national IK resources is needed. The most efficient way of establishing such an inventory is to start by documenting IK resources. In light of this, issues related to the documentation of IK are discussed in the following section.

6.3 Documenting IK

Indigenous communities are becoming increasingly aware of the many benefits of documenting IK. Some indigenous communities have established databases which they maintain themselves. This strengthens their ability to control access to and use of their indigenous and related knowledge (IUCN 1997:117-8). Conversely, there are some institutions that maintain websites containing IK information which were not established in consultation with the indigenous communities who provided such information.

Community registers have been developed in countries such as India as a means of securing community control over traditional ecological knowledge. Locals document all known plant and animal species with full details of their uses. Community members are then in position to refuse access to the register. They usually set conditions under which others would be allowed access. Sacred sites and secret information are not made part of the common register. Some registers are freely available to communities. This is intended to make the patenting of indigenous knowledge by others more difficult as by reading the register, community members will become more vigilant. Contracts are the most accessible and easily instituted legal instruments that can assist in the protection of IK. Registers can be quickly drawn up and they require little legal expertise to implement. They can guarantee upfront payments, training, technology transfer, royalties and other financial and non-monetary forms of benefit sharing (IUCN 1997:118-9&140). Proposed compensation mechanisms are discussed further on in this chapter.

Documentation of IK is one means of giving recognition to knowledge holders. However, merely documenting IK does not necessarily imply that the benefits arising from its use will be shared, unless it is backed by some kind of mechanism for protecting the knowledge. Documentation of traditional knowledge may serve only a defensive purpose, namely, preventing the patenting of this knowledge in the form in which it exists (Protecting Indigenous Knowledge 2002:5; Viergever 1999:338).

It is quite clear that existing IP protection regimes do not adequately recognise the rights of IK holders. National level mechanisms and legal provisions are required both to prevent biopiracy and to install informed consent mechanisms to recompense IK holders. However, these mechanisms will only be effective if they are recognised internationally and enforced in other countries. In this regard, there is a need for the development of an international mechanism for protecting IK. Such an international mechanism should include local protection of the rights of IK holders through national level *sui generis* regimes, including customary laws (Mulenkei 1998:126; Protecting Indigenous Knowledge 2002:6).

During the process of documenting IK, it is important to discuss cooperation between bioprospecting researchers and the holders of IK. The researchers' contact with IK, as discussed in chapter four, should be enhanced by meaningfully involving the locals in their research endeavours. Joint ventures and collaborative research are the most practical ways of involving locals when conducting IK-related research.

6.4 Joint ventures and collaborative research

Joint management of IK in this context implies a certain relationship between government, indigenous communities and parties interested in IK. Such relationships may vary from government retention of key management functions through various forms of partnership to full indigenous control. Indigenous people must have a stake in the management of local resources on which their subsistence economy is based. Cooperative or co-management arrangements in which indigenous communities share management authority with other government organs represent an incremental step

towards self-determination. Such benefits should entail aspects such as joint research and information sharing systems (IUCN 1997:132-3; Mulenkei 1998:126).

Collaborative research is undertaken between two equal parties based on agreed objectives and methods. Conditions necessary for collaborative research may depend on the ability of an indigenous group to regulate access to their lands. For indigenous people to participate in collaborative research, the process needs to be cross-cultural, multilingual, and geared to free exchange of information and viewpoints. The terms of the collaboration should be negotiated, and activities of the researchers working within indigenous people's territories must be controlled. Models of collaboration between indigenous and non-indigenous experts and scientists for collecting, processing and applying IK are varied and must be adapted to local situations (IUCN 1997:141-2).

Indigenous people need to be recognised and compensated for the role played or contributions made during research. There are various ways in which indigenous people could be compensated for their research contribution. These may include monetary and non-monetary compensation. Such compensation mechanisms are discussed in the following section.

6.5 Possible compensation mechanisms

Compensation is expected to vary depending on a number of factors. For example, in the pharmaceutical industry, if knowledge and resources are contributed during the early stages of the research only, compensation in the form of royalties will be quite low. If the knowledge and resources identify an actual product, royalties may be higher. It should always be determined whether the form of compensation reflects the community's needs and desires or the researchers' perception of the situation. Money may not always be the most suitable form of compensation (Posey & Dutfield 1996:37-38).

The question of whether compensation is merited on moral grounds alone depends on the individual country's national laws. Compensation of source communities for knowledge and biogenetic resources is problematic and will invariably differ from case to case, not only in quantity but also in type of compensation. A number of compensation mechanisms, such as funds, contracts, IPR agreements, nonbinding agreements, and defensive publications are used as compensation. Defensive publications are used for compensation, benefit sharing, and the protection of IPR. The same mechanisms can be applied to IK (Grenier 1998:23; Posey & Dutfield 1996:37).

6.5.1 Funds

Companies can establish funds to compensate communities for appropriated IK that is no longer widely available. Such IK might be unattainable because the original innovators are anonymous or no longer living. This type of mechanism can support a wide variety of regional goals, such as biodiversity-conservation programmes (Grenier 1998:24).

6.5.2 Contracts and IPR agreements

Contracts are legally binding agreements between two or more parties that enable the contractees to take legal action on their own behalf. This may be appropriate if knowledge and resources are not widely known and are not in the public domain. A community's contract with a company may give the community (among other things) rights, local training, royalties on compounds, or the option of filing a joint patent with the company or having local community members named as inventors. Contracts can address issues of confidentiality and exclusivity. A confidentiality clause can ensure that the knowledge or material will not be made available to anyone else without the community's permission. The company may request exclusive rights to the information or material supplied (Grenier 1998:24).

Material transfer agreements (MTAs) establish standards for the transfer of biological resources and outline the benefits to the supplier (for example, upfront benefits, a trust

fund, or future royalties). When the material has commercial potential, MTAs usually grant the commercial party the right to apply for patents. Information transfer agreements (ITAs) move one step beyond MTAs. ITAs give communities the right to be compensated for material transfer and also the right to be recognised for their intellectual contribution by having community members named as inventors in the patent application, or by being able to file a joint patent with the company. Licensing agreements enable a community to sell a patent to a company that is better equipped to market a product. Under a licensing agreement, a company pays fees to the community for knowledge (or samples); and the community transfers this particular knowledge to no other party besides the company during the period that the licensing agreement is in effect (Grenier 1998:24; Posey & Dutfield 1996:68-9).

6.5.3 Non-binding agreement

A letter of intent or a memorandum of understanding is a statement of principles between parties that serves as a framework for a future legally binding contract. A letter of intent or a memorandum of understanding can address issues of confidentiality, the sharing of research results, and the provision of benefit, but is not legally enforceable. Covenants establish principles for future legally binding agreements and often contain ethical commitments (Grenier 1998:25).

6.5.4 Defensive publications

Inventors may publish a thorough description of their invention containing information on how to use it. After the date of publication, any patent claim for the same invention will be invalid. The quality and form of compensation for IK are complex issues. Competition should depend on how closely the commercial product is related to the traditional compound or use. If a community contributes knowledge and resources during the early stages of research only, royalties can be as low as one to five percent. If the commercial product is based on an indigenous product, royalties can be as high as 10 – 15 percent. The details of such arrangement are negotiated on a case-by-case basis (Grenier 1998:25).

Compensation mechanisms do not preclude the protection of IK. It does not mean that if indigenous people were rewarded for their knowledge, IK could be left at the mercy of prospecting researchers. IK should be protected and compensation could be administered on a case-specific basis. The following section addresses the need for additional mechanisms by which IK could be protected.

Effective measures are needed to protect IK. The cases discussed in the previous chapter show that serious IK appropriation has taken place. Protection against such appropriation is scarce, since current international IP regimes and conventions were not designed with IK in mind. The following section investigates the necessity of designing appropriate IK protection systems.

6.6 Systems for IK protection

It has become apparent that piracy in the form of IK appropriation is being perpetrated on the part of certain Northern corporations against Southern communities. The cases mentioned in the previous chapter bear testimony to this piracy. The lack of legal frameworks for the protection of IK has made indigenous communities of the developing world vulnerable to biopiracy. More generally, biopiracy is one way for some rich countries to extract wealth from poorer countries (Martin 1995:9; Shiva 1996:10).

WIPO agreements appear to allow the retention of an indigenous system, but this is not a real alternative. In defending trade-related actions, the systems recognised by international conventions have the legal benefit of the doubt whilst the indigenous system must prove itself. However, developing countries do not always have resources to prove themselves (Finger & Schuler 2000:522).

The attempts made by the Convention on Biodiversity to outline some measures to protect IK were not sufficient. The convention promotes the idea of biodiversity as a global common heritage which, therefore, requires biodiversity-rich countries to allow other countries access to biological resources on mutually agreed terms. It requires

technology-rich nations (generally developed nations) to encourage the transfer of technology to biodiversity-rich, developing countries. Thus, the Convention promotes the exchange of biological resources for technology to facilitate bioprospecting, which benefits all nations in the world. This clearly spells out a need for an inclusive system of IP regimes to protect IK (Bhat 1999; Thrupp 2000:280).

In the Uruguay Round, IPR was linked for the first time with international trade to become what is known as Trade Related Aspects of Intellectual Property (TRIPS). Some TRIPS provisions differ dramatically from some of the patent regulations which prevail in the developing countries. TRIPS provisions restrict the way farmers and the local people have traditionally utilised biological resources and their derivatives (McCalman 2001:161).

The international environment has changed considerably with respect to IP with the conclusion of the TRIPS agreement. The TRIPS accommodates the demands of the industrialised countries for higher international standards of protection by mandating the extension of patentability to virtually all fields of technology recognised in developed countries' patent systems. This could prolong patent protection for a uniform term of twenty years, and provide legal recognition of the patentee's exclusive rights to import the patented products (Kumar 2002:37).

TRIPS is not a product of negotiations. It was imposed by transnational corporations on the citizens of the world. These corporations achieved this by manipulating the governments of industrialised countries into consensus. TRIPS is not a result of democratic negotiations between the larger public and commercial interests or between industrialised countries and the Third World. TRIPS is weighted in favour of transnational corporations against Third World countries. TRIPS recognises IPRs as private rights which lead to a corporate monopoly. The other limitation of TRIPS is that it recognises IPRs when knowledge and innovation generate profits, but not when they meet social needs. However, it seems fair that ideas produced in rich countries be provided to poor countries at no cost (Martin 1995:9; Shiva 1996:18-19).

It is a costly process to determine the genetic and biochemical information contained in biotic material, and to further generate information on how to apply basic knowledge to produce and develop useful products. However, once this is generated and incorporated in new products or technologies, the copying or emulation of the new product or process is relatively cheap, such that the access to the new information is almost free. Because of this, producers of information or knowledge have difficulty capturing at least some of the social value of their creative activity, and hence difficulty in meeting the costs of producing innovations (Finger & Schuler 2000:512; Janssen 1999:318).

The Western patent system is inappropriate for the subject of biodiversity or living resources. The shift from the chemical era to the age of biology creates new problems of patentability. Patents on biodiversity falsely claim that properties of plant-derived drugs are 'products of the mind' when they are actually products of plant biodiversity. Plant-based medicines depend on existing properties and characteristics of diverse plants. The boundary between the 'product of nature' and the 'product of mind' is therefore blurred in the case of plant medicines. Medicinal plants in indigenous systems of knowledge are the basis of most patent claims by Western enterprise (Shiva 1996:23).

Instead of recognising the innovation of traditional systems, recognition and protection under Western-style patent regimes are given to minor modifications of IK systems by practitioners of Western science. Thus, patents cannot offer protection to the intellectual heritage of practitioners of indigenous medical traditions. Traditional knowledge relating to biodiversity is not patentable by indigenous practitioners since the criteria of patentability are novelty, non-obviousness and industrial application. Knowledge pluralities have been transformed into knowledge hierarchies as a result of colonial biases which have treated Western knowledge as exclusively scientific and non-Western knowledge systems as unscientific. A pluralistic IPR regime needs to be evolved which makes it possible to recognise and respect IK systems, practices and livelihoods (Shiva 1996:23-5).

If no property rights are accorded to IK, then for many companies, such information will remain a free input for production. Most IK is said to fall outside the scope offered by standard IP regimes. The creation of *sui genris* regimes was proposed as suitable for the developing world. A possible *sui generis* strategy for the developing world is that each developing country should legislate for a *sui genris* form of protection for IK within its borders. The *sui generis* system should later be linked to the national statutory regimes of developing countries that are participating in the process. Once a significant number of developing countries agreed to participate in such an agreement, it is likely that the Western world would also join (Drahos 1997:209-211). This arrangement is unjust to the developing world because IK is sidelined and removed from the international platform of protection.

IP cannot alone sufficiently protect IK. All IK resources need to be documented, digitised and stored in national repositories. Any registration of a patent or an invention based on an IK resource could be verified against this repository and further actions could then be taken against any infringement. There is a need for an additional system to protect IK and also improve access to it. An internationally agreed upon system that recognises national level IK protection should also be designed. Such an instrument would not only help to prevent biopiracy but would also ensure that national level benefit-sharing mechanisms and laws are respected worldwide. However, the efforts to develop such a system should not lead to the harmonisation of national level *sui generis* systems but should rather recognise the diversity in national level systems and provide for international recognition of this diversity. There is a dire need for another system to protect IK in addition to the existing IP regimes.

6.7 Summary

This chapter investigated some of the measures that are currently employed to promote and protect IK. It was proposed that some *sui generis* IP laws be employed together with various measures to promote and protect IK. Various measures currently employed to promote and protect IK include documenting IK resources, joint ventures and collaborative research, as well as various financial compensation measures. In an

attempt to answer the main research problem statement, this chapter answered the following research sub-question:

Which measures are currently used to protect and promote IK?

It was further discovered that these measures do not adequately promote and protect IK and that an additional system is required to protect and promote IK. Chapter seven investigates the use of information and communication technologies as additional mechanisms to promote and protect IK.

Chapter 7

Using ICT to protect and promote IK

7.1. Introduction

The previous chapter identified some limitations in the use of intellectual property (IP) laws and some measures currently implemented to protect indigenous knowledge (IK). It also suggested that there is a need to implement another system in addition to existing measures to protect and promote access to IK. Such a system must be appropriate for the information age in which globalisation is a growing trend. The additional system should also be able to protect any form of IP, in other words, it should not be limited to IK only but should also be applicable to other forms of knowledge. In an attempt to address the main problem statement, this chapter answers the following research sub-question:

What information and communication technologies (ICT) solutions exist to promote and protect IK?

In an attempt to answer this research sub-question, this chapter aims to explore the possibilities for the protection and increased access to IK. This will be done through a consideration of the following proposals:

- Briefly determine the existence of IK on the Internet.
- Establish IK Resource Centres (IKRCs).
- Implement the repositories to store and preserve digitised IK resources.
- Employ cryptography and digital watermarking techniques to protect IK resources.
- Use the Dublin Core (DC) Metadata Element Set, the World Wide Web and multimedia standards derived from DC to organise IK resources into repositories

- Use the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) as an interoperable transport protocol to harvest the metadata from the repositories.

7.2. Background

Documented IK must be protected and preserved digitally. Digital preservation can be defined as managed activities to ensure continued access to electronic resources. Access is the key factor here because it does not help to preserve digitised IK information that cannot be easily accessed. If an IK resource cannot be used effectively anymore, it is pointless to preserve it. It is thus very important to protect and promote digitised IK. This section does not, however, address the protection of IK in printed books. Contrary to digital material, it is relatively easy to preserve printed material for decades or even centuries. First, paper is usually very durable material. Second, humans can extract information from a book by a simple process of reading. Third, understanding the information is possible since written languages have not changed entirely and there are human experts who can translate the documents into a commonly understood language. Electronic resources differ in a fundamental way from printed resources. Every electronic resource has to be interpreted by an application before it can be displayed to and understood by humans (Hakala 2001a). Before investigating the actual promotion and protection of digitised IK, it is thus important to investigate the Internet as an important tool to communicate digital IP. In addition, the existence of digitised IK on the Internet must be explored.

7.2.1 Internet as an important tool of communicating digital IP

The most prominent phenomenon of the information age is the Internet. The Internet began in 1969 when the US Department of Defense created a computer-based failsafe communication system for the US President. This system was called the Arpanet. It was intended to give the signal for war in the event of nuclear attack, and to conduct such a war safely should traditional means of communication be knocked out. It was later extended to form links between the Pentagon and university researchers conducting military research. Gradually the Internet expanded to communicate non-

classified research and personal messages. The Internet has become the most open, uncontrolled and heavily trafficked communication system the world has ever seen. Modern-day IW is conducted via the Internet because organisations and individuals are dependent on it for communication (Graham 1999:484; Harris 1998:135-6; Hofman et al. 1999:11-12).

Technology is advancing too fast for the law in the area of IP. The main problem is that the Internet is an international tool and that IP regulations are nationally based. As chapter three pointed out, each country has its own laws regulating copyright, trademarks, patents, designs and trade names. The revolution in information technology is making information easier to access and move around. Should national patent offices allow access to their collection via the Internet, this would be a major breakthrough for the efforts of information transfer. Such endeavours would be driven by the need to reduce registration costs at the patent offices, to please governments and industrial applicants who want lower fees. This would likely be driven mainly by the developed world due to their stronger bargaining power. The availability of patents via the Internet would entail less use of expert help for patent searches (Bettcher et al. 2000:526; De Villiers 2000:37; Van Dulken 2000:273).

Society can increasingly be defined in terms of information-poor and information-rich communities, but boundaries may shift as technology becomes available and it is difficult to predict whether those who are currently disadvantaged will continue to be so in the future. The unequal distribution of resources such as IP, telecommunications and technical skills, causes concern about the ability of developing countries to participate in the emerging world economy. There are fears that globalisation trends may result in a further marginalisation of poor countries within the world economy and may lead to disruption of their social fabric (Avgerou 1998:15; Elman 2001:896; Pye 1999:307). Challenging intellectual property must involve the development of methods to support small intellectual producers. An obvious way to challenge IP is simply to defy it by reproducing protected works, which is punishable according to the stipulations of the international conventions (Martin 1995:19; Shiva 1996:27-8).

The nature of the Internet may force international governments to standardise law, not only in the intellectual property field, but elsewhere also. Currently international relationships in the area of IP, in South Africa for instance, are governed by several international conventions and agreements, most notably the Berne Convention (see table 3.1 in chapter three), and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). These conventions dealt with copyright, trademarks and patents. The TRIPS agreement and the other Conventions make some provision for the enforcement of IPRs across borders and oblige signatories to grant protection to foreign works through amending their domestic legislation. These Conventions were aimed at harmonising IPRs across the world. Because these agreements were signed before the Internet became the force it is today, they do not address the problems associated with it (Bettcher et al. 2000:525; De Villiers 2000:37; Wallis et al. 1999:9; WIPO 2000:27).

By making IP work available on the Internet, the copyright holder must implicitly grants a non-exclusive licence to all Internet users who have access to the material to make transient copies of such works on their computers. Where a user gains access to material without proper authorisation, it could be argued that authorised access resulted in copyright infringement. This might be applicable to material on a website available to the general public. When determining copyright infringement, the courts evaluate the substantial similarity between works (Beutler 1997:254; De Villiers 2000:39-40; Goodchild 2000:352; Harris 1998:9; Hofman et al. 1999:85; Lloyd 1997:299; Search 1999:191).

Exposing works via the Internet holds an inherent threat of the illegal use of such works. There is a totally new reuse capacity of electronic works; original work can be copied over time without loss of quality. Stealing IP has become easier with digital technology. Electronically copying someone else's work takes very little time and almost no effort, often costs very little, and the reproductions are as perfect as originals (De Castell 2000:369; Granstrand 2000:340; Hart 1995:128; Hofman et al. 1999:85; Lloyd 1997:279; Search 1999:191).

Referring to the current Internet, Clifford Lynch (in Hakala 2001a) states that:

> The Internet – and particularly its collection of multimedia resources known as the World Wide Web – was not designed to support the organized publication and retrieval of information, as libraries are. It has evolved into what might be thought of as a chaotic repository for the collective output of the world's digital "printing presses." This storehouse of information contains not only books and papers but raw scientific data, menus, meeting minutes, advertisements, video and audio recordings, and transcripts of interactive conversations. The ephemeral mixes everywhere with works of lasting importance. In short, the Net is not a digital library. But if it is to continue to grow and thrive as a new means of communication, something very much like traditional library services will be needed to organize, access and preserve networked information.

The presence of IK on the Internet is a recent phenomenon because IK has recently started to intrigue many people. Many of the IK-related websites support and encourage research on the subject of IK. They also solicit financial and student support for their academic and postgraduate research programmes. The main reason for making IK available on the Internet was to coordinate the work that was being done internationally on IK. ICTs became the most feasible mode of communication and this was accelerated by technological advances, improved availability of computers and increased Internet access. Indigenous people themselves have limited or no access to the Internet. Even if they obtain access to the Web, they may lack training and familiarity with the technology (Le Roux 2003:107-108). The Internet can be regarded as a tool for communicating IK. However, the information on IK resources available on the Internet is not always controlled or verified with the indigenous communities.

7.2.2 IK on the Internet

There are various organisations that fund IK-related research and projects across the globe. These organisations include governments and multinational companies, especially pharmaceutical companies, that contribute funds to IK-related research. The World Bank, for instance, funds various development projects around the world, including IK-related projects. As discussed in chapter five, some of the information on IK resources available on the Internet could easily originate from appropriated IK resources. Although such IK is protected by various IP regimes, it is not possible for the poor indigenous communities to contest the appropriation thereof. The World Bank in particular has an IK Internet database available (see http://www4.worldbank.org/afr/ikdb/search.cfm) to which anyone can contribute. There is no form of control and verification of the information included in the database. The fact that anyone can contribute anything to the database means that serious inaccuracies and falsifications may be included. Thus, the quality of the information contributed to the database cannot be trusted.

Several other databases on the Internet contain information based on IK resources collected across the developing world. These databases are not always constructed in conjunction with the indigenous communities whose IK is sought after. Most of these databases are not related to each other but they, to some extent, contain similar information on IK resources from various geographic regions of the developing world. Duplication of information cannot be easily identified. The cataloguing of the information in most of these repositories does not conform to any standard. The following URL is a reference to UNESCO's IK database which contains information from various areas of the developing world: http://www.unesco.org/most/bpikreg.htm.

Academic institutions within the developed world also possess catalogues of IK resources, which are integrated with their main academic collection. Such IK resources are kept for research purposes. A number of institutions are already promoting IK as a popular research topics. This is not yet a reality in some academic institutions of the developing world. The Antioch New England School Library's Indigenous Knowledge Gateway Page is an example of such a catalogue (see

http://library.antiochne.edu/LIBPAGE/Envstudies/indigenous).

It is now very clear that digitised IK has been available via the Internet for some time. In most instances, the indigenous communities are not consulted prior to making information about their IK resources available on the Internet. Information on IK resources available on the Internet should be promoted through its indigenous owners and protected from appropriation. The next section illustrates various ICT-based mechanisms that could be implemented to protect and promote digitised IK.

7.3. Management structures to protect and promote IK

Based on the Information Science perspective, this section will focus on the management structure required to protect and promote IK on the Internet. Electronic organisation and retrieval of information are measures that may improve access to information and eliminate problems that are usually experienced with the communication between end-users and indirect information sources (see figure 2.4 in chapter two). The Dublin Core (DC) Metadata Element Set and the Open Archives Initiatives (OAI) are the *de facto* standards used for information organisation and retrieval. The purpose of implementing DC and OAI is that they support detailed analysis and retrieval of the intellectual content of an information resource. DC and OAI should be implemented to strengthen the existing IP laws that protect IK. The importance of having a national body in each country, particularly the developing IK-rich countries, to oversee the exploitation of domestic IK must be emphasised. The overall aim of this section is to explore the establishment of appropriate management structures to promote, protect and improve access to IK.

7.3.1 Repositories

Repositories are required for the storage of digitised IK. Modern-day repositories are electronic databases supported by specific application software. Copyright on databases is enforceable and the arrangement of their contents constitutes the author's own intellectual creation. IK databases are to be protected by copyright. The authors

of a database are defined as a natural person or group of natural persons who create the database. The rationale behind the introduction of databases is purely economical, but it protects the author's creativity in the selection and arrangement of the content of databases. In this instance, the official author of an IK database will always be the relevant Indigenous Knowledge Resource Centre (IKRC). The *sui generis* rights take a different approach when it comes to databases. They protect the investment made by database makers (Beutler 1997:257). The main purpose for the use of repositories is to promote the use of IK because all the IK resources will now be organised into one union catalogue, namely, international repository. The format or structure of all repositories should be consistent.

There are usually costs involved in the protection of the intellectual content of documented IK. Protection of the intellectual content of IK is cheaper than costs incurred for the protection through the law. This is the main reason for having chosen the use of repositories. Legal costs include transaction costs of transferring the rights, the costs of protection and enforcement, and the cost of filing. These high transaction costs may delay or even impair filing, exposing ideas that have been discovered over time to appropriation (Drahos 1997:207).

The advent of digital technology is an important element of modern-day IP. Digital technology permits the storage, production and transmission of material in the form of digits in binary codes consisting of zeros and ones. Digital information is only machine-readable and must be converted by a machine into some other form before it can be understood by a human being. Hart (1995:128) posits that the boundaries between different types of works must break down to allow text, pictures, audiovisual and musical works to be viewed and heard through the same medium, namely, a computer screen. This is imperative for digitised IK because it is available in different forms and multimedia would be the most appropriate way to portray it. Works would be transmitted anywhere when combined with telecommunications systems. Enormous volumes of material can be stored in relatively small spaces, allowing for increased portability (Goodchild 2000:344; Hart 1995:128; Oddie 1999:239; Shiozaki et al. 1999:100).

It should be decided at a later date if it is feasible to translate the documented information into any foreign language. On-demand or on-request translation services would be used. However, the original language version should always be kept because the meaning and implications are not always precisely reflected whenever the information is translated into a foreign language, especially in terms of cultural mores and norms. Various organisations are already involved in maintaining IK collections. These organisations would be required to contribute to the national IK repositories. The intellectual content of the recorded IK resources in all the repositories would be catalogued according to the DC Metadata Elements Set, in other words, it would be OAI compliant (see table 7.3). It would be mandatory for each IK resource to have an abstract in the English language.

Three repositories including local, national and international information, would be constructed. All of these repositories would be accessible via the Internet. A downloadable copy of the digitised resources must be stored in the local or national repository in a compressed format. The format of the IK resources would be determined by each IKRC and must be as popular as possible. Limited cross language information retrieval (CLIR) would be used where available. CLIR is still under research and would not be fully employed in the repositories until a universal standard has been adopted.

7.3.1.1 Local repositories

Various organisations involved and interested in IK research already have their own IK databases. These organisations serve as IK Resource Centres (IKRCs). Such organisation must contribute their collection to the national repository in the national interest. Should the organisation not be interested in contributing their IK resources to the national repository, they would have to contribute their metadata (which would always include an English abstract).

Local repositories with complete IK resources would contain various information resources such as still pictures, graphics, 3D models, audio, speech, video, documents, images, datasets, and so on (Richardson & Powell 2003). A dataset is information encoded in a defined structure (e.g., lists, tables, and databases), intended to be useful for direct machine processing. Multimedia would be catered for in the local repository. An abstract and any documented information regarding the relevant IK resource would be available over the Internet

A keyword search, based on the DC Metadata, would be allowed. Due to the fact that IK resources would be documented in the indigenous language, full-text searches would only be available in the indigenous language and can be used if known to the user. Should the organisation conducting the research decide to document their research only in English or any language other than the indigenous language, full-text searches would be allowed in that language. This means that for every full-text IK resource in the local repository, a full-text search should be possible in the documenting language. Local repositories would mainly serve as data providers during harvesting (for more details, see the section of OAI-PMH). Thus, local databases would allow both keywords and full-text searches. All the local repositories must be consolidated into national IK repositories. The local repositories would also be directly accessed via the Internet, without having to be harvested via the national or international repository.

7.3.1.2 National repositories

Indigenous communities must benefit from increased recognition of their own intellectual contributions to the national IK databases. All the local repositories must be consolidated into national repositories. Copies of IK resources in the local repositories would also be kept in the national repositories for redundancy purposes. The national repository would thus function as both a data provider and as a harvester. This means that searchers must be pointed to the relevant repository, and if no full-text IK resource is available, they should be directed to the local repository. This

would curb the free exploitation of resources for commercial purposes by companies who feel no obligation to compensate indigenous communities for their IK resources.

National IK Resource Centres (NIKRCs) would be responsible for overseeing the creation of the national repositories. The NIKRCs would facilitate the documentation of the undocumented IK. Some national governments have already started documenting their resources into national registers. This process would supplement the IK resources copied from local repositories. Appropriate methods of collecting IK information for documentation must be used. Duplicate research should be detected and avoided as early as possible. Video and audio recording must be used where required, especially if cultural performances are involved. The indigenous language must preferably be used during the documentation process at national level (Posey & Dutfield 1996:30).

Full-text searches would only be possible where the local IK resource centres contributed full texts or complete resources to the national repository. Mainly keyword searches would be allowed on the national repositories, especially for the digitised IK in the indigenous language. The national repository would be directly accessed via the Internet without first having to go via the international repository.

7.3.1.3 International repositories

The international repository would be a consolidation of the metadata and complete digitised IK resources of all the national IK repositories. No complete IK resources would be contained in the international repository. It would serve as an international common catalogue of all the IK resources and would also be accessible via the Internet. The international repository would act as a service provider of the stored IK metadata. The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) is the standard to be used in harvesting IK in the local, national and international repositories. Any organisation interested in conducting IK research in a particular country would work via the IIKRC.

The international repository would serve as a register of all the IK resources available internationally. It would be an international database created for tracing any IK resource. The international repository would serve as an "IK body of knowledge" (Ikbok) that would be used as an international IK register. Any overlap of IK resources among nations on an international level could be determined by means of this repository.

7.3.2 National IK Resource Centres

A global network of Indigenous Knowledge Resource Centres (IKRCs) has been growing since 1987 (IUCN 1997:174-7). The network could be used to ensure that there is a free flow of information for the benefit of developing countries and local communities. The purpose of IKRCs is to collect, record, organise and disseminate information pertaining to IK. The Centre for International Research and Advisory Networks (CIRAN) in Iowa, Leiden Ethnosystems and Development Programme (LEAD) in the Netherlands and the Centre for Indigenous Knowledge for Agriculture and Rural Development (CIKARD) in the USA all have global mandates and interests. ARCIKA in Nigeria and REPPIKA in the Philippines both have regional mandates. An Indigenous Knowledge and Development Monitor is published three times a year by CIRAN in partnership with the other centres. The Indigenous Knowledge and Development Monitor contains matters of common interest on IK. All the IKRCs in a country should be consolidated into a National IK Resource Centre (NIKRC). NIKRCs should develop and maintain national IK databases that contribute to sustainable development and education (IUCN 1997:174-7; Posey & Dutfield 1996:30).

The appendix to this thesis contains a list of some currently active IKRCs. The most important function of these centres is to protect and promote indigenous resources in the national interest of their countries. The national repositories would be located at the NIKRCs.

The NIKRC could perform or consolidate the following functions in conjunction with the relevant local populace or IKRCs:

- Identify national IK resources
- Document IK
- Digitise IK

The NIKRC would ensure that IK is included alongside scientific knowledge as part of a national and international effort to promote and protect IK.

Each NIKRC must ensure that the electronic copyright management systems used to protect IK resources integrate many different techniques to identify the authors and owners of rights. The systems at each IKRC must provide information about the terms and conditions for the use of works, provide billing systems, and track royalties paid to rights holders. It is strongly recommended that such systems form an integral part of each national repository (Harris 1998:173; Mansell & Wehn 1998:210).

Digitised IK resource requested from a national repository would be available for downloading by the requester on completion of the payment that would be deposited in the bank account of the appropriate IKRC. The payment could be based either on a predefined subscription system or on a per transaction purchase basis. Online electronic payment will have to be effected before complete digitised IK resource could be downloaded. The rules on the apportionment of payment for a period-based subscription would have to be determined by WIPO in consultation with all the parties involved. A subscription would have to be purchased for a predetermined period of time during which any number of resources can be downloaded.

Where a subscription for a specific period has been purchased, a note with the original receipt details with a zero fee would always be generated for each download. IK resources would be downloaded in a compressed format. The purpose of employing compression techniques on digitised resources is to enable minimal use of network resources during transmission and download. Users would have to apply a private key when accessing the compressed source for the first time on a machine. Compressed

IK resources will be auto-extractable and will not require any specialised uncompressing software.

7.3.3 International IK Resource Centre

Another possible way of managing the protection and promotion of IK is to establish an international IK repository managed by an International IK Resource Centre (IIKRC). The Institute of Intellectual Property in Japan identified a need for the establishment of a Digital Information Centre as a collective administrative centre in which information related to copyright works would be readily accessible to efficiently facilitate copyright clearance. The same kind of centre is required for the administration of IK. It is proposed that the IIKRC would be used for this purpose, under the auspices of WIPO (Hart 1995:128; Shiozaki 1999:105). Currently, one kind of centre for such information operates through the World Bank, which maintains an international IK database to which anyone can contribute. The bank is supposed to support endeavours aimed at promoting and protecting IK in conjunction with WIPO, rather than operating independently.

The IIKRC would have to maintain the international repository and the NIKRCs would have to contribute their metadata to the international IK repository. This means that WIPO would not necessarily need to directly maintain the repository but would rather be indirectly involved in each NIRC.

The IIKRC would have to act as an internationally recognised mediator or ombudsman for any dispute that might arise in relation to IK resources among nations. The IIKRC would assist in ensuring that the financial benefits derived from the acquisition of IK information benefits the local communities and/or their governments. IK resources cannot continue to be used by interested multinational companies as raw material for the production of goods without compensation to the indigenous owners of such resources.

7.4 Deploying ICT to protect IK

The IK resources contained in the national repositories would have to be protected against any infringement such as the IW identified in chapter two. Cryptography and digital watermarking are mechanisms to be employed to protect digitised IK resources.

Protecting digital IK would require secure marking mechanisms, such as embedded digital registration numbers to label works. This would be done so that IK owners are easily identifiable for the purpose of licensing materials such as a picture, an audiovisual sequence or a piece of music wanted for use in a multimedia work. Such arrangements would then be used by the clearinghouse authorised to grant requested licences. Failing this, they would at least provide contact information for the current copyright owner (Hart 1995:128; Shiozaki 1999:105).

7.4.1 Cryptography

Cryptography is the most popular technology effective in the protection of information that is transmitted via the Internet. Thus, a possible solution to the problem of infringement of digitised IK may lie in the field of cryptography or digital signature. Because of the non-physical nature of electronic communication, traditional methods of physically marking artefacts are obsolete. Cryptography is the most widely used method of protecting information from potential infringement. Public key cryptography allows users of an insecure network, like the Internet, to exchange data with confidence that it will be neither modified nor inappropriately accessed. This is accomplished through a transformation of the data according to an algorithm parameterised by a pair of numbers, the so-called public and private keys. Information is encrypted so that it is unusable until a key is transmitted and applied. This kind of transmission is limited to a one-off transmission and is regarded as being costly, time-consuming and complex to implement, although it is very effective (Harris 1998:173; Mansell & Wehn 1998:210).

The exchange of intellectual property data over digital networks is heavily dependent upon the technology of secure systems. The technologies of digital authentication and encryption can be used both to validate a data source and to demonstrate the integrity of a retrieved data. Secrecy-enhancing technologies will have extremely important consequences as they can radically improve the protection of IK resources over the Internet. The purpose of encryption is to keep information confidential. Encryption is a function, like adding or dividing, to calculate new numbers from old numbers. As ICT advances, it is expected that various transaction costs will be lowered and that investors can be remunerated more easily through higher protection (Granstrand 2000:339; Pretorius 2000:121; WIPO 2000:79). IK resources would be available via the Internet. Anyone who acquires any digitised IK resource would have to own a private key, to be able to access the documents.

One widely used privacy protection mechanism for electronic information protection a is what cryptographers call a secret key. Logon passwords and cash card PINs are examples of secret keys. Consumers share these secret keys only with the parties with whom they wish to communicate, such as an online subscription service or a bank. Private information is then encrypted with this password, and it can only be decrypted by one of the parties holding that same key (Pretorius 2000:121). The same mechanism can be employed when information on IK resources is made available via the Internet to the requesting party.

Positive identification of IK resources is needed when it is sent to the requester via the Internet from the national repository. The most realistic way of doing this is to provide identification in the cyber world by trusted references, in a specific domain and for a specific role. This would allow risk to be determined on the basis of trust and identity. The most common solution to the identity problem is to use a trusted third party, known as a certification authority (CA), to authenticate the key holders' identity. CAs are computerised databases that issue digital certificates. They may be run by government or the private sector. A digital certificate is a computer record sent via a computer network, such as the Internet, to a requesting party. It contains, at the minimum, the certification authority's name, the name of the person being certified, and that person's public key. A system that certifies the public key holder's identity is

known as a public key infrastructure (PKI). The current certification process used by the CAs is based on the public key infrastructure and X.509 certificate. Secret keys would be sent with the receipt details to the purchaser and should be applied the IK resource (Hofman et al. 1999:70-2; Pretorius 2000:128-31; WIPO 2000:79). The purpose of this would be to curb possible fraud or the illegal use of IK resources.

A private key would be downloaded together with the receipt details at the same time as the compressed copy of the IK resource. The key will make an entry on the machine's registry when applied. This is done to avoid another key being used for the same resource on another machine. Should people try to open a digitised IK resource on a different machine without a private key, they would be unsuccessful. Should a key be lost or destroyed by mistake and the IK resource be transferred to another machine in the meantime, a query should be entered at the local repository with the payment reference number and a new private key would be generated for the buyer of a specific IK resource. This would reduce the incidence of unauthorised copying of IK resources.

This system should be incorporated into WIPONET, with WIPO overseeing its implementation. WIPO launched a major project in 1998 (the project deployed in 2000), which was intended to develop and establish a global information network officially known as the WIPO Global Information Network (WIPONET). WIPONET is a state-of-the-art project designed to ensure that WIPO is able to respond to the remarkable growth of electronic commerce and the increased demand for electronic data exchange services (Idris 2000:63; Finger & Schuler 2000:521; Mashelkar 1999; WIPO 2000:54&59).

Although no encryption methods have been accepted as a standard, encryption has been used to an increasing extent. Until 1977, the International Traffic Arms Regulation in the United States prevented American firms from exporting encryption techniques. In addition, the Organisation for Economic Cooperation and Development (OECD) developed an initiative to harmonise the use of encryption techniques among its member countries and the OECD Council adopted a set of guidelines in March 1997 to formalise the encryption techniques (Bettcher et al. 2000:528; Mansell &

Wehn 1998:211). These guidelines will have to be ratified by WIPO before they can be implemented as digital technologies to protect IK.

7.4.2 Digital watermarking

Digital watermarking is a technique for secretly hiding copyright information in digital content such as digital images. Watermarking audio material with a code of numbers does not affect the sound quality of a recording but offers a method of establishing whether or not the material has been used by a non-licensed user. Other techniques related to digital watermarking are holograms and fingerprinting. Holograms are embedded in the conduit of the digital resource (this technique was initially employed for CD-ROM packages) or media to authenticate the legitimacy of a copy. This was devised to limit the reproduction of digital media, such as second generation copies, by making it almost impossible to copy. Fingerprinting digital images by embedding originator-specific data-within-data is a potential method of legally demonstrating originality, which is attracting the interest of publishers. This technique is also relevant to digitised IK resources. In principle, all of these methods might be circumvented, but in practice their increasing use is a deterrent to those who might consider infringing digital IK (Harris 1998:173; Mansell & Wehn 1998:210; Shiozaki et al. 1999:100).

The use of technical systems for IK protection would increasingly be supported by IK owners, researchers and policy makers. However, a study on the methods of copyright protection adopted by small and medium-sized electronic information publishers in the United Kingdom suggests that the use of digital watermarking is not yet widespread (Mansell & Wehn 1998:210). The following factors contribute to the relatively low take-up of new techniques:

- the absence of an agreed standard
- rising costs of production and customer support
- the need to make electronic publications user-friendly
- the perceived inadequacy of copyright laws
- the need to accelerate the time to market the products

Most of these issues are relevant to IK in the sense that digital watermarking would be a new feature added to digitised IK resources. The publishing industry is supposed to be the leader in this regard and their efforts would continue to guide the industry in the protection of digital information.

7.5 Deploying ICT to promote IK

It would be possible to use ICTs to facilitate communication between the international repository and the relevant IKRC repositories. ICT promotes networking as a dynamic, self-expanding form of communication which transforms all domains of social and economic life (Golding 2000:171; Luzwick 2000b).

7.5.1 Organising and retrieval of digital IK

The most efficient way to promote digitised IK is to improve its organising within repositories and to ease its retrieval. An IK resource would be organised according to metadata or content. Metadata retrieval would be based on the DC Metadata Element Set and would have to be OAI-compliant for efficient retrieval. Content retrieval should be full-text and/or CLIR-based. Metadata can be described as the content of a knowledge source and would be used as the standard adopted to organise information stored within repositories. Repositories are also referred to as digital libraries (DLs).

All the repositories, namely, local, national and the international repositories, would have their IK resources organised according to the DC Metadata Element Set and would be OAI-compliant. Should it happen that a search is launched from the international repository, the user would be pointed to the relevant local or national repository with the relevant IK resource. Users searching on a national repository would be pointed to the local repository. This would happen in cases where the IK resources themselves were never contributed to a national repository and only the metadata were made available. Keyword searches would be allowed in all the repositories. Full-text searches in the documenting language of the IK resource would

be allowed in cases where full-text resources are available, in other words, in the local and national repositories. The documenting language would in most instances be an indigenous language. Limited CLIR would be used where available. CLIR would be a futuristic development for information retrieval from repositories with fill-text resources. This would be the case until a standard in the CLIR field has been adopted to help ensure consistency in the CLIR systems developed.

There has been a general desire for systems to be interoperable at the levels of data exchange and service collaboration. A Resource Description Framework (RDF) would be employed for additional requirements not covered by the DC Metadata. RDF would support the consistent encoding and exchange of standardised metadata. It provides for the interchangeability of separate packages of metadata defined by different resource description communities.

There are different metadata initiatives aiming at unifying the naming of data worldwide. Dublin Core is the basis for further developments in metadata standards. RDF is used for the management of metadata on the World Wide Web and the MPRG-7 format covers many approaches for describing multimedia metadata. All these initiatives need to be consolidated for the management and naming of the IK data.

7.5.1.1 Dublin Core Metadata

The Dublin Core Metadata Initiative (DCMI) began in 1995 with an invitational workshop in Dublin, Ohio, that brought together librarians, digital library researchers, content providers, and text markup experts to improve discovery standards for information resources. The original DC emerged as a small set of descriptors that quickly drew global interest from a wide variety of information providers in the arts, sciences, education, business, and government sectors (ISO 15836:2003(E); National Information Standards Organisation 2001).

The DC Metadata Element Set comprises 15 descriptors (see table 7.2) that resulted from this effort in interdisciplinary and international consensus building. The DC now exists in over 20 translations and has been adopted by CEN/ISSS (European Committee for Standardisation / Information Society Standardisation System), and is documented in two Internet RFCs (Requests for Comments). It also has official standing within the WWW Consortium and the Z39.50 Standard. DC Metadata has been approved as a U.S. National Standard (ANSI/NISO Z39.85), formally endorsed by over seven governments for promoting the discovery of government information in electronic form, and has been adopted by a number of supranational agencies such as the World Health Organisation (WHO). Numerous community-specific metadata initiatives in library, archival, educational, and governmental applications are using the DC as their cataloguing basis (ISO 15836:2003(E); National Information Standards Organisation; Hakala 2001b).

The Dublin Core Initiative adopted the Resource Description Framework. Table 7.2 contains the DC Metadata Element Set required for cataloguing the intellectual content of an information resource and is also applicable to the field of IK. Anyone who infringes the rights as stipulated in the 'Rights' element, would be prosecuted.

7.5.1.1.1 Resource Description Framework

Resource Description Framework (RDF) is the result of a number of metadata communities (including Dublin Core, PICS, Digital Signatures) bringing together their needs to provide a robust and flexible architecture for supporting metadata on the Internet and the World Wide Web (WWW). RFD is thus a standard developed for the management of metadata on the WWW. RDF was developed under the auspices of the WWW Consortium and is an infrastructure that enables the encoding, exchange, and reuse of structured metadata. The RDF schema uses the Dublin Core schema as well as additional schemas for technical data (Hunter 2003; Miller 1998). It uses the vocabulary developed by the Dublin Core Initiative. Thus, RDF is extended DC metadata.

RDF as a framework for metadata provides interoperability between applications that exchange machine-understandable information on the web. It emphasises facilities to enable the automated processing of web resources. RDF is the result of a number of metadata communities bringing together their needs to provide a robust and flexible architecture for supporting metadata on the Web. The development of RDF as a general metadata framework, and as a simple knowledge representation mechanism for the Web, was developed under the serious influence of the Platform for Internet Content Selection (PICS) specification. PICS is a mechanism for communicating ratings of webpages from a server to clients. This is an initiative started by WWW Consortium, which also ratified the DC Metadata (Miller 1998; Lassila & Swick 1999).

RDF could thus be said to be a WWW Consortium proposed standard for defining the architecture necessary for supporting Web metadata. RDF is an application of XML that imposes needed structural constraints to provide unambiguous methods of expressing semantics for the consistent encoding, exchange, and machine processing of metadata. In addition, RDF provides means for publishing both human-readable and machine-processable vocabularies designed to encourage the exchange, use and extension of metadata semantics among disparate information communities (Miller 1998; Lassila & Swick 1999). This would also be very beneficial to those interested in IK.

7.5.1.1.2 MPEG-7

Audiovisual resources in the form of still pictures, graphics, 3D models, audio, speech, and video will play an increasingly pervasive role in the field of IK. Because of the complex, information-rich nature of such content, value-added services such as analysis, interpretation and metadata creation might become much more difficult, subjective, time-consuming and expensive. During the compilation of the MPEG-7 standard, the DC Metadata Initiative was taken into account. Standardised multimedia metadata representations that would allow some degree of machine interpretation would be necessary. The MPEG-7 and MPEG-21 standards have been developed to

support such requirements and should be adopted for IK (Hunter 1999; Hunter 2003). MPEG would have to be integrated with DC in order to ensure the implementation of common standardised metadata elements.

MPEG-7 defines an interoperable framework for content descriptions way beyond the traditional metadata. MPEG-7 has descriptive elements that range from very low-level signal features like colours, shapes and sound characteristics, to high level structural information about content collections. MPEG-7 also has unique tools for structuring information about content (Koenen 2001). Table 7.1 depicts MPEG-7 descriptors.

MPEG-7 is intended to describe audiovisual information regardless of storage, coding, display, transmission, medium, or technology. It can address a wide variety of media types, including still pictures, graphics, 3D models, audio, speech, video, and combinations of these, in other words, multimedia presentations. The MPRG-7 format covers many approaches for describing multimedia metadata. It is the Multimedia Content Description Interface, which is an ISO/IEC standard for describing multimedia content developed by the Moving Pictures Expert Group (MPEG). The goal of this standard is to provide a rich set of standardised tools to enable both humans and machines to generate and understand audiovisual descriptions. The goal of MPEG's latest initiative, MPEG-21, the Multimedia Framework, is to define the technology needed to support users to exchange, access, consume, trade and manipulate multimedia digital items in an efficient, transparent and interoperable way. Users may be content creators, producers, distributors, service providers or consumers (Koenen 2001; Hunter 1999; Hunter 2003)

Table 7.1 Overview of MPEG-7 descriptors

Type	Feature	Descriptors
Visual	Basic Structures	Grid layout
		Histogram
	Color	Color space
		Dominant color
		Color histogram
		Color quantization
	Texture	Spatial image intensity distribution
		Homogeneous texture
	Shape	Object bounding box
		Region-based shape
		Contour-based shape
		3D shape descriptor
	Motion	Camera motion
		Object motion trajectory
		Parametric object motion
		Motion activity
		Motion trajectory features e.g., speed, direction, acceleration
Audio	Speech Annotation	Lattice of words and phonemes plus metadata
	Timbre	Ratio of even to odd harmonics
		Harmonic attack coherence
	Melody	Melodic contour and rhythm

Source: Hunter (1999), Table 2

Table 7.2 Description of DC with proposed added subdivisions

User interface label	Definition	Comment	Added subdivisions
Title	A name given to the resource.	Title will be a name by which the resource is formally known.	
Creator	An entity primarily responsible for making the content of the resource.	Examples of a creator include a person, an organisation, or a service.	Creator.status
Subject	The topic of the content of the resource.	A subject will be expressed as keywords, key phrases or classification codes that describe a topic of the resource. Recommended best practice is to select a value from a controlled vocabulary or formal classification scheme.	Subject.keyword Subject.domain
Description	An account of the content of the resource.	Description may include but is not limited to an abstract, table of contents, reference to a graphical representation of content or a free-text account of the content.	
Publisher	An entity responsible for making the resource available.	Examples of a publisher include a person, an organisation, or a service. Typically, the name of "publisher" should be used to indicate the entity.	
Contributor	An entity responsible for making contributions to the content of the resource.	Examples of a contributor include a person, an organisation, or a service. Typically, the name of a contributor should be used to indicate the entity.	
Date	A date associated with an event in the life cycle of the resource	The date is associated with the creation or availability of the resource. Recommended best practice for encoding the date value is defined in a profile of ISO 8601 and follows the YYYY-MM-DD format.	Date.recorded Date.published Date.added Date.created Date.valid Date.available Date.modified Date.accepted Date.copyrighted
Type	The nature or genre of the content of the resource.	Type includes terms describing general categories, functions, genres, or aggregation levels for content. Recommended best practice is to select a value from a controlled vocabulary.	
Format	The physical or digital manifestation of the resource.	Typically, format may include the media-type or dimensions of the resource. Format may be used to determine the software, hardware or other equipment needed to display or operate the resource. Examples of dimensions include size and duration.	
Identifier	An unambiguous reference to the resource within a given context.	Recommended best practice is to identify the resource by means of a string or number conforming to a formal identification system. Examples of formal identification systems include the Uniform Resource Identifier (URI), the Uniform Resource Locator (URL), the Digital Object Identifier (DOI) and the International Standard Book Number (ISBN).	
Source	A reference to a resource from which the present resource is derived.	The present resource may be derived from the source in whole or in part. Recommended best practice is to reference the resource by means of a string or number conforming to a formal identification system.	
Language	A language of the intellectual content of the resource.	Recommended best practice is to use RFC 3066 [RFC3066] in conjunction with ISO 639 [ISO639].	
Relation	A reference to a related resource.	Recommended best practice is to reference the resource by means of a string or number conforming to a formal identification system.	

User interface label	Definition	Comment	Added subdivisions
Coverage	The extent or scope of the content of the resource.	Coverage will typically include spatial location (a place name or geographic coordinates), temporal period (a period label, date, or date range) or jurisdiction (such as a named administrative entity). Recommended best practice is to select a value from a controlled vocabulary (for example, the Thesaurus of Geographic Names [TGN])	Coverage.location Coverage.timespan Coverage.tribe
Rights	Information about rights held in and over the resource.	The rights element will contain a rights management statement for the resource, or reference to a service providing such information. Rights information often encompasses Intellectual Property Rights (IPR), copyright, and various property rights.	
Proposed addition			Funding agency

Source: Based on http://dublincore.org/

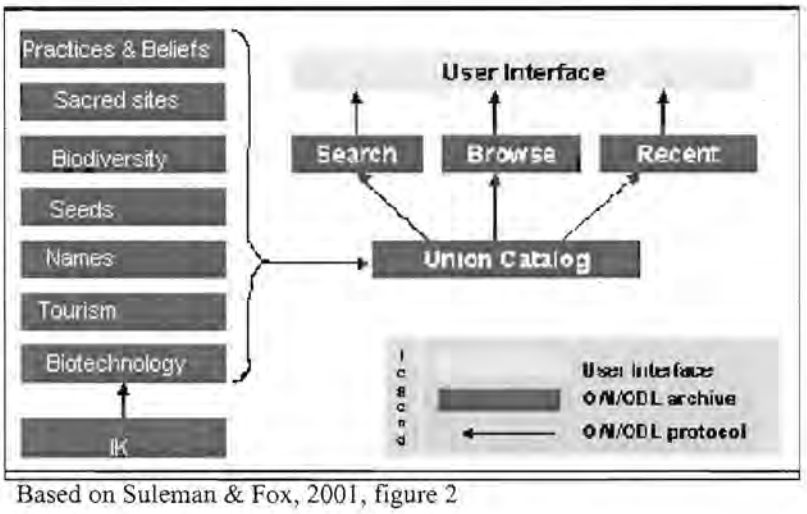
7.5.1.2 OAI

In October 1999 the Open Archives Initiative (OAI) was launched in an attempt to address interoperability issues among the many existing and independent digital libraries (DLs) to facilitate the sharing of the metadata. The focus was on high-level communication among systems and simplicity of protocols. The OAI has since received much media attention in the DL community, primarily because of the simplicity of its standards (Suleman & Fox 2001).

The Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) is a transport protocol that oversees the transfer of any metadata from one computer, acting as the data provider (or repository) for another computer, which acts as the service provider (or harvester). A harvester can request information about the repository or request an individual record or groups of records that may be restricted by date or by other predefined groupings. In the case of IK, the local and national repositories would be data providers whilst the international repository, and the national repositories in some instances, would be the service provider or the harvester (Richardson & Powell 2003).

The OAI-PMH in essence supports a system of interconnected components, where each component is a DL in its own right. Since the protocol is simple and is becoming widely accepted, it is far from being a custom solution for a single project. Since the DLs are loosely defined, this collaborative system could be composed of individual component DLs, each with a different function. In the extreme case, each component DL would supply the functionality of exactly one service expected by a user. This is the approach taken for managing IK where repositories are modelled as networks of extended Open Archives, with each extended Open Archive being a source of data and the international repository being a provider of services. Based on this network of extended Open Archives, Figure figure 7.1 illustrates a so-called Open Digital Library (ODL) (Suleman & Fox 2001).

Figure 7.1 IK-based OAI



Based on Suleman & Fox, 2001, figure 2

Figure 7.1 illustrates various types of IK. Even though they may all appear in more than one repository, they would be subdivided as such in the backend of the catalogue of the international repository. User interface design and workflow management are complex tasks and would have to be implemented in the international repository. Common base-level services have emerged in practice, for example, supporting searching and browsing. There would be various IK DLs with different subjects on local and national repositories. Entries in all the repositories would be arranged according to the DC Metadata Element Set. The same principle would be applied when configuring the international repository housing the union catalogue.

In this case, the OAI Harvester is used to obtain a stream of data, which in turn is used to create indices for searching. Queries are then submitted through the OAI Data Provider interface. These queries overload the semantics of the OAI-PMH by using the OAI notion of sets to correspond to the dynamically generated result sets of a search engine. Analogously, when such a request is submitted, the query is mapped to the name of a set. Thus, without making any changes, the OAI-PMH can be used to serve as the interface to a search engine. With a few minor additions to the OAI-PMH, information such as cardinality of result sets also could be returned. To test the feasibility of ODL design, a suite of components has to be specified, implemented, integrated into a network, and assessed for their feasibility (Suleman & Fox 2001).

Table 7.3 Components used in prototype system

Component	Function
ODL-Union	Combine metadata from multiple sources
ODL-Filter	Reformat metadata from (non-OAI-Conforming) data sources
ODL-Search	Provide search engine functionality
ODL-Browse	Provide category-driven browsing functionality
ODL-Recent	Provide a sample of recently-added items

Source: Suleman & Fox (2001), table 1

Componentisation and standardisation are built into the system by design if every service is delivered by an extended Open Archive. This inherently supports reuse and allows for interoperability at the level of individual services within the DL. The ODL approach closely resembles the way that physical libraries work. In a physical library the individual systems interoperate within their own communities. For example, the purchasing department interoperates with the booksellers and the interlibrary loan department interoperates with peer departments at other libraries.

As mentioned earlier, the Internet is an extremely effective information dissemination tool. This is primarily due to the simplicity of the protocols it relies on and the hierarchical manner in which protocols such as HTTP are built. They are built on more fundamental protocols such as IP and TCP. The OAI provides a simple protocol to transfer metadata. Building simple layered extensions to this protocol would closely follow the proven methodology of the networking community.

7.6 Summary

This chapter used an Information Science perspective of IW to protect and promote access to IK. Specific ICTs were adopted to promote, protect and ease access to IK resources. The Internet is the most important tool for communicating information, including IK, in the digital age. Various instances were identified in which IK has been made available via the Internet without the consent of the indigenous communities involved. This necessitates the deployment of ICT to promote and

protect IK. Documented IK would have to exist in the indigenous language only and would have to be digitised and stored in the format deemed most appropriate by the IKRC. The NIKRCs would have to oversee the management activities of IK in each country. The digitised IK would have to be accessible from local and national IK repositories. The stored IK resources would have to be catalogued according to the DC Metadata Element Set.

All repositories, namely, local, national and international IK repositories, would be accessible via the Internet. As such, keyword and full-text searches would be done on local and national repositories whilst only keyword searches would be allowed on international repositories. The IIKRC, an international IK management body, would have to be established under the auspices of WIPO. The DC Metadata Element Set in both repositories would be in written in the English language. Cross-language information retrieval would be catered for, where possible. However, this subject is still under research and could not be fully implemented until a standard has been adopted. This is devised to promote the access to digitised IK. An Information Science perspective of IW was employed in this chapter through implementing ICT to promote and protect IK. This chapter answered the following research sub-question:

What ICT solutions exist to promote and protect IK?

Techniques of cryptography and digital watermarking are to be employed to protect IK. Cryptography uses private keys and digital certificates that are downloaded with an IK resource. CAs would be employed to authenticate the key holders' identity. A private key would always have to be used when an IK resource is accessed on a machine for the first time and would be written to the registry of the machine. Digital watermarking would employ holograms and fingerprinting to protect the authenticity of a copyrighted work. Holograms are embedded in the conduit of the digital resource. The fingerprinting of digital images is done by embedding originator-specific data-within-data, such as the author's signature, within a document.

The DC Metadata Element Set and OAI are to be employed respectively for the organisation and retrieval of digitised IK. DC is a standard that comprises of 15

Metadata Element Sets that would determine the schema of all the repositories or DLs containing digitised IK. Extended DC Metadata such as RDF, which is a standard for the management of IK on the World Wide Web, and MPEG-7 that would ensure implementation of multimedia objects, would be implemented. OAI-PMH is a protocol to be employed for harvesting IK resources and overseeing the transfer of metadata from one computer (acting as a repository) to another computer (acting as a harvester).

Chapter eight discusses the value of this research and presents conclusions and recommendations.

Chapter 8

Conclusions and recommendations

8.1 Introduction

This research set out to explore issues surrounding the following research problem statement:

To critically investigate IW against IK in the developing world with specific reference to intellectual property rights

A study of various problems that exist between indirect information sources and end-users led to the adoption of an Information Science perspective of IW that has formed the basis of this research. This study further identified various kinds of IPRs. IK is a form of IP that is greatly sought after for use as a resource. Its popularity may be in part because it is not well protected by the IP laws. It is notable that some agencies and organisations in the developing world have recently developed an interest in the field of IK.

The approach taken in this thesis with regards to the protection of IK was based on the technological developments of the information age. One of the characteristics of the information age is that information and knowledge are documented and digitised as much as possible to ease access to and availability of information. Information will have to be protected by means of available ICTs. This includes using the Internet as a medium to distribute information.

8.2 Research summary

This research adopted an Information Science perspective in investigating factors of IW perpetrated against IK. The Information Science perspective of IW entails an analysis of factors which inhibit access to indirect information sources. These factors contribute to IW against IK within the developing world. IK has recently become recognised as a resource by some sectors within the developed world. Some prospecting IK researchers started using IK without the consent and recognition of the indigenous communities from which this knowledge originated. No financial benefits were derived by the source communities from the exploitation of their IK. To fully understand this issue, various issues pertaining to IW, IP, IK and ICT had to be investigated. This research was based on an extensive literature analysis, which drew upon various sources of academic literature, including scholarly empirical articles, dissertations, monographs and books, electronic articles and other types of material such as non-empirical scholarly articles.

The problem statement, research focus and roadmap of this thesis were introduced in chapter one. Various types of IW were identified in chapter two. The evolution of IP legislation in different parts of the world was discussed in chapter three. The origin and purpose of IK was investigated in chapter four. Chapter five investigated specific cases that involved IK appropriation, while chapter six investigated various measures that are currently employed to promote and protect IK. Chapter seven explored various applications of ICT to protect and promote IK.

8.3 Answers to research questions

Information warfare against IK has been in existence for some time even though its origin cannot be traced back to the colonial era. Interest in IK is a recent phenomenon. A critical investigation of IW against IK in the developing world entails a multiplicity of factors. The main research question could not be answered without addressing these factors, which were translated into research sub-questions and addressed in each

chapter. The following sections summarise the findings relating toe ach of these sub-questions.

8.3.1 What constitutes information warfare?

This research sub-question was answered in chapter two. This chapter investigated various types of IW that exist. An Information Science perspective of IW was formulated and later adopted in chapter four because it was more deemed to be helpful in understanding various issues pertaining to IK appropriation. Other perspectives of IW identified were militaristic warfare, intelligence-based warfare, electronic warfare, psychological warfare, hacker warfare, economic warfare and cyber warfare. Military warfare is the oldest form of warfare and all other forms of warfare owe their origin to it. Although many forms of warfare exist, the Information Science perspective was adopted for this thesis because it emphasises the study of problems pertaining to the flow of information between information sources and end-users.

When information is recognised as a commodity, its management becomes paramount. If an individual or organisation has sole possession of a particular body of information, that information may enable the holder to achieve their desired objectives. As more information becomes commoditised, the economic value of such information increases. The original owners or originators of such information should also enjoy the financial benefits derived from the exploitation of their information resource. Excessive power and stringent control over access to information would curtail access to protected information. Protection of information would be further enhanced by the ICTs available in the information age (Debon, Horne & Cronenweth 1988:2).

In further answering this research sub-question, a definition of IW based on the Information Science perspective was also adopted. The formulated Information Science definition of IW is a deliberate or non-deliberate attempt to restrict and control access to information.

This definition of IW was found to be relevant in chapter five when various cases of IK appropriation were discussed, especially when indigenous names are registered as Internet domain names that have nothing to do with the real people who use such names. The relevant communities are subsequently barred from registering Internet domains with the same names. The cases investigated in chapter five affirmed the validity of this definition by demonstrating the appropriation of IK resources from developing countries by some organisations based in the developed world. This was seen to be a direct result of the commoditisation of IK resources for financial gains.

8.3.2 What is IP and what role does it play in globalisation?

This research sub-question was answered in chapter three by exploring the historical evolution of IP within the global context. The philosophy and the historical background of IPRs were explored and various perspectives of IP investigated. The Western perspective and its evolution in other parts of the world were investigated. The Eastern and African perspectives on IP were also investigated. The Western perspective is the basis that shaped the international IP regimes that evolved worldwide and may be considered the dominant perspective.

The Eastern perspective owes its origin to the Western perspective because it also recognises an individual or organisation as the sole holder of intellectual property rights. The African perspective is based on a system of communal ownership where all the community members are considered to be co-owners of any form of property that exists within the community. The most commonly known and recognised forms of IP that are discussed in chapter three are copyright, trademarks, patents and plant breeders' rights. Most countries have their own legislation on IP. This legislation was often strongly influenced by international conventions that were set up to harmonise the national IP legislation.

Conventions such as GATT and TRIPS achieved the harmonisation of various aspects of the IP legislation such as setting the lifespan of a patent at 20 years from the date of

filing. This ruling was extended to the developing world to protect the interests of those who register patents. Plant breeders' rights is the most common form of IP that should protect indigenous bioresources; however, patents are registered based on the properties of such resources. This action leaves the indigenous people helpless to protect their indigenous knowledge. Instead, the plant breeders' right protect those who invent a 'new' plant variety rather than the custodians of indigenous resources.

It is very expensive for the developing world to register an international patent or to acquire a product protected by an internationally registered patent. This is due to the higher fees linked to patent registration. The initial intention of IP was to provide access but also to protect the economic interests of the creator of knowledge. The advent of a monetary economy created a shift towards a stricter focus on protection and less emphasis on access to IP. Increased IP protection curtails access to IP by the developing world, to the economic disadvantage of the latter. IK starts to fall within the realm of IP because there are several patents registered on IK resources.

It is in the long-term interests of all countries to create IP systems that conform to the rulings established by TRIPS. Failure to implement TRIPS may undermine the system as a whole and delay progress in other key areas such as the development of improved protection for indigenous knowledge (Morris et al. 2001:81).

8.3.3 What constitutes IK and how is it treated in the global IP regimes?

This research sub-question was addressed in chapter four. Various researchers and organisations have adopted their own definitions of IK, as a universally adopted standard definition of IK does not yet exist. This research does not try to generate a universally acceptable definition of IK, but rather explores various definitions that exist. These definitions are generally very similar. They commonly define IK as knowledge that has been used and still exists within the developing nations of the world.

IK is also contrasted with Western or modern knowledge. Modern knowledge is the knowledge developed by universities, research institutions and private firms using a formal scientific approach. IK has been portrayed as value laden, and content driven. No convincing proof exists to show that Western knowledge is superior to IK. IK also exists in the globalised environment and it is thus influenced by globalisation factors. International agreements such as GATT support globalisation. Development agencies, especially bilateral donors, have historically displayed limited interest in indigenous peoples. They gave low priority to the preservation of traditional cultural values compared to the conservation of biological resources. This might have been caused by the oral nature of the traditional cultural values.

IK is not important to indigenous people only, but also to the Westerners who discovered it elsewhere. It has been an open treasure box for the unfair appropriation of items of value. When IK is appropriated, it is transformed into a constituent of the commercial process. Schools within traditional societies were never prepared to act as a medium for the promotion of IK and they never fulfilled that role. IK research should be conducted according to the principles of sustainable development to preserve existing knowledge and resources for future generations. Bioprospecting was identified as one of the reasons for the interest in IK shown by a number of researchers.

8.3.4 What is the current state of IW against IP?

This research sub-question was answered in chapter five. IW against IK within the developing nations is a serious threat to sustainable development within these nations. Various cases investigated confirmed that IW is perpetrated against IK within the developing nations. The IW definition coined within the Information Science perspective was also validated against the cases investigated.

The cases explored support the reasons for protecting IK. In order to do this, national biodiversity conservation regimes are starting to conform to the objectives of the Convention on Biological Diversity. The aim is for these regimes to provide legal

protection to biological resources and associated IK at the national level. In order to promote sustainable development, it is important to recognise the value of IK and facilitate the resource management of indigenous people (Van Dulken 2000).

The appropriation of some IK resources by the developed world constitutes a form of information warfare against the developing nations. For a patent to be eligible, inventions should be novel, non-obvious, and useful. In theory, intellectual property laws ensure that inventors and investors are rewarded for their endeavours if their product is successfully commercialised. IPR mechanisms give patent holders exclusive monopoly over their inventions for 17 to 20 years and royalties on the use of their invention. IPR mechanisms also allow patent holders to control access to their inventions. They may also set the conditions for the sale of the invention, because the patent holder can vary the licensing arrangement. The patent holder can also deny access to some customers. In practice, intellectual property regimes have evolved into mechanisms that allow some corporations to protect markets and to trade technologies among themselves, barring disadvantaged communities from entering the market (Grenier 1998:13).

8.3.5 Which measures are currently used to protect and promote IK?

Chapter six addressed this research sub-question by determining the current measures employed to promote and protect IK. Measures currently employed to promote and protect IK require that indigenous people be recognised as the original owners of IK. Various endeavours are underway by national governments to document their IK resources. Should any IK resource be appropriated it would be verified against the documented resource. Joint ventures and collaborative research projects are usually undertaken in IK research in which both the researchers and the local communities have a meaningful role to play in the process.

Indigenous people must have a stake in the management of local resources on which their subsistence economy is based. Cooperative or co-management arrangements, in which indigenous communities share management authority with other government

organs, are a vital step towards a self-sustaining economy. A number of compensation mechanisms such as funds, contracts and IPR agreements, nonbinding agreements, and defensive publications should be used to compensate indigenous communities. Defensive publications and benefit sharing can also be used for compensation. IW against IK and the lack of legal protection for biological and cultural heritage has made the indigenous communities of the developing world vulnerable to biopiracy and intellectual piracy. There is a dire need for a system of protection of indigenous knowledge in addition to the existing IP regimes.

Some indigenous communities have established databases which they maintain themselves. Community registers must be developed in IK-rich countries as a means of securing community control over traditional ecological resources. Locals would have to document all known plant and animal species with full details of their uses. The information would then be contributed to the national IK repository for protection and access (see chapter seven).

It is neither logical nor practical that the best system for the protection of the culture and intellectual property of indigenous people resides with the state or even with the international community. Protection can only be designed and implemented by indigenous communities themselves in partnership with individuals and organisations (local, national, regional and international) of their choosing, and on an informed basis. The body most capable of respecting and enhancing the unique needs of an indigenous community is one initiated, developed and staffed by the community itself, namely, Indigenous Knowledge Resource Centres (IKRCs) (Johnston 2000:95).

8.3.6 What ICT solutions exist to promote and protect IK?

This research sub-question was answered in chapter seven. ICTs could be employed to better protect and promote IK. Instead of reinventing the wheel, existing infrastructures could be employed to promote and protect IK. The ICT infrastructure includes the Internet, digitisation of documented or recorded IK by the national IKRCs and storage into national repositories, and the deployment of cryptography and

digital watermarking for the protection of IK. Access to IK could be improved by employing efficient information organising and retrieval mechanisms.

The Internet is the most important medium for communicating information, including IK, in the digital age. Various instances were identified in which IK has been made available on the Internet without the consent of indigenous communities. This necessitates the deployment of ICT to promote and protect IK. IK need only be documented in the indigenous language and would have to be digitised and stored in the national repositories in a format deemed appropriate by the IKRC. The national IKRC will have to oversee the management activities of IK in each country. The digitised IK would have to be stored in the national IK repository according to the Dublin Core (DC) Metadata Element Set. Subscription payments for all the IK resources will be effected to the appropriate bank account of the relevant IKRC.

The international repository will have to be established under the auspices of WIPO. The DC Metadata Element Set in all repositories will be in plain text and in the English language only. No cross-language information retrieval will be catered for because it is still under research. This is devised to promote the access to digitised IK. All IK repositories will be accessible to the public via the Internet, that is, searches would be done on any accessed repository.

The techniques of cryptography and digital watermarking are to be employed to protect IK. Cryptography uses private keys and digital certificates that are downloaded with an IK resource. A Certification Authority will be employed to authenticate the key holders' identity. A private key will have to be applied whenever the resource is accessed for the first time on a machine. An entry would be made to the machine's registry and the subsequent access to the resource would not require a key to be applied because it would be verified through the registry. Digital watermarking will employ holograms and fingerprinting to protect the authenticity of a copyrighted work. Holograms are embedded in the conduit of the digital resource. The fingerprinting of digital images is done by embedding originator-specific data-within-data, such as the author's signature, within a document.

The DC Metadata Element Set and Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) are to be employed respectively for the organising and retrieval of digitised IK. DC is a standard that comprises of 15 Metadata Element Sets that will determine the schema of all the repositories containing digitised IK. Some additional elements are proposed for the further analysis of the intellectual content of the IK resources. OAI-PMH is a transport protocol that could be employed for harvesting IK resources and overseeing the transfer of any metadata from one computer acting as a repository (national and local repositories) to another computer acting as a harvester (international repository).

There are different metadata initiatives aiming at unifying the naming of data worldwide. Dublin Core is the basis for further developments in metadata standards. Resource Description Framework is used for the management of metadata on the World Wide Web and the MPRG-7 format covers many approaches for describing multimedia metadata. All these initiatives need to be consolidated for the management and naming of the IK data.

8.4 Conclusion

This research argues that there is increasing interest in the field of IK. This interest originated with the profit motives of certain individuals and organisations. The potential to use IK as a resource or raw material in the production of goods such as pharmaceutical products was discovered. Financial reward or recognition was seldom, if ever, given to the indigenous people who were the original practitioners or owners of such IK resources. This phenomenon progressed to a point where patents were registered on products derived from such discoveries. IK has now come to be regarded as a commodity and a form of intellectual property.

Various organisations such as academic institutions and the World Bank undertook to create and maintain IK databases. In some cases, the IK contained in such databases does not recognise the indigenous people as the proprietary owners of such information. Due to the intensification of globalisation, websites containing IK information later mushroomed; however, indigenous people were still not recognised.

This can be interpreted as a form of IW which is perpetrated against IK and the indigenous populace. The Information Science perspective was adopted to address the problem of IW perpetrated against IK. The Information Science perspective proposed using ICT to promote and protect IK. This would also improve access to IK.

This research proposes the use of the Internet as a medium of communicating digitised IK. IK has to be documented, digitised and stored in a national repository in each country's IKRC. An international repository will have to contain abstracts and descriptors of all the IK resources contained in local national repositories. All repositories will be accessible via the Internet. IK resources will be protected by means of cryptography and digital watermarking.

The information about the IK resources in all repositories will have to be catalogued according to the DC Metadata Element Set. The catalogued information is to be available in the English language only. Cross-language information retrieval would be implemented as soon as a standard has been adopted. Retrieving or harvesting information from the national repositories through the international repository will be done by means of OAI-PMH. These techniques will be implemented in support of the existing IP regimes to promote and protect IK.

8.5 Recommendations

The digitized IK is already available on the Internet and ICT would be required to access it. New ICTs are expensive and not pervasive, especially in the developing world. It would be necessary that the technology employed to access the digitized IK is compatible with the previous versions so that those who cannot afford leading technologies, but having earlier versions thereof are not left out. It is thus recommended the all the IK repositories or database should be equally usable by those using Internet Explorer or Netscape Navigator browsers (including older versions) to maximise possible use.

Free subscriptions to patent office sites or asking users to sign in as guests should be discouraged because this is a value-added service that requires subscription services

or payment per download. Help facilities on the international repository should indicate how far back the coverage extends and how up-to-date it is. The help facilities should also provide examples of how to enter searches; they should not be case-sensitive; they should explain how to truncate; and so on.

The Information Science retrieval mechanisms that support OAI-PMH must be fully employed. This includes the use of Boolean operators in information searches and truncation techniques. There should also be clear links to relevant classification or encoding schemes such as MESH, LCC, DDC and LCSH. An inventory of almost all sites listing all patents registered from IK resources can be provided.

8.6 Value of the research

This research would result in a large amount of tacit knowledge that impacts on the collection, digitisation and storage of IK being identified and stored in the local and national repositories. Various factors have been highlighted that justify the recognition of IK as a form of IP. IK has also been made available on the Internet, although this has rarely been done in consultation with the indigenous people who own such IK. For technological and political reasons, the current status of the protection of IP on a global level is uncertain. New technologies, including the Internet, undermine the effectiveness of IP because of heightened hacking. The speed at which hackers are able to reverse-engineer certain information products suggests that there is a serious need to integrate copyright with strong encryption (Morris et al. 2001:82).

It is suggested that this research holds the following value:

- An Information Science definition and perspective of IW has been coined.
- Various prominent forms of IPRs and their conventions have been identified.
- The background and current context of IK within the global IPR context has been explored.
- IK-related IW facing the developing world has also been uncovered.

- The use of ICT in promoting and protecting IK has been explored.
- The creation of national and international IK repositories may assist in determining the same and related forms of natural resources.

8.7 Limitations of the research

The research may have been more valuable and more representative of the Information Science field were it not for the following:

- The research was conducted by a single individual and an extended period of time has elapsed since its commencement. In the interim, some valuable papers may have been produced which have not been considered in the scope of this study.
- Various institutions haphazardly maintain independent IK databases. These institutions may refuse to cooperate with the formation of national and international IK repositories.
- Mechanisms for the exploitation of IK resources may appear in more than one country's national repository.
- Indigenous knowledge is investigated by various disciplines within their confined context. These disciplines may ignore many of the factors impacting on IK.
- This research does not investigate factors that can inhibit the development of the creation of an international IK repository.

8.8 Recommendations for further research

It is assumed that, in any research, there are more questions than answers. This research has exposed some of the complexities involved in the IW against IK from an Information Science perspective. There are a number of issues that warrant further investigation:

- The threat to biodiversity from wars, unstable economic situations and a lack of decision-making power about development projects were not investigated in any depth in this thesis and deserve further attention.
- Attention should be given to financial models for the apportionment of fees among various national IKRCs on downloads, established on a period-based subscription.
- The informational and economic value of IK derived products in the global economy should be investigated.

8.9 Final comment

This chapter evaluated this research and its contribution or value to the field. It showed that the use of ICT to promote, protect and improve access to IK (investigated in chapter seven) was executed according to good qualitative research principles. Furthermore, it was based on the available scientific literature and other electronic sources, and it was deemed that the contribution was a legitimate theoretical one.

It is important that appropriate solutions are devised and implemented to solve relevant information-based problems. Making IK available via the Internet reflects one of the prominent features of the information age. Contributions to the international repository are very important and must be highly controlled by each IKRC.

Viewing the architecture of various IK resources that form a union catalogue in the international repository in figure 7.1 puts into perspective the feasibility of making IK available via the Internet. This interaction cannot be considered in isolation; rather, it should be viewed according to the Information Science perspective on IW against digitised IK. We need also to understand the possible mechanisms by which digital IK can be protected as part of the global village. Indigenous owners of IK must also be beneficiaries of any profit that might be derived from the exploited IK resources.

ICT-related attacks that are very likely to be brought against IK on the Internet. These should be minimised. This can be addressed by making IK resources accessible on the Internet. Complete IK resources should be contained in the local national repositories. Cryptography and digital watermarking would be efficient in protecting digitised IK. It is difficult to conceptualise of digitised IK without considering the advent of various kinds of IW that have become a reality in the information age.

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Annexure

Indigenous Knowledge Resource Centers

This resource guide comprises of a list of indigenous and non-indigenous people's organizations and institutions that are interested in intellectual property rights. Some of these organizations are referred to in this thesis. This is not a complete list of all IK resource institutions but some of the most prominent organizations that represent IK interest across continents (IUCN, 1997:174-7; Posey & Dutfield, 1996:245-281).

Africa	
Burkina Faso Burkina Faso Resource Centre for Indigenous Knowledge (BURCIK) IRSSH BP 515 Ouagadougou Burkina Faso Tel: +226 306 664 Fax: +266 312 209	*Cameroon* Cameroon Indigenous Knowledge Organisation (CIKO) Private Sector Research Institution PO Box 170 Buea Southwest Province Cameroon Tel: 237 32 2690 Fax: +237 32 2514
Ghana Ghana Resource Centre for Indigenous Knowledge (GHAECIK) School of Agriculture University of Cape Coas Cape Coast Ghana Tel: +233 42 22409	*Kenya* Kenya Resource Centre for Indigenous Knowledge (KENRIK) National Museums of Kenya PO Box 40658 Nairobi Tel: +254 2 742 161/4 Fax: +254 2 741 424 E-mai: kenrik@tt.sasa.unep.no

Africa	
Madagascar Madagascar Resource Center for Indigenous Knowledge (MARCIK) Centre d'Information et de Documentation Scientifique et Technique Ministere de la Recherche Appliquee au Developpment 21 rue Kasanga BP 6224 Antananativo IOI Madagascar Fax: +261 2 32123	*Nigeria* African Resource Centre for Indigenous Knowledge (ARCIK) Nigerian Institute of Social and Economic Research PMB 5-UI Post Office Ibadan Nigeria Tel: +234 22 416 129
South Africa South African Resource Centre for Indigenous Knowledge (SARCIK) Institute for indigenouus Theory and Practice 6th Floor 45 Castle Street 8001 Cape Town South Africa Tel: +27 21 242 012 Fax: +27 21 232 168 E-mail: hansn@iaccess.za	*Nigeria (cont.)* Center for Indigenous Knowledge on Population, Resource and Environmental Management (CIKPREM) Department of Sociology and Antropology University of Nsukka Nigeria Tel: +234 77 1911

Africa	
Tanzania	*Nigeria (cont.)*
Masailand Resource Center for Indigenous Knowledge (MARECIK) Simanjiro Animal Husbandry Vocational Training Centre PO Box 3084 Arusha Tanzania Fax: 255 57 8907	Nigerian Resource Center for Indigenous Knowledge (NIRCIK) Institute for Agricultural Research Ahmadu Bell University PMB 1044 Zaria Nigeria Tel: +234 69 50571 (ext. 4322) Fax: +234 69 50891

Asia	
India	*Indonesia*
Centre for Advanced Research of Indigenous Knowledge Systems (CARIKS) PO Box 1 Saraswathipuram Mysore 570 009 India Tel: +91 82 106 1467 Fax: +91 82 161459	Indonesian Resource Centre for Indigenous Knowledge (INRIK) Department of Anthropology University of Padjadjaran Bandung 40115 Indonesia Tel: +62 22 250 371 Fax: +62 22 237 416
Philippines	*Sri Lanka*
Philippines Resource Centre for Sustainable Development and Indigenous Knoelwdge (phirCSDIK) Philippine Council for Agriculture, Forestry, and National Resources Research and development (PCAARD) Los Banos Philippines	Sri Lanka Resource Centre for Indigenous Knowledge (SLARCIK) Department of Geography University of Sri Jayawardenepura Nugegoda Sri Lanka Tel: +94 1851 685 Fax: +941 852 604

Asia	
Philippines (cont.) Regional Programme for the Promotion of Indigenous Knowledge in Asia (REPPIKA) International Institute of Regional Reconstruction (IIRR) Silang Cavite Philippines Fax: +63 25 222 494 E-mail: IIRR@phil.gn.apc.org	

Central America	
Mexico Mexico Research, Teaching and Service Network on Indigenous Knowledge Colegio de Postgraduados CEICADAR Apartado Postal L-12 CP 72130 Colonia La Libertad Puebla, Pue Mexico Tel: +52 22 851442 Fax +52 22 851444	

Europe	
Georgia Georgia Resource Centre for Indigenous	*Netherlands* Gustaaf von Liebenstein

Europe	
Knowledge (CERCIK) Institute of Botany Georgian Academy of Sciences 22 Mosashvili Street 380062 Tbilisi Georgia Tel: +995 8832 988276 E-mail: dato@botany.kheta.ge	Centre for International Research & Advisory Network (CIRAN/Nuffic) Kortenaerkade II PO Box 29777 2502 LT The Hague Hetherlands Tel: +31 70 426 0321 Fax: +31 70 426 0329 E-mail: lieb@nuffiecs.nl
Russia Yevgeny Fetisov Russian Resource Centre for Indigenous Knowledge EkoNiva PO Box 1 Nemchinovaka-I Moscow Region Russia 143013 Tel: +7 095 591 8487 Fax: +07 095 591 8275 E-mail: 100630.157@compuserve.com	*Netherlands (cont.)* Laiden Ethnosystems & Development Programme (LEAD) Institute of Cultural & Social Studies University of Leiden PO Box 9555 2300 RB Leiden Netherlands Tel: +31 71 527 3469 Fax: +31 71 527 3619 E-mail: deehrin@rulfsw.LeidenUniv.nl

North America	
Canada Centre for Traditional Knowledge 135 Hawthorne Avenue Ottawa, K12 OB2 Ontarion Canada Fax: +1 613 232 0452 E-mail: jtinglis@magi.com	*United States of America* Interinstitutional Consortium for Indigenous Knowledge (ICIK) 24 Chambers Building University Park PA 16802 Tel: +1 814 865 6565

North America	
	Fax: +1 814 863 7602
	United States of America (cont.) Center for Indigenous Knowledge for Agriculture & Rural Development (CIKARD) 318 Curtiss Hall Iowa State University Ames Iowa 50011 USA Tel: +1 515 294 0938 Fax: +1 515 294 6058 E-mail: dmwarren@iastate.edu

South America	
Brazil Brazil Resource Centre for Indigenous Knowledge (BEARCIK) Departamento de Biologia UNESP 14870.000 Jabiticabal SP Brazil Fax: +55 163 22 4275 E-mail: uejab@brfapesp.bitnet	*Uruguay* Uruguay Resource Centre for Indigenous Knowledge (URURCIK) Casillo Correo 20.201 Codigo Postal 12.900 Sayago Montevideo Uruguay Tel: +598 2 350 634 Fax: +598 2 913 780 E-mail: seprodel@chasque.apc.org
Venezuela Venezuelan Secretariat for Indigenous Knowledge and Sustainable development (VERSIK)	

South America	
Center for Tropical Alternative Agriculture and Sustainable Development Agrarian Science Department Nucleo Rafael Rangel Universidad de Los Andes Trujillo Estado Trujillo Venezuela Fax: +58 72 33667	

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