INNOVATION & INTELLECTUAL PROPERTY
COLLABORATIVE DYNAMICS IN AFRICA
Editors: Jeremy de Beer, Chris Armstrong, Chidi Oguamanam & Tobias Schonwetter

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Collaborative Dynamics in Africa

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JEREMY DE BEER, CHRIS ARMSTRONG,
CHIDI OGUAMANAM AND TOBIAS SCHONWETTER

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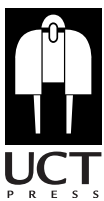

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Preface

This book is among the key outputs of the Open African Innovation Research and Training (Open A.I.R.) Project. Based on case study research in nine African countries, the book examines the recent history and current on-the-ground realities of innovation and intellectual property (IP) in African settings. In doing so, the book reveals complex collaborative dynamics across a range of different countries, sectors and socio-economic contexts, and generates recommendations for how innovation and IP can be married with social and economic development objectives in African settings. This book's sister report, *Knowledge and Innovation in Africa: Scenarios for the Future,* situates the current realities covered in this book within a much longer historical trajectory and multiple potential futures.

Conceived in 2009, established in 2010 and launched in 2011, Open A.I.R. is a pan-African and globally interconnected research and training network, which was established to:

- raise IP awareness in African settings and facilitate critical policy engagement;
- empower a networked, epistemic IP community in Africa;
- identify IP-related innovation bottlenecks and modes of open collaboration; and
- interrogate IP-related innovation metrics, capital and power structures.

Open A.I.R. is financially supported by Canada's International Development Research Centre (IDRC) and Germany's Federal Ministry for Economic Cooperation and Development (BMZ), and collaborates with numerous other organisations and individuals – all of whom are recognised in the Acknowledgements' pages of this book. In addition to the aforementioned case study and foresight research, the Open A.I.R. network engages in a wide range of training, capacity building, outreach and policy engagement activities – both on the African continent and in settings outside the continent where matters of African innovation and IP are engaged. These engagements target external stakeholders capable of changing policies and practices, including:

- innovators, creators and entrepreneurs – individuals and companies;
- business groups such as chambers of commerce and industry associations;
- national, regional and international law-makers and policy-makers;
- issue leaders, such as politicians, judges, professors and practitioners;
- scientific and cultural research and development funding bodies;

- university researchers, administrators and technology transfer officials;
- rights-holders and collective rights management organisations; and
- representatives of indigenous and local communities.

Open A.I.R. is motivated by a vision in which innovation and creativity in Africa are sustainable, properly valued, collaborative, widely accessible and result in benefits that are distributed throughout society. Based on this vision, the network's mission is to better understand how innovation and IP processes work in African settings, how knowledge and technology currently protected by IP can be mobilised, and how IP systems can be harnessed or adapted in a manner that fosters openness-oriented collaborative innovation resulting in just distribution of new knowledge and technology.

This book and the *Scenarios* volume are two parts of a much broader attempt, by Open A.I.R. and other initiatives, to facilitate, in the medium to long term, the emergence of new, pragmatic means of valuing and facilitating innovation and creativity in Africa. Contextually appropriate metrics sensitive to the monitoring of meaningful changes in behaviour around innovation and creativity could be instrumental for promoting African grassroots entrepreneurship, broad-based business development, and a vibrant private sector built on small and medium-sized enterprises (SMEs) with a sustained ability to innovate. And the opportunities for innovation-driven SMEs could also benefit from policy-maker adoption of appropriate metrics when designing the policy and regulatory frameworks necessary to ensure predictable innovation environments for stakeholders.

Open A.I.R.'s core funders, IDRC and BMZ, have provided a framework for Open A.I.R.'s objectives. Open A.I.R. fits within the IDRC's Science and Innovation programme, which supports research and policy engagement in relation to how science, technology and innovation (STI) can be engines of socio-economic development. Within this programme, the Information and Networks (I&N) initiative, which funds the Open A.I.R. Project, aims to better understand the linkages among innovation, creativity, networked collaborations (often enabled via information and communication technologies [ICTs]), and determinants of openness – including IP rights. The IDRC also supported the precursor network to Open A.I.R., the African Copyright and Access to Knowledge (ACA2K) Project, which ran from 2007 to 2011 and generated the nucleus of the expert network now driving Open A.I.R.

BMZ supports Open A.I.R. via Germany's Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), under the GIZ commons@ip – Harnessing the Knowledge Commons for Open Innovation initiative**.** The commons@ip initiative focuses on how IP rights interact with open innovation, the knowledge commons, open licences and collaborative innovation. It is part of the BMZ-

mandated Train for Trade programme, which aims at strengthening the private sector and its constituent bodies in the Southern African Development Community (SADC) region through training and capacity building in export promotion, quality control and promotion of open innovation – as well as through promotion of local and regional economic development and trade.

Open A.I.R.'s training and capacity building components include:

- building the network's capacity – through online platforms, network-wide workshops, research methodology support, scenario-building meetings and thematic seminars;
- awarding Open A.I.R. Fellowships to emerging IP scholars and potential leaders – from Tanzania, Kenya, Uganda, Ethiopia, Cameroon, Nigeria and Egypt;
- exchanging knowledge through Africa-wide and South–South knowledge networking at seminars, workshops and conferences;
- growing awareness among African creators, innovators, entrepreneurs and policy-makers of openness-oriented approaches to innovation and IP matters in Africa; and
- teaching at African tertiary educational institutions, including development of a replicable, open course curriculum on IP law and development.

Because of the immense geographic size of the African continent, and unique logistical challenges of African intra-continental travel, ICTs have been instrumental in empowering the research network's "community of practice". Open A.I.R. has an offline presence in 14 African countries and in multiple countries outside the continent. Online, the network includes hundreds of individuals and institutions throughout Africa and from all corners of the globe, linked via a suite of online networking and social-media tools. The Open A.I.R. community of practice advances a culture of multidirectional exchange among African innovative and creative communities and external actors – with a view to sustainably empowering local communities and SMEs. Network members promote cross-fertilisation of ideas via original thinking and partnerships with national and international institutions, scholars, funding agencies, civil society organisations and other willing partners. Those wishing to join the community can visit http://www.openair.org.za/join.

Acknowledgements

True to its emphasis on "collaborative dynamics", this book is the product of the collective energy of dozens of people and institutions in many countries, all of whom work within the Open African Innovation Research and Training (Open A.I.R.) network. Open A.I.R. currently has core network members and institutions in 14 African countries, spanning North Africa (Egypt, Tunisia), West Africa (Senegal, Ghana, Nigeria, Cameroon), East Africa (Ethiopia, Uganda, Kenya, Tanzania) and southern Africa (Malawi, Mozambique, Botswana and South Africa). Other network members and institutions are in Canada, the United States, the United Kingdom, Germany and France. These members are, in turn, linked – via online and offline interactions – to a broader Open A.I.R. network of hundreds of individuals and institutions, including people and entities in Brazil, India, Malaysia, Australia, Switzerland and the Netherlands. The network receives generous financial support from Canada's International Development Research Centre (IDRC) and Germany's Federal Ministry for Economic Cooperation and Development (BMZ).

Each of the editors and authors of this volume is part of, and collaboratively exchanges knowledge and expertise with, this large network, and we the editors, and each of the contributors, are profiled in "About the Editors" and "About the Contributors" sections of this book and on the Open A.I.R. website's Team page, http://www.openair.org.za/content/open-air-team. On this Team page, one can also find the names and contact details of Open A.I.R. Fellows and other network members and institutions. The network is also accessible via its social media platforms, featured at http://www.openair.org.za/join

Open A.I.R.'s administrative hub is the IP Unit in the University of Cape Town Faculty of Law, where Project Manager Nan Warner and Administrator Phyllis Webb are the key operational drivers. Warner and Webb receive management support from two of the editors of this book (and the co-Principal Investigators of the Open A.I.R. Project), UCT IP Unit Director Tobias Schonwetter and Jeremy de Beer of the University of Ottawa Faculty of Law. Also supporting project management are Julie Nadler-Visser of UCT's Research Contracts and IP Services (RCIPS) unit, members of the UCT Finance Department and Faculty of Law Finance Department, and another editor of this book: Chris Armstrong of the LINK Centre at the University of the Witwatersrand (Wits) in Johannesburg.

Network strategic guidance is provided by a Steering Committee composed of De Beer, Schonwetter, Warner, Chidi Oguamanam (another of this book's

editors) of the University of Ottawa Faculty of Law, Nagla Rizk of The American University in Cairo (AUC), Sisule Musungu of IQsensato in Nairobi, Khaled Fourati of the IDRC office in Cairo, and Balthas Seibold of Germany's Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in Bonn. Further strategic support from the IDRC is, or has been, provided by Naser Faruqui, Simon Carter, Laurent Elder, Fernando Perini, Matthew Smith, Heloise Emdon and Phet Sayo; Karim Badran and Rose-Marie Ndiaye Pereira on financial matters; and Michelle Hibler and Nola Haddadian on publications. GIZ's involvement is focused on the capacity-building components of the network, which are carried out in collaboration with the GIZ's commons@ip – Harnessing the Knowledge Commons for Open Innovation initiative. At GIZ, in addition to support from the aforementioned Steering Committee member Balthas Seibold, who advises on matters of international knowledge cooperation and networking, support has also come from Petra Hagemann, Christine de Barros Said, Ursula van Look, Marina Neuendorff, Margrit Brockhaus and the Working Group of German Development Organisations on Promoting Innovation Systems. At UCT, as well as those already mentioned, key supporters and collaborators have been the Dean of Law, PJ Schwikkard, Lee-Ann Tong in the Faculty of Law, and, in the IP Unit, the Unit's founder Julian Kinderlerer, its Deputy Director Caroline Ncube and its Senior Research Fellow Bernard Maister. At the University of Ottawa, in addition to those already mentioned, support has been provided by the Dean of the Faculty of Law, Common Law Section, Nathalie Des Rosiers, and Former Dean Bruce Feldthusen.

For this book, key network participants were the team of JD candidates in the University of Ottawa Faculty of Law – Lukas Frey, Will Sapp, Phil Holdsworth, Maya Boorah, Kristen Holman and Saara Punjani – who provided long hours of diligent editorial assistance. In addition, because the research case studies presented in this book all required collection of data from human subjects – via interviews and/or focus group discussions and/or written surveys – this book would not have been possible without the cooperation of dozens of respondents across the countries of study. For reasons of confidentiality, most survey and interview respondents are not named in this book, but we are sincerely grateful for their contributions. Also contributing to the research outlined in this book was Donna Podems of OtherWISE in Cape Town, who advised on research methodologies and supported a methodology workshop for several of the authors featured in this volume, in addition to her support of Open A.I.R.'s monitoring and evaluation (M&E) framework. At this book's publisher, UCT Press, the key drivers have been Publisher Sandy Shepherd and Project Manager Glenda Younge. The cover design for this volume is by Elsabe Gelderblom of Farm Design in Cape Town, who does all of Open A.I.R.'s design work for its website, social media tools, PR materials,

Briefing Notes and the network's other substantial publication output, the Open A.I.R. *Scenarios* compendium – which is available in hard-copy, and on the Open A.I.R. website, as a separate published output and companion to this book.

Network headquarters at the UCT IP Unit serves as Open A.I.R.'s Southern Africa Hub, coordinated by Project Manager Warner. There are also four other Hubs: the North Africa Hub at the Access to Knowledge for Development Center (A2K4D) of the School of Business at The American University in Cairo (AUC), coordinated by Nagham El Houssamy under the direction of Nagla Rizk; the West Africa Hub at the Nigerian Institute of Advanced Legal Studies (NIALS) in Lagos, coordinated by Helen Chuma-Okoro under the direction of Adebambo Adewopo; the East Africa Hub at the Centre for IP and IT Law (CIPIT) of Strathmore University, Nairobi, coordinated by CIPIT Director Isaac Rutenberg; and the Canada Hub at the University of Ottawa Faculty of Law, coordinated by De Beer and Oguamanam. Contact can be made with these Hubs and Hub Coordinators via the aforementioned Open A.I.R. website Team page.

Also integral to the success of the network are its nine Fellows, each of whom has spent time at the UCT IP Unit in Cape Town. The Fellows have contributed to Open A.I.R.'s case study and foresight research, to outreach and training work, and to building the network. The nine Fellows are: Esther Ngom of the Ngo Nyemeck law firm in Yaoundé; Seble Baraki of the Justice and Legal System Research Institute (JLSRI) in Addis Ababa; Moses Mulumba of the Centre for Health, Human Rights and Development (CEHURD) in Kampala; Douglas Gichuki of CIPIT in Nairobi; Milton Lore of Bridgeworks Africa in Nairobi; Eliamani Laltaika of the Tanzania Intellectual Property Rights Network (TIP-Net) in Dar es Salaam; Alexandra Mogyoros, a student in the Faculty of Law at the University of Ottawa; West Africa Hub Coordinator Helen Chuma-Okoro of NIALS in Lagos; and North Africa Hub Coordinator Nagham El Houssamy of A2K4D in Cairo.

Other collaborating institutions are the Program on Information Justice and Intellectual Property (PIJIP) at the Washington College of Law at American University in Washington, DC; the Centre for Technology and Society (CTS) in Brazil; the Centre for Internet and Society (CIS) in India; and the Open Society Foundations, where Open A.I.R.'s key partner is Vera Franz. The Open A.I.R. network has also benefited from interaction with staff at the World Intellectual Property Organisation (WIPO) headquarters in Geneva. In London, Shirin Elahi of Scenarios Architecture is the driver of Open A.I.R. foresight research work, as featured in the aforementioned *Scenarios* compendium that provides an important forward-looking complement to the current picture offered by this volume. Jo Higgs of Go Trolley Films in Cape Town did post-production on the videos available on the Open A.I.R. YouTube channel – videos which show how the network came into being and how the research was conceptualised.

All the people and institutions mentioned here have in one way or another played a role, by collaborating within the Open A.I.R. network, in the conceptualisation, planning, data collection, data analysis, writing, editing, design and production processes that resulted in successful research and the completion of this book. It is hoped that this volume's free availability online, under a Creative Commons (CC) licence, will ensure that the book's collaborative dynamics do not end here at the moment of publication, and continue long into the future in the work of the still-growing Open A.I.R. community.

Jeremy de Beer, Chris Armstrong, Chidi Oguamanam, Tobias Schonwetter
September 2013

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Acronyms and Abbreviations

A2K	access to knowledge
A2K4D	Access to Knowledge for Development Center (The American University in Cairo, Egypt)
AAU	Addis Ababa University
ABS	access and benefit-sharing
ACA2K	African Copyright and Access to Knowledge Project
ACP	African, Caribbean and Pacific Group of States
ACTS	African Centre for Technology Studies (Kenya)
ADPP	Ajuda de Desenvolvimento de Povo para Povo (Mozambique)
AERC	African Economic Research Consortium
AFTE	Association for the Freedom of Thought and Expression (Egypt)
AGOA	African Growth and Opportunity Act
AIM	Agência de Informação de Moçambique
AmCham	American Chamber of Commerce (Egypt)
ARC	Aquaculture Research Centre (Egypt)
ARIPO	African Regional Intellectual Property Organisation
ASSAf	Academy of Sciences of South Africa
ASTII	African Science, Technology and Innovation Indicators
ATO	alternative trading organisation
ATPC	African Trade Policy Centre
ATPS	African Technology Policy Studies Network
AU	African Union
AUC	The American University in Cairo
B-BBEE Act	Broad-Based Black Economic Empowerment Act 53 of 2003 (South Africa)
BCP	bio-cultural community protocol
BIH	Botswana Innovation Hub
BMZ	Federal Ministry for Economic Cooperation and Development (Germany)
BoI	Bank of Industry (Nigeria)
BOTEC	Botswana Technology Centre
BPR	business process re-engineering
CAA	Cocoa Abrabopa Association (Ghana)
CARICOM	Caribbean Community
CBD	Convention on Biological Diversity
CBN	Central Bank of Nigeria

CC	Creative Commons
CCIA	Computer and Communications Industry Association
CEDAT	College of Engineering, Design, Art and Technology (Makerere University, Uganda)
CEHURD	Centre for Health, Human Rights and Development (Uganda)
CEPIL	Centre for Public Interest Law (Ghana)
CIGI	Centre for International Governance Innovation
CIPC	Companies and Intellectual Property Commission (South Africa)
CIPIT	Centre for IP and IT Law (Strathmore University, Kenya)
CIPO	Canadian Intellectual Property Office
CIPR	Commission on Intellectual Property Rights (UK)
CMO	collective management organisation
COCOBOD	Ghana Cocoa Board
CPD	Centre for Policy Dialogue (Nigeria)
CRTT	Centre for Research in Transportation Technologies (Makerere University, Uganda)
CSIR	Council of Scientific and Industrial Research (India)
CTEA	Copyright Term Extension Act (US)
CVCP	Committee of Vice-Chancellors and Principals (UK)
DACST	Department of Arts, Culture, Science and Technology (South Africa)
DEST	Department of Education, Science and Training (Australia)
DFID	Department for International Development (UK)
DHET	Department of Higher Education and Training (South Africa)
DNS	domain name system
DRC	Democratic Republic of Congo
DRM	digital rights management
DRST	Department of Research, Science and Technology (Botswana)
DST	Department of Science and Technology (South Africa)
DTI	Department of Trade and Industry (South Africa)
EAEP	East African Educational Publishers (Kenya)
EC	European Commission
ECBP	Engineering Capacity Building Program (Ethiopia)
ECOWAS	Economic Community of West African States
ECX	Ethiopia Commodity Exchange
EEAA	Egyptian Environmental Affairs Agency
EIPO	Ethiopian Intellectual Property Office
EIPRL	Egyptian Intellectual Property Rights Law
EPA	Environmental Protection Authority (Ethiopia)
EPO	European Patent Office
EST	environmentally sound technology

EU	European Union
EUEI	EU Energy Initiative
Eurostat	Statistical Office of the European Communities
FAO	UN Food and Agriculture Organisation
FCN	Friendship, Commerce and Navigation (Kenya)
FDI	foreign direct investment
FDRE	Federal Democratic Republic of Ethiopia
FDSE	Free Day Secondary Education (Kenya)
FES	Friedrich Ebert Stiftung (Germany)
FLO	Fairtrade Labelling Organisations International
FOSS	free and open source software
FPE	Free Primary Education (Kenya)
FTA	free trade agreement
GDP	gross domestic product
GEM	Global Entrepreneurship Monitor
GERD	gross expenditure on research and development
GI	geographical indication
GIPC	Global Intellectual Property Center
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (Germany)
GM	genetically modified
GOAN	Ghana Organic Agriculture Network
GOK	Government of Kenya
GR	genetic resources
GTZ	German Technical Cooperation
HSRC	Human Sciences Research Council (South Africa)
ICANN	Internet Corporation for Assigned Names and Numbers
ICIDSS	International Creativity and Innovation Development Support Services (Ethiopia)
ICJ	International Commission of Jurists
ICLS	International Conference of Labour Statisticians
ICPSK	Institute of Chartered Public Secretaries of Kenya
ICT	information and communication technology
ICT4D	ICT for development
ICTSD	International Centre for Trade and Sustainable Development
IDC	Industrial Development Corporation (South Africa)
IDLO	International Development Law Organisation
IDRC	International Development Research Centre (Canada)
IDS	Institute of Development Studies (Kenya)
IE	informal economy

IFC	International Finance Corporation
IICA	Inter-American Institute for Cooperation on Agriculture
IIDMM	Institute of Infectious Disease and Molecular Medicine (South Africa)
IIED	International Institute for Environment and Development
IIPA	International Intellectual Property Alliance
IISD	International Institute for Sustainable Development
ILC	indigenous and local community
ILO	International Labour Organisation
INAO	Institut national des appellations d'origine (France)
IP	intellectual property
IPA	Industrial Property Act (Botswana)
IPC	International Patent Classification
IPI	Industrial Property Institute (Mozambique)
IPR-PFRD Act	Intellectual Property Rights from Publicly Financed Research and Development Act (South Africa)
IRB	Institutional Review Board (Botswana)
IRENA	International Renewable Energy Agency
ISAS	integrated seawater agriculture system
ISCTEM	Instituto Superior de Ciências e Tecnologia de Moçambique
ISI	Institute for Scientific Information
ISO	International Organisation for Standardisation
ISP	Information Society Project (Yale University, US)
ITC	International Trade Centre
JBEDC	Japan Bio-Energy Development Corporation
JITAP	Joint Integrated Technical Assistance Programme
JLSRI	Justice and Legal System Research Institute (Ethiopia)
K2C Biosphere	Kruger to Canyons Biosphere (South Africa)
KE	knowledge economy
KECOBO	Kenya Copyright Board
KENFAA	Kenya Nonfiction and Academic Authors' Association
KES	Kenyan Shilling
KHA	Kenya Historical Association
KICD	Kenya Institute of Curriculum Development
KIPI	Kenya Industrial Property Institute
KIPPRA	Kenya Institute for Public Policy Research and Analysis
KNAS	Kenya National Academy of Sciences
KOLA	Kenya Oral Literature Association
KTO	knowledge transfer office
LBC	Licensed Buying Company (Ghana)
LDC	least developed country

LE	Egyptian Pound
LINK Centre	Learning Information Networking Knowledge Centre (Wits University, South Africa)
LSK	Law Society of Kenya
MAN	Manufacturers Association of Nigeria
MANCAP	Mandatory Conformity Assessment Programme (Nigeria)
MCH	Maasai Cultural Heritage Organisation (Kenya)
MCST	Ministry of Communications, Science and Technology (Botswana)
MCT	Ministério da Ciência e Tecnologia (Mozambique)
MDCA	Malindi District Cultural Association (Kenya)
MDG	Millennium Development Goal
MEA	Multilateral Environmental Agreement
MIST	Ministry of Infrastructure, Science and Technology (Botswana)
MIT	Massachusetts Institute of Technology
MOA	Ministry of Agriculture (Ethiopia)
MOE	Ministry of Education (Ethiopia)
MOFA	Ministry of Food and Agriculture (Ghana)
MoFED	Ministry of Finance and Economic Development (Ethiopia)
MOST	Ministry of Science and Technology (Ethiopia)
MoU	memorandum of understanding
MRC	Medical Research Council (South Africa)
Natoil	Natural Oil Company (Egypt)
NACI	National Advisory Council on Innovation (South Africa)
NCC	Nigerian Copyright Commission
NDA	non-disclosure agreement
NEP	National Enquiry Point (Botswana)
NEPAD	New Partnership for Africa's Development
NESC	National Economic and Social Council (Kenya)
NESTI	National Experts on Science and Technology Indicators
NIALS	Nigerian Institute of Advanced Legal Studies
NRF	National Research Foundation (South Africa)
NGO	non-governmental organisation
NIALS	Nigerian Institute of Advanced Legal Studies
NIPMO	National Intellectual Property Management Office (South Africa)
NIS	national innovation system
NMIMS	Narsee Monjee Institute of Management Studies (India)
NPR	National Public Radio (US)
NPSB	National Policy and Strategy on Biofuels (Mozambique)
NRC	National Research Centre (Egypt)

NREA	New and Renewable Energy Authority (Egypt)
NWLR	Nigerian Weekly Law Report
OA	open access
OAPI	Organisation africaine de la propriété intellectuelle
OCEES	Oxford Centre for the Environment, Ethics and Society
OCFCU	Oromia Coffee Farmers Cooperative Union (Ethiopia)
ODEL	open, distance and electronic learning
ODI	Overseas Development Institute (UK)
OECD	Organisation for Economic Co-operation and Development
OER	open educational resource
Open A.I.R.	Open African Innovation Research and Training Project
ORD	Office of Research and Development (Botswana)
PBIP	place-based intellectual property
PCT	Patent Cooperation Treaty
Petromoc	Petróleos de Mozambique
PIIPA	Public Interest Intellectual Property Advisors (US)
PIJIP	Program on Information Justice and Intellectual Property (American University, US)
PPS	probability proportional to size
PRO	public research organisation
ProBEC	Programme for Basic Energy and Conservation in Southern Africa
R&D	research and development
RCIPS	Research Contracts and IP Services unit (UCT, South Africa)
RIPCO (B)	Rural Industrial Promotion Company (Botswana)
RMI	rights management information
SADC	Southern African Development Community
SARUA	Southern African Regional Universities Association
SCE	Society for Critical Exchange (Kenya)
SID	Society for International Development (Kenya)
SINER-GI	Strengthening International Research on Geographical Indications
SME	small and medium enterprise
SMIEIS	Small and Medium Industries Equity Investments Scheme (Nigeria)
SMME	small, micro and medium enterprise
SNA	social network analysis
SON	Standards Organisation of Nigeria
SPS	sanitary and phytosanitary measures
STCI	Science and Technology Capacity Index
STEP	Science Technology and Economic Policy (US)
STI	science, technology and innovation
STS	Society for Technology Studies (Ethiopia)

SVKM	Shri Vile Parle Kalamani Mandal (India)
TBT	technical barriers to trade
TCE	traditional cultural expression
TGE	Transitional Government of Ethiopia
THE	Times Higher Education (UK)
THRIP	Technology and Human Resources Programme (South Africa)
TIA	Technology Innovation Agency (South Africa)
TIP-Net	Tanzania Intellectual Property Rights Network
TISC	Technology and Innovation Support Center
TK	traditional knowledge
TKDL	Traditional Knowledge Digital Library (India)
TPMs	technological protection measures
TRIPS	Agreement on Trade-Related Aspects of Intellectual Property Rights
TTO	technology transfer office
TVET	Technical and Vocational Education and Training (Ethiopia)
UB	University of Botswana
UCC	Universal Copyright Convention
UCITA	Uniform Computer Information Transactions Act (US)
UCT	University of Cape Town (South Africa)
UEM	Eduardo Mondlane University (Mozambique)
UGT	Uganda Gatsby Trust
UK	United Kingdom
UM	utility model
UNCST	Uganda National Council for Science and Technology
UNCTAD	UN Commission on Trade and Development
UNDESA	UN Department of Economic and Social Affairs
UNDP	UN Development Programme
UNECA	UN Economic Commission for Africa
UNEP	UN Environment Programme
UNESCAP	UN Economic and Social Commission for Asia and the Pacific
UNESCO	UN Educational, Scientific and Cultural Organisation
UNFCCC	UN Framework Convention on Climate Change
UNICAMP	University of Campinas (Brazil)
UNIDO	UN Industrial Development Organisation
Unilag	University of Lagos
US	United States
USAID	US Agency for International Development
USPTO	US Patent and Trademark Office
WAK	Writers Association of Kenya
WATH	West Africa Trade Hub

WBCSD	World Business Council for Sustainable Development
WCT	WIPO Copyright Treaty
WEF	World Economic Forum
WEP	World Employment Programme
WHO	World Health Organisation
WIPO	World Intellectual Property Organisation
Wits	University of the Witwatersrand (South Africa)
WPIS	WIPO Patent Information Service
WPPT	WIPO Performances and Phonograms Treaty
WTO	World Trade Organisation
ZAR	South African Rand

Chapter 15

Perspectives on Intellectual Property from Botswana's Publicly Funded Researchers

Njoku Ola Ama

Abstract

This chapter outlines the findings from a case study of perceptions of intellectual property (IP) issues among researchers conducting publicly funded research in Botswana. The country's emergent legal and policy framework on IP and on science, technology and innovation (STI) shows that Botswana is actively seeking to position itself to take advantage of IP commercialisation opportunities. However, the data from this study's survey of publicly funded researchers reveal low levels of awareness among the researchers of both national and institutional IP frameworks governing the outputs of their research – and, at the same time, an apparent desire among the researchers for there to be a combined emphasis on commercialisation of knowledge while adhering to the principles of "open science". The study also found strong evidence of researcher desire for improved research climates at their institutions, in order to foster the high-quality research necessary to feed into open science dissemination and sharing, as well as commercialisation synergies with the country's parastatal and industrial entities.

1. Research problem

Owners of intellectual property (IP) will normally make works or inventions available to the public in exchange for exclusive rights granted for a limited time. Exclusive rights enable the IP owner to generate economic returns from protected works or inventions. Formal IP rights may take the form of a patent, industrial design, copyright or trademark. In many countries belonging to the Organisation for Economic Co-operation and Development (OECD), universities and public research organisations (PROs) that receive significant public research funding have become increasingly alerted to the value of IP. This is, to some extent, a

result of a view taken by governments that placing the outputs of publicly funded research in the public domain is not sufficient to generate adequate social and economic benefits from research (Salter and Martin, 2001).

IP regulatory environments influence both the type of research that is publicly funded and the value that accrues from such research. IP is, therefore, part of a nation's public policy relating to the promotion of technological innovation in a knowledge-based economy. According to Huang (2006), a prevalent view of the value of a strong IP system, as typified by the US Patent and Trademark Office (USPTO), is that IP protection "contributes to a strong global economy, encourages investment in innovation and fosters entrepreneurial spirit" (Huang, 2006, p.12).

The question this research study sought to answer was: *How do Botswana's IP laws, and the policies of institutions doing publicly funded research, potentially impact on dissemination, utilisation and commercialisation of research output?* The question was premised on the assumption that benefits accruing to a country from publicly funded research can be influenced by the nation's IP regime, and the hypothesis that policies encouraging openness in the dissemination of research outputs may encourage more active participation in research and innovation.

Context

University research has historically formed the foundation for many of the most significant technological and industrial advancements (Holly, 2010). However many ideas and discoveries arising from university research are never fully developed. Social prosperity and economic growth are stimulated when academic discoveries are adopted and transformed by entrepreneurs and established corporations, but many great ideas springing from publicly funded research do not make the step from the laboratory to the marketplace. Several explanations have been offered for this problem, including: a lack of funding to scale and commercialise ideas; a lack of the business expertise required to understand the steps towards commercialisation; a scarcity of the human capital required to build start-up companies when needed; and inadequate mentoring and educational support for new entrepreneurs (Holly, 2010).

It has been persuasively argued that the innovation performance of a country largely depends on how its universities, PROs and parastatal and industrial enterprises relate to each other in the creation and use of knowledge, i.e. that the level and type of interaction between these major actors in a national innovation system determines the rate and direction of technological progress (OECD, 1997). The smooth operation of a national innovation system depends on, among other factors, wide dissemination of knowledge generated by universities and PROs in a

way that maximises its developmental impact. The ability of parastals and industry to access knowledge from universities and PROs is thus crucial. The quality of public research infrastructure, and the infrastructure's links to industry, are among the most important national assets for supporting innovation.

But the relationship between IP and access to research results and innovation performance is, at the same time, contentious. One position posits that IP ownership by public institutions, and exclusive licensing of technologies by these institutions to the private sector, will increase the rate of commercial application of knowledge (GIPC, n.d.). This view is typified by the provisions of the US Bayh-Dole Act of 1980. The opposing view argues that the interests of technology transfer are best served by the widest possible dissemination of knowledge, through what has come to be known as "open science" (Sampat, 2002). The impact of IP on the growth, diffusion and use of scientific knowledge is thus a central issue for economists, law-makers, policy-makers, technology scholars, sociologists and decision-makers in public and private institutions (Campbell *et al.*, 2002; David, 2001; Heller and Eisenberg, 1998; Straus *et al.*, 2004; Walsh *et al.*, 2002). Heller and Eisenberg (1998) have argued that IP rights can have an "anti-commons" effect, deterring investment and stifling innovation rather than spurring it. Heller and Eisenberg, along with others, view IP systems as a potential impediment to the free flow of scientific knowledge and the ability of researchers to build cumulatively on each other's discoveries, particularly in the field of biomedical research (Heller and Eisenberg, 1998; David, 2004; Huang, 2006; Murray and Stern, 2007). This approach aligns with Weitzman's (1974) work on a "new economics" of scientific research, which itself built on Merton's (1942) "science first" position, which advocated for norms of full disclosure for knowledge dissemination. Dasgupta and David (1994) agree with Merton, arguing that full-disclosure systems reward scientific endeavour, through community recognition of those with the greatest knowledge contribution over a sustained period of time. Career incentives such as tenure also encourage open disclosure through, *inter alia*, publications (which help ensure that research outputs remain as public goods, readily accessible for application).

The US Bayh-Dole Act enabled universities to own and manage the IP arising from federally sponsored research, with royalty revenues shared between universities and inventors. From an economic development perspective, it has been argued by some that Bayh-Dole was a boon to local economies and to society at large, as new technologies were introduced to market (Holly, 2010). However, Sampat (2002) argues that Bayh-Dole was promulgated based on minimal evidence that the *status quo ante* resulted in low rates of commercialisation of university inventions. The Act neglected the economic importance of the public aspects of university research and ignored the possibility of potential negative effects of

increased patenting and licensing on online-based science and other emergent channels of technology and knowledge transfer (Sampat, 2002). Mazzoleni and Nelson (2007, as cited in Sampat, 2009), argue that one of the main ways in which publicly funded research contributes to domestic innovation and productivity is by making knowledge and technology readily accessible to the public. The underlying logic of this view is that the outputs of academic research disseminated via open science contribute not only to industry, but also to future academic research (Salter and Martin, 2001). Put another way, the argument is that greater attention needs to be paid to the *socialisation* of knowledge for the benefit of society – as opposed to a narrower focus on generating primarily *commercial* value from knowledge.

In recent years, maximising the societal benefits of publicly funded research has become a subject of debate in some African countries, particularly those which have introduced, or are planning to introduce, legislation in this area. South Africa (see Chapter 13 in this volume) passed a law in 2008 dealing with IP from publicly funded research (IPR-PFRD Act of 2008). Other African countries are currently contemplating similar legislation. In Ethiopia (see Chapter 14 in this volume), the STI Policy of 2012 has identified building capacity to manage IP, at both national and institutional levels, as one of its strategies. However, there is a view that African countries, in developing policy and legislation related to IP from public research, must be careful not to blindly mimic the approach of the American Bayh-Dole Act – an Act adopted in national and global contexts different from the ones faced by African countries at present (Youngleson, 2012).

2. The research

The study reported in this chapter sought to probe the potential impact of Botswana's IP legal and policy environment on dissemination, utilisation and commercialisation of knowledge generated through publicly funded research. The study was exploratory in nature. Through examination of Botswana's legal and policy frameworks relevant to IP from public research, and a survey of researchers' perceptions of the IP situation at their institutions, the study sought to discover how Botswana's IP environment was interacting with publicly funded research. The primary contribution of this study is its focus not on abstract principles or secondary literature, but on empirical data regarding the understandings and beliefs of Botswana's researchers.

The core of the study was a structured survey questionnaire administered to researchers across three publicly funded research settings: (1) universities;

(2) PROs and government/NGO entities; and (3) parastatal/industry/consultancy institutions. To decide on the sample size for the survey of researchers, the Creative Research Systems (2010) *Sample Size Calculator* was used to determine an appropriate sample size to provide 95% confidence, and a 5% margin of error, so that responses from the sample would reflect those of the target population. For a population of 2,000 (the approximate size of the target community of Botswana's public researchers), the statistically desirable sample size was calculated at 323. However, because of budget constraints, the sample size for this study could only be 194 respondents (60% of the optimal sample size). The population was organised into the three aforementioned strata: universities, PROs and parastatal/industry institutions. The statistically determined sample size was allocated to each stratum using probability proportional to size (PPS) measures, which provided a more representative sample of the population than simple random sampling would have. A purposive sampling method was used to identify the individual researchers to be surveyed. This method enabled identification of researchers with the desired characteristics (e.g. those with a record of innovation, those belonging to particular disciplines central to innovative research, those whose research was publicly funded). Another method of non-random sampling – the snowball technique, relying on referrals from initial subjects to additional subjects – was also employed.

The questionnaire administered to each of the respondent researchers was completed in writing either (1) by research assistants during structured interviews adhering to the questionnaire or (2) by the respondents themselves. The questionnaire sought information from the researchers on:

- the nature and type of research they were involved in;
- their general knowledge and utilisation of IP;
- the IP-related activities of their institutions; and
- their views on the potential impact of IP on the publicly funded research environment.

The questionnaire was reviewed and ratified by the University of Botswana's Institutional Review Board (IRB) and then approved by the Ministry of Trade and Industry's Ethical Committee. In addition, permission to conduct the study was obtained from the heads of the institutions where the respondents were based. The trained research assistants informed respondents about the purpose of the study before the questionnaire was administered. Of the 194 respondents targeted, 187 questionnaires were completed and returned, providing a response rate of 96.4%. The questionnaire data were supplemented by key informant interviews with select policy-makers (Members of Parliament, ministry staff, councillors, village development committee members) and heads of institutions, directors of research and development, heads of IP units and some members of the judiciary.

Before describing and analysing the findings from the study (in Sections 4 to 6), it is first necessary (in the next section) to provide an understanding of the IP and science, technology and innovation (STI) legal and policy environment in Botswana.

3. Botswana IP and STI environment

IP rights are essentially territorial: they generally operate within borders. A number of international instruments attempt to establish uniform standards and overcome the difficulties that arise from this territorial nature of IP rights. To that end, Botswana is a contracting member of a number of international instruments.

Global instruments:

- Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS);
- Berne Convention for the Protection of Literary and Artistic Works;
- Convention Establishing the World Intellectual Property Organisation (WIPO);
- Hague Agreement Concerning the International Deposit of Industrial Designs;
- Paris Convention for the Protection of Industrial Property;
- Patent Cooperation Treaty (PCT);
- Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks;
- WIPO Copyright Treaty (WCT); and
- WIPO Performances and Phonograms Treaty (WPPT).

African instruments:

- Banjul Protocol on Marks within the Framework of ARIPO;
- Harare Protocol on Patents and Industrial Designs within the Framework ARIPO;
- Lusaka Agreement on the Creation of the African Regional Intellectual Property Organisation (ARIPO); and
- Swakopmund Protocol on the Protection of Traditional Knowledge and Expressions of Folklore within the Framework of ARIPO.

Botswana has signed treaties that fall into two general categories: those which aim to achieve harmonisation through the provision of minimum standards of protection (such as the Paris Convention and TRIPS) and those which aim to achieve international registration to obviate the need for an applicant to file

applications in every country where protection is sought (such as the ARIPO Harare Protocol and the Madrid Protocol). International treaties have influenced Botswana's statutory IP protection framework. For example, Botswana's Industrial Property Act (IPA), which governs patents and trademarks, provides internationally recognised standards of protection for both foreign and domestic IP.

IP law in Botswana is regulated by a combination of common law and statute. Although applicable IP law is mainly statutory, there are many aspects of it – such as actions for unlawful competition – which are governed by the common law. For instance, under the common law, an Aquilian action (*actio legis Aquiliae)* can be instituted for the recovery of compensation for patrimonial loss caused by the unlawful conduct of another through acts such as breach of confidence, passing off and injurious falsehood. Botswana has grappled with the challenges of enacting laws that reflect the country's hybrid Roman-Dutch and common law legal heritage. In modernising its laws to keep pace with current developments to attract and retain foreign investors, Botswana has also incorporated many of the principles from international treaties into its domestic IP laws. Some of these domestic laws are:

- Copyright and Neighbouring Rights Act 8 of 2000;
- Industrial Property Act 14 of 1996 (replaced in 2010);
- Industrial Property Regulations, Statutory Instrument 78 of 1997; and
- Industrial Property Act 8 of 2010.

Prior to 1996, protection of industrial property rights (patents, trademarks and industrial designs) in Botswana was primarily via extension of protections granted in the UK and South Africa.[1] Botswana enacted the IPA, its first comprehensive legislation on the matter, in 1996. The IPA was restructured in the new IPA of 2010, and amendments came into force on 31 August 2012, by virtue of Statutory Instrument 69 of 2012. Unlike its previous incarnation, the 2010 IPA incorporates separate registers for traditional knowledge (TK) and geographical indications (GIs). Broadly, the IPA deals with the protection of patents, trademarks, utility models and industrial designs. The IPA also aims to encourage the diversification of industry, to expand the manufacturing base, to encourage small, micro- and medium-sized enterprises (SMMEs) and to improve overall economic growth. The 2010 IPA is conspicuously silent about IP emanating from publicly funded research and development, including its dissemination, utilisation, management and commercialisation. A new Act or amendments would be required to

1 For further discussion of this background, see Department of Research, Science and Technology (DRST) (2006, pp. 7–8).

streamline the issues of management of IP arising from publicly funded research in the context of Botswana's economic development.

IP and the University of Botswana (UB)

The IPA does, however, establish an IP framework for Botswana's higher education institutions and industry, which is indirectly relevant to publicly funded research. In response to the IPA, the University of Botswana (UB) has developed an IP policy designed to support publicly funded research (UB, 2004). The policy indicates that the University will own all original IP generated by its academic community. This includes official documents, experimental databases, computer programmes and software. Possible exceptions include: copyright held by staff and students, IP arising from work conducted outside of the University, work done by students (unless the University has paid for the work) and where there is a written agreement to the contrary between the inventor and the University (UB, 2004).

Subsection 10(4) of the 2010 IPA states that, in the absence of any agreement, IP of an employee belongs to the employer. The IPA recognises that when the owner of the IP is protected by a patent, he/she can license the IP to a business. The business then pays the owner a share of profits from the use of the licences. UB's IP policy recommends that the split of any profits from IP shall be 50% for the inventor and 50% for the University (after the University recovers costs) (UB, 2004). The UB Office of Research and Development (ORD) manages IP at the university. There are several units within ORD, including a knowledge transfer office responsible for the training of staff on commercialisation, ethics and how to source research funds internationally. ORD also has a project office for the management of research funds. In addition, the UB Research Commercialisation Unit works with the UB research community in the following areas:

- creating awareness and training on research commercialisation and its potential contributions to the University's mandate;
- fostering a culture of innovation for the UB research community as part and parcel of the broad research agenda of the University;
- availing relevant information and materials to researchers on technology transfer and the commercialisation process at UB in order to support the commercialisation of research at UB;
- assisting in identifying and protecting the IP generated by UB researchers through a variety of approaches, including patenting, copyrights and trademarks;
- performing due diligence studies and market studies to ascertain the commercialisation potential and potential markets for UB inventions and innovations;

- promoting and marketing opportunities for technology transfer to potential industry partners;
- negotiating licences with industry partners and other stakeholders for inventions which arise from UB research; and
- creating strong relationships between the UB research community and business, government, NGOs and other relevant stakeholders which can facilitate the translation of knowledge into products, policies and services (UB, 2008).

Ministerial powers and parastatal institutions

The Department of the Registrar of Companies, Business Names, Patents, Trademarks, Utility Models, and Industrial Designs, which operates within the Ministry of Trade and Industry, is responsible for implementing the IPA. The Department houses a National Enquiry Point (NEP) for IP matters. This NEP is a Joint Integrated Technical Assistance Programme (JITAP) project supported by the World Trade Organisation (WTO), the UN Conference on Trade and Development (UNCTAD) and the International Trade Centre (ITC). JITAP initiatives aim to help African member countries benefit from multilateral trade. The NEP is open to government officials, business representatives, university professors and students. Interested parties can obtain trade-related information resources with a specific emphasis on the WTO TRIPS Agreement (Government of Botswana, n.d.).

Botswana's Minister of Trade and Industry is empowered by the IPA to exploit a patented invention under compulsory licence (without authorisation of the owner) in the interests of nutrition, national security or health, or for the development of a vital sector of the national economy. Further, where the court determines that exploitation of a patent by the owner or licensee is anti-competitive, the Minister may infringe upon the owner's/licensee's patent rights in order to alleviate the anti-competitive situation (IPA of 2010; Benett and Chilume, 2007).

Other ministries also play a role in fields related to IP, in particular science and technology. In 1979, the Ministry of Infrastructure, Science and Technology (MIST) implemented, as a parastatal, the Botswana Technology Centre (BOTEC). BOTEC is part of a deliberate federal effort in Botswana to integrate traditional knowledge (TK) within international structures of IP. It aims to bridge publicly funded research institutions – such as UB, the Botswana Export Development and Investment Authority and the Botswana Innovation Hub (BIH) – with TK. BOTEC is viewed by international organisations such as WIPO as a successful model for other developing African countries to follow. BOTEC also played a critical role in developing the TK aspects of the new IPA of 2010. Today, BOTEC's mandate is tied to Botswana's Vision 2016 programme.

MIST also created the Rural Industrial Promotion Company Botswana (RIPCO (B)) and the BIH as parastatal organisations. Headquartered in Gaborone, RIPCO (est. 1974) is a research and development organisation that follows Botswana's broader objectives of improving the living standards of its citizens by developing and disseminating agriculture-related technology. The BIH (est. 2012), announced in a keynote address by the Vice President of Botswana in November 2012, was established to accelerate the country's Vision 2016 goals. Its aim is to promote "research, technology and innovation based entrepreneurship" through the interaction between academics, entrepreneurs and government (the so-called "triple helix" of research and development) (Government of Botswana, 2012). The BIH is a product of the Revised National Policy on Research, Science, Technology and Innovation (MIST, 2011). It was also developed in response to the World Economic Forum's (WEF's) *Global Competitiveness Report* (*2011–2012*), which highlighted Botswana's need to attract foreign direct investment (FDI). General statistical data also highlight Botswana's need for improvement in this area (WEF, 2012).

According to the Science and Technology Capacity Index (STCI), Botswana is a scientifically developing country. The STCI measures the ability to absorb and retain specialised knowledge and research, to meet needs and to develop efficient products and processes. Botswana also falls within the category of countries that are below the international mean for most components of science and technology indices. The gross expenditure on research and development (GERD) in Botswana is low, at 0.52% of GDP (World Bank, 2012), when compared to the recommended Southern African Development Community (SADC) and African Union (AU) investment targets of at least 1% of GDP. However, Botswana has a high proportion of PhD and MSc employees (at least 48% of research and development staff – higher than South Africa's 34%) (CSIR, 2005). The government of Botswana aims to invest at least 2% of GDP to develop scientific and technological research, consistent with SADC targets (MIST, 2011). Botswana's Vision 2016 objective for its science and technology environment aims to foster: (a) an educated, informed nation; (b) a prosperous, productive and innovative nation; and (c) a compassionate, just and caring nation. MIST's parastatal organisations and Botswana's leading research organisations have modelled their IP objectives around Botswana's Vision 2016 (Government of Botswana, 1997).

IP expertise and activity in Botswana

The total number of patents registered in Botswana is unknown, as there are inconsistencies in Botswana's patent registration system, and the list of registered patents is not available in electronic format. The Registrar of Companies estimates that between 15 and 30 patents are registered annually, and the majority of the

patents are registered by foreign entities. Botswana has few legal firms with qualified IP professionals (e.g. attorneys, agents and licensing professionals) who are in a position to assist during the patent life cycle, i.e. the application process, the negotiation of a licence over patented technology and the settlement of disputes over IP rights. The only readily available IP case found in Botswana was *Botswana Football Association and Another v. Kgamane* [1998 BLR 153 (CA)]. This suggests minimal legal activity in Botswana related to IP.

However, since the 1970s, Botswana has taken progressive steps to improve its general IP framework. Furthermore, the country has attempted to develop the necessary institutional infrastructure to encourage and support its objectives. Botswana's Vision 2016 objectives and the broad integration between MIST, its parastatals and academic institutions such as UB are certainly steps in the right direction. Botswana is clearly cognisant that it needs to continue to improve its publicly funded research environment in order to stimulate research and to attract, support and retain academic talent. The data collected and analysed in the sections that follow provide some insights into researchers' perspectives on the existing public research environment.

4. Research findings Part 1: awareness, knowledge, institutional frameworks

Respondent demographics

Of the 187 researchers who participated in the study, 61.5% were married, 28.3% were single (never married) and 7% were divorced. The highest educational qualification of respondents was as follows: 58.3% PhD, 34.8% Master's degree, 5.9% Bachelor's degree. The age of the respondents varied as follows: 35.8% were between 40 and 49; 17.1% between 30 and 39; 16% between 50 and 59, and 22% did not state their age. Of the respondents, 67.4% were male and 32.6% female (see Figure 15.1).

Awareness of use of IP to protect research output

The study found that 84.5% of the researchers were aware that the intellectual output of their research activities (their IP) could be protected from being used, sold and copied by other individuals or organisations without their permission. Meanwhile, 11.8% were unaware of this fact, and 3.7% did not indicate. Researchers were aware of various methods of protecting IP: copyright (89.2%), trademark (77.8%), patent (75.9%), industrial designs (56.3%), geographical indications (50.6%) and trade secrets (49.4%) (Figure 15.2).

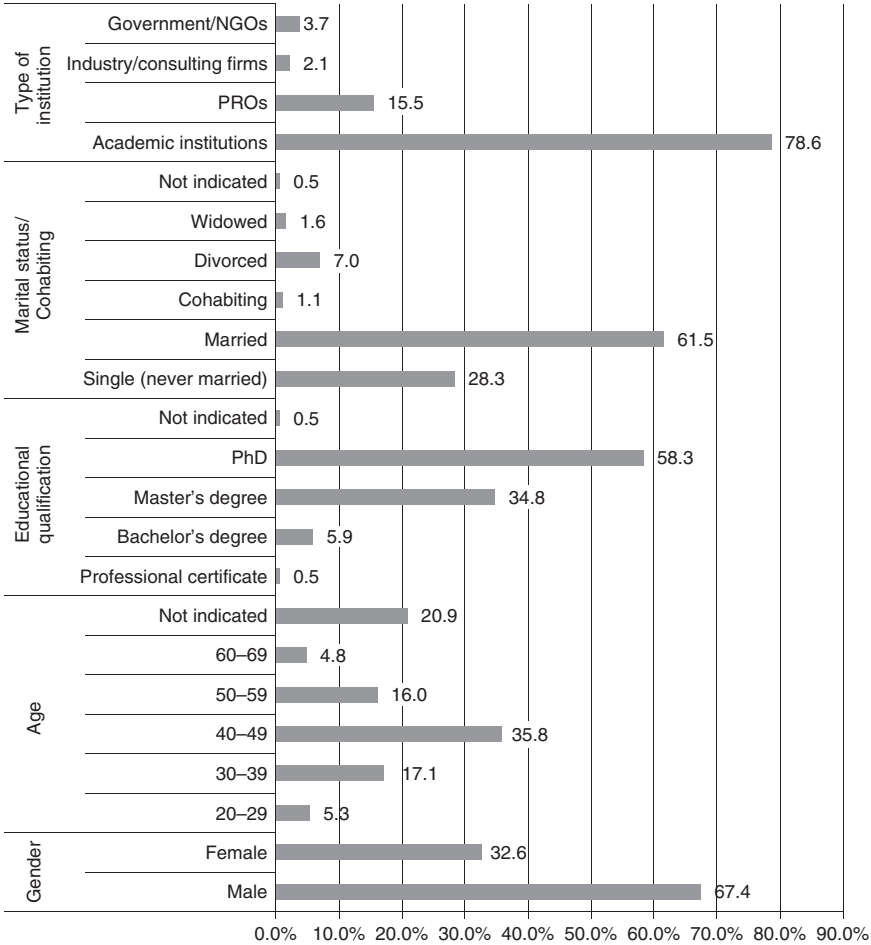

Figure 15.1: Demographic characteristics of respondents

When asked whether they knew how to use the various mechanisms to protect their IP, 81.5% of the researchers said they had knowledge of the use of copyrights, 65.5% said they knew how to use patents, 66.4% trademarks, 48.7% industrial designs, 42% geographical indications and 47.9% trade secrets (Figure 15.3).

On whether they had used IP protection methods, 62% stated they had used copyrights, 28% patents, 30% trademarks, 28% geographical indications, 24% trade secrets and 16% industrial designs (Figure 15.4).

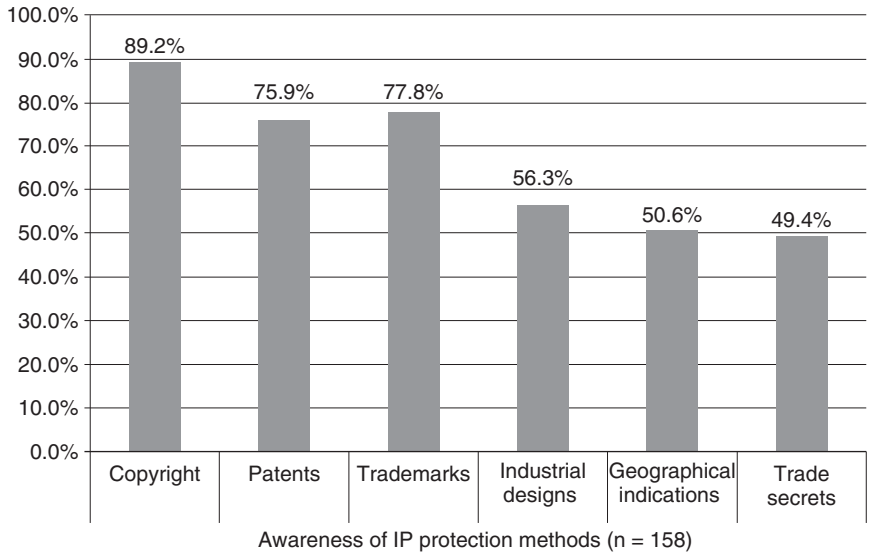

Figure 15.2: Awareness of IP as mechanism to protect research output

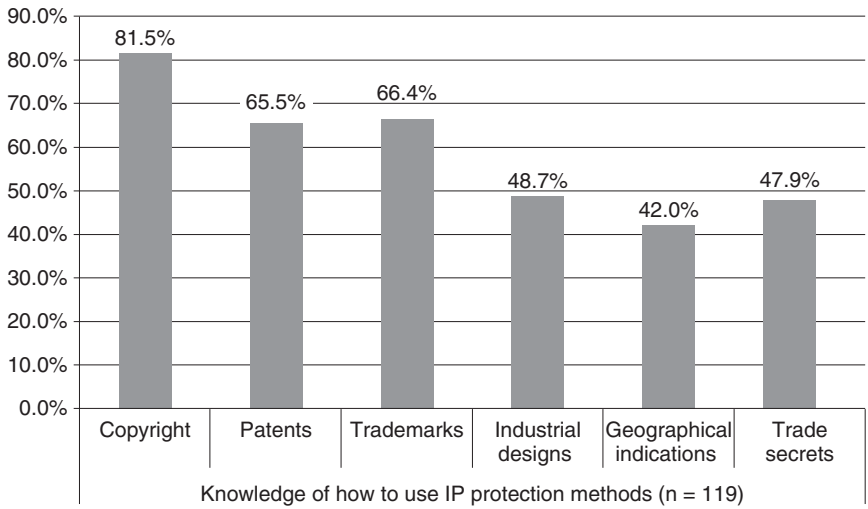

Figure 15.3: Knowledge of how to use IP

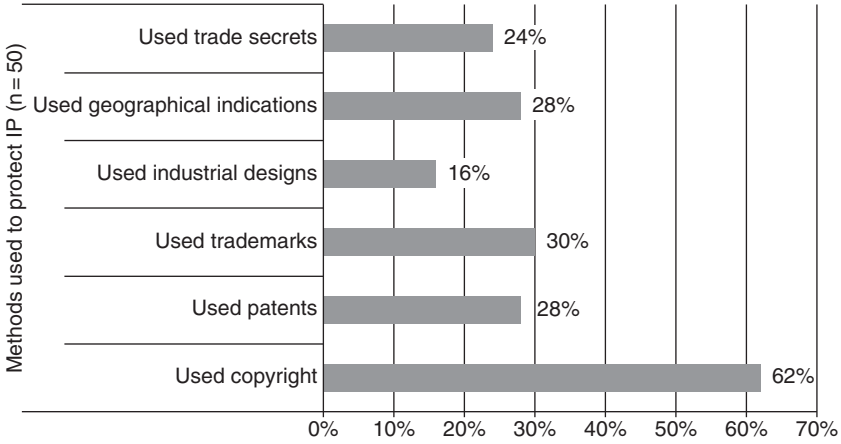

Figure 15.4: Use of IP

Framework for IP at institutions

The respondents were asked to indicate their knowledge of the existence or nonexistence of a policy and regulatory framework governing IP in their institutions on a three-point scale (1 = yes, 2 = no and 3 = don't know) and to answer five questions on the content and nature of the framework. The researchers' responses (see Table 15.1) showed a lack of knowledge of the prevailing IP conditions in their various institutions. While 54.2% of the researchers indicated that their institutions had IP policies, the majority of the researchers did not know whether the policy was environmentally friendly (53.2%), how ownership of the IP was managed (53.8%), or whether the policy encouraged openness in sharing information from publicly funded research (53.6%). In addition, 51% did not know whether the policy articulated the management of the IP.

The researchers were asked how the IP policies of their institutions impacted: (1) their knowledge dissemination; (2) their knowledge utilisation; and (3) their commercialisation of research output. The results elicited by these questions are shown in Tables 15.2 to 15.4. On knowledge dissemination (Table 15.2), between 52% and 58% did not know whether their institution's IP policy had provision to track the research projects that were publicly funded (57.7%); provision to review IP and associated commercial activities and outcomes (57%); or provision to clarify staff responsibilities in relation to IP (e.g. prevention of premature public disclosure of research results prior to obtaining IP [54.1%]). However, 42.3% of the researchers knew that the IP policies of their institutions provided guidance

Table 15.1: Knowledge of institutional IP policies

Institutional IP policies	Yes		No		Don't know	
	Number	%	Number	%	Number	%
Does your institution have an IP policy?	98	54.2	20	11.0	63	34.8
Is the policy environmentally friendly?	57	36.0	17	10.8	84	53.2
Does the policy encourage innovation?	60	38.5	22	14.1	74	47.4
Does the policy spell out the management of IP?	62	39.4	15	9.6	80	51.0
Does the policy clarify ownership of IP?	60	38.5	12	7.7	84	53.8
Does the policy encourage openness in sharing information from publicly funded research?	56	36.6	15	9.8	82	53.6

in relation to potential conflicts of interest concerning ownership, management, protection and exploitation of IP, and 41.7% knew of provisions recognising the IP rights and needs of stakeholders involved in research.

On how institutional IP policies impact knowledge utilisation, 56.3% of researchers understood that their institution's policy encouraged openness in sharing information from research, while 48.3% knew that it required researchers using public funds to publish outputs through open sources, conferences, workshops or through patenting. The majority of the researchers did not know whether knowledge transfer offices (KTOs) in Botswana were financially supported by several funding sources, including public authorities (64.1%); whether government policy in Botswana requires organisations receiving public funds to comply with any national interest policy (51.4%); whether Botswana national policy granted the public free and unrestricted access to cultural works supported by public funds and publicly funded collections and activities (57.1%), or free and unrestricted access to government-collected data (57%), or free and unrestricted access to output of publicly funded research (54%) (see Table 15.3).

The research (Table 15.4) found that the majority of respondents did not know that their institution's IP policy encouraged commercialisation of research output. For instance, 69.2% did not know whether Botswana's IPA assigned PROs

Table 15.2: Impact of institutional IP policy on dissemination

Impact of institutional IP policy on your knowledge dissemination	Yes		No		Don't know	
	Number	%	Number	%	Number	%
Provides for a review process to identify IP that can be protected and exploited	55	34.6	16	10.1	88	55.3
Guides researchers in assessing the existing IP that may affect their freedom to operate in their field of research	63	40.6	10	6.5	82	52.9
Recognises the rights and needs of all stakeholders involved in the research	65	41.7	10	6.4	81	51.9
Provides guidance in relation to potential conflicts of interest concerning ownership, management, protection and exploitation of IP	66	42.3	9	5.8	81	51.9
Clarifies staff responsibilities in relation to IP, including the prevention of premature public disclosure of research results prior to obtaining IP	65	41.4	7	4.5	85	54.1
Reviews IP and associated commercial activities and outcomes	47	30.1	19	12.2	90	57.7
Has provisions to track the research projects that are publicly funded	47	32.2	18	12.3	81	55.5

ownership of results and first right to inventions. A further 13.7% stated explicitly (and falsely) that the Act did not make such a provision. In addition, 64.2% of researchers did not know whether their institutional IP policies made provisions for conducting surveys to see how many publicly funded research endeavours produced patents and commercial outcomes such as spin-off companies; whether the policies defined the way in which benefits from the development and exploitation of IP would be allowed (60.8%); or whether the institution would claim

Table 15.3: Impact of institutional IP policy on knowledge utilisation

Impact of institutional IP policy on your cumulative knowledge utilisation	Yes		No		Don't know	
	Number	%	Number	%	Number	%
Grants the public free and unrestricted access to outputs of publicly funded research	58	38.7	11	7.3	81	54.0
Grants the public free and unrestricted access to government-collected data	52	34.9	12	8.1	85	57.0
Grants the public free and unrestricted access to cultural works supported by public funds and publicly funded collections and archives	52	35.4	11	7.5	84	57.1
Encourages openness in sharing information from research	80	56.3	6	4.2	56	39.5
Requires organisations receiving public funding to comply with a national interest policy	69	46.6	3	2.0	76	51.4
Requires researchers using public funding to publish research outputs through open sources, conferences, workshops or through patents	71	48.3	5	3.4	71	48.3
Knowledge transfer offices (KTOs) are financially supported by several funding sources, including public authorities	43	29.7	9	6.2	93	64.1

any ownership or associated rights to IP from publicly funded research, including research conducted by postgraduate students (60%). Only 38% of the researchers indicated that their institution's IP policies supported discoveries that may have commercial value.

Table 15.4: Impact of institutional IP policy on commercialisation

Impact of institutional IP policy on your commercialisation of research output	Yes		No		Don't know	
	Number	%	Number	%	Number	%
Supports researchers in recognising discoveries that may have commercial value	57	37.5	18	11.8	77	50.7
Outlines whether institution will claim any ownership or associated rights to IP from publicly funded research (including research conducted by postgraduate students)	47	31.5	12	8.1	90	60.4
Defines the way in which benefits from the development and exploitation of the IP will be allocated	43	29.1	15	10.1	90	60.8
Makes provisions for conducting surveys to see how much of the publicly funded research produces patents and commercial outcomes such as spin-off companies	33	22.3	20	13.5	95	64.2
Provides legal frameworks for IP that spell out clearly the ownership of IP	46	30.9	16	10.7	87	58.4
Encourages and strengthens links between the research base and industry	44	30.1	20	13.7	82	56.2
Assigns to institution ownership of results and first right to inventions	25	17.1	20	13.7	101	69.2

Between 17% and 37.5% of the researchers showed an understanding of the potential impact of their institution's existing institutional policy on improving the commercialisation of their research outputs (Table 15.4), while

less than 50% showed an understanding that their institution's IP policy could impact on their knowledge utilisation (Table 15.3) and knowledge dissemination (Table 15.2).

Knowledge and perceptions of Botswana IP law and policy

Institutional IP policies in Botswana operate in relation to national laws and policies. The findings clearly illustrated that the researchers, although aware that national laws and policies relevant to IP did exist, knew very little about the content of those laws and policies and their potential impact on management of their IP derived from publicly funded research. The researchers were asked about their knowledge and perceptions of key elements in Botswana's IP law and policy environment (Table 15.5).

Thirteen per cent of the researchers knew that Botswana's IP law and policy framework provides for tax incentives to innovators for IP generated from their inventions and processes but 80% did not know this and 78.4% did not know that the framework provides for KTOs to be financially supported by several funding sources, including public authorities. Similarly, 74% had no knowledge that the framework assigns PROs ownership of research results and the first right to inventions. Thirty-seven per cent did know that the framework encourages pursuit of protection of innovative ideas and processes, and 34% knew that it promotes sharing of knowledge and collaboration.

5. Research findings Part 2: research activities, patenting, licensing, partnerships

Types of research conducted

The types of research most frequently conducted by respondents were: applied research (i.e. research undertaken to solve practical problems rather than acquire knowledge for knowledge's sake) (57.8%); literature/desk review (47.6%); basic research (i.e. experimental and theoretical work undertaken to acquire new knowledge without looking for long-term benefits other than advancement of knowledge) (44.9%); consultancies for industry (28.6%); evaluation research (27.6%); and epidemiological research (9.2%) (Figure 15.5).

When looking at the different types of research conducted by institutions, the results showed that about half of the research in academic institutions (53%) was applied research. This compares with an overwhelming majority of research in

Table 15.5: Knowledge of IP law and policy

Key elements of IP law and policy	Yes		No		Don't know	
	Number	%	Number	%	Number	%
It leverages the IP system to better mobilise knowledge within a global economy	41	26.6	10	6.5	103	66.9
It encourages sharing of knowledge and collaboration	51	33.6	16	10.5	85	55.9
It encourages pursuit of protection of innovative ideas and processes	57	36.8	9	5.8	89	57.4
It encourages trans-disciplinary understanding about the history of innovation	40	25.8	12	7.7	103	66.5
It facilitates the flow of information to solve problems through networks of collaborators	42	27.5	10	6.5	101	66.0
It facilitates knowledge networks and markets through university, industry and government	46	29.9	12	7.8	96	62.3
It emphasises managing IP in ways that facilitate innovation within the existing legislative framework	43	28.7	10	6.7	97	64.7
It encourages institutions to develop IP policies within the national framework	48	31.6	12	7.9	92	60.5
It ensures incentives are in place to encourage patenting of inventions in the country as well as strategic patenting of inventions from elsewhere	35	22.6	20	12.9	100	64.5
It spells out the sharing of proceeds from commercialisation of IP rights	29	19.0	14	9.2	110	71.9

Key elements of IP law and policy	Yes		No		Don't know	
	Number	%	Number	%	Number	%
It assigns to publicly funded research institutions ownership of research results and first right to inventions	25	16.3	14	9.2	114	74.5
It provides for knowledge transfer offices (KTOs) to be financially supported by several funding sources, including public authorities	23	15.0	10	6.5	120	78.4
It defines appropriate tax incentives to innovators for IP generated from their inventions and processes	20	13.2	10	6.6	121	80.1
It facilitates the exploitation of indigenous technologies and the evaluation, acquisition and adaptation of foreign technologies for increased competitiveness	33	22.1	14	9.4	102	68.5
It creates avenues to educate and sensitise all Batswana in matters of IP	29	19.2	19	12.6	103	68.2
It incorporates aspects of IP law in the school curricula at the various levels of education	15	9.9	28	18.4	109	71.7
It stimulates innovation nationwide by setting up an advisory network in the use, production, protection, and commercialisation of inventions and artistic works	28	18.3	19	12.4	106	69.3
It ensures that research in universities and public research organisations (PROs) is adequately transferred to the commercial sector	21	13.9	22	14.6	108	71.5

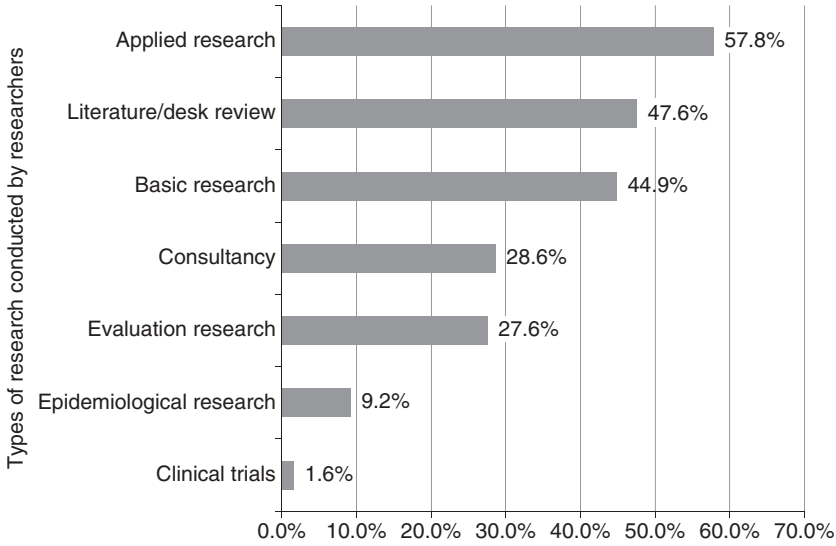

Figure 15.5: Types of research

PROs (86%), which was applied research (Table 15.6). In industry and consulting firms, most research (75%) was basic research. Government and NGO research was most likely to be applied (43%) or basic (29%).

Levels of research activity

Respondents were asked about their involvement in past and present research. The finding was that, while 94.1% of respondents had conducted research in the past, only 79.5% were at present actively engaged in research**.** In terms of perception of their institutions' involvement in research, 43.8% of respondents assessed the level as "medium" while 32.4% rated it "high" and 22.7% rated it "low" (Figure 15.6). The study results suggest that the level of involvement in research was significantly dependent on the type of institution. The majority of the researchers from academic institutions (48.3%) and research institutions (69%) rated their institution's level of involvement in research as medium, while 75% of researchers from industry rated it as high.

The magnitude of respondents' annual research activity was also assessed. Figure 15.7 aggregates the respondents' average annual research output over a five-year period (2006–10) across 13 kinds of outputs. The 187 respondents surveyed were found to have produced an annual average of 165 journal articles,

Table 15.6: Research emphasis of institutions

Type of research conducted	Type of institution				Total
	Academic institutions	PROs	Industry/ consulting firms	Government/ NGOs	
Basic research	44%	50%	75%	29%	45%
Applied research	53%	86%	50%	43%	58%
Literature/desk review	47%	57%	75%	14%	48%
Consultancy	26%	43%	50%	14%	29%
Clinical trials	1%	4%	0%	14%	2%
Epidemiological research	10%	7%	0%	14%	9%
Evaluation research	27%	32%	25%	29%	28%
Total	79%	15%	2%	4%	100%

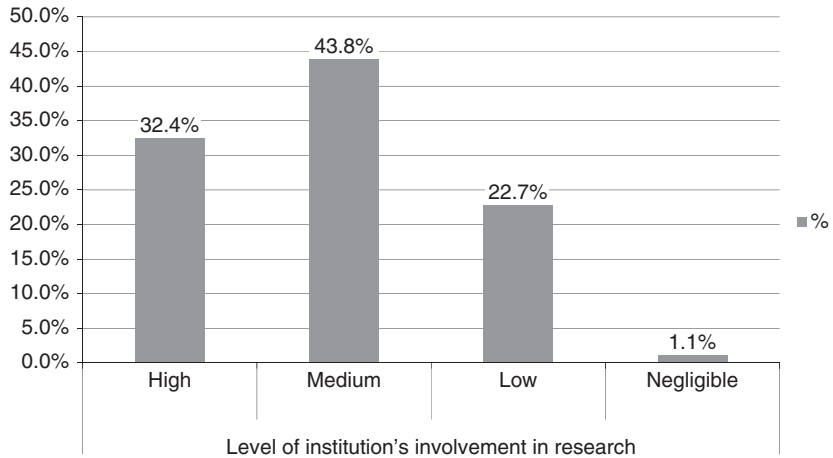

Figure 15.6: Perception of institution's research involvement

156 conference/seminar presentations, 70 published conference papers, 34 book chapters, 12 monographs and 2 books. On average only one patent was registered each year among the 187 respondents. This value is low considering the amount of applied research being conducted, and reflects the fact that most of the applied research does not yield patentable outputs.

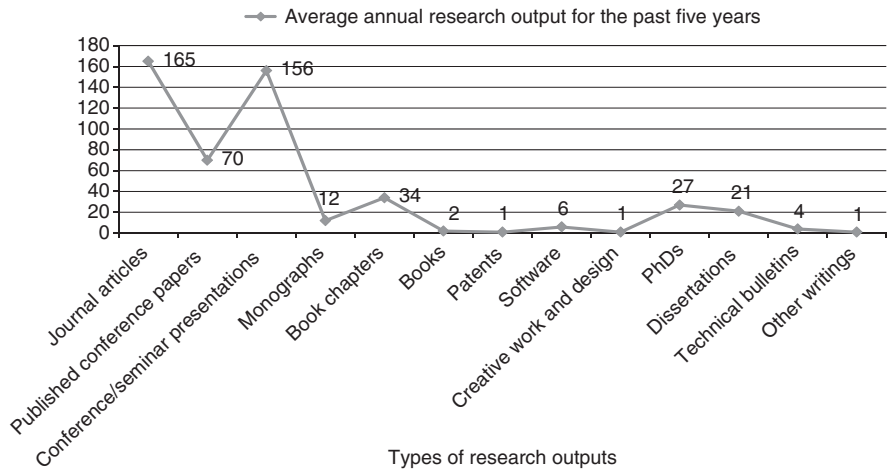

Figure 15.7: Respondents' average yearly research output

Use of IP procedures

The study found that only 28% of respondents (53 researchers) had (or were at institutions that had) attempted to use IP procedures. The methods are shown in Figure 15.8. The most common legal arrangement pertaining to IP, tried/used by 74% of respondents, was a research agreement or contract, while 20% had tried/used exclusive licences and 16% had tried/used joint ventures. Establishment of spin-off companies, or use of non-exclusive licenses, was found to be uncommon.

IP and research factors and commercialisation

Table 15.7 (on page 360) shows how respondents rated the importance of various IP and research factors in the commercialisation of research output on a four-point scale (1 = high; 2 = medium; 3 = low; and 4 = not important). The results show that the most highly rated factors enabling commercialisation of research outputs were: quality of the research base (81%); innovation (64.4%); availability of companies willing to implement research results (61%); openness in sharing information from research (59%); the strength of links between industry and research (56.6%); and maintenance of science and technology skills (56.6%). The number of patents (53.7%), timely protection of discovery (48.7%) and supportive IP policies that encourage sharing of benefits from research (46.8%) were considered the three least important factors.

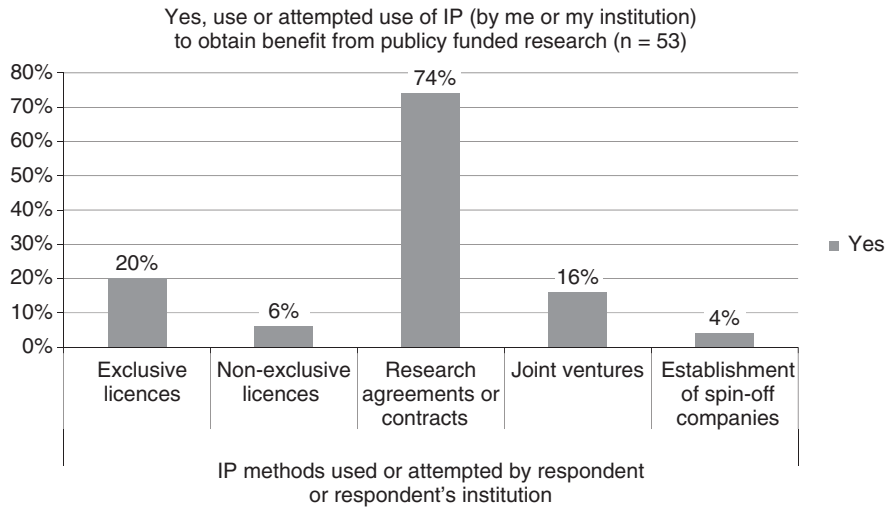

Figure 15.8: IP methods used or attempted by respondent or respondent's institution

IP and value from publicly funded research

Also surveyed were respondents' perceptions of the practices necessary in the IP and research environments in order to generate value from publicly funded research. Respondents assessed the practices on a four-point scale (1 = high; 2 = medium; 3 = low; 4 = not important). The results, in Table 15.8 (on page 361), indicate that the most highly rated practices were: creating the right academic environment (77.5%); innovation (66.5%); openness in sharing information from research (58.6%); increasing funds allocated to research (55.7%); and increasing capital to commercialise research and technology innovation (45.8%). Protection of invention and processes (51.6%), development of effective commercialisation support structures (50%), existence of an appropriate legal and regulatory environment for IP (45.9%) and IP policies in universities and institutions (46%) were less important.

Benefits to the economy and society

Respondents were asked to indicate their perceptions of benefits to the economy and society derived from publicly funded research. The responses in Figure 15.9 (on page 362) are the most highly rated benefits. Among the 186 respondents who answered this question, the majority identified the increase in stock of useful knowledge available for firms and other users (76%) as the most important benefit. Other benefits cited as important were: production of skilled graduates

Table 15.7: Importance of IP and other research factors to commercialisation

Perceived importance of IP and other research factors to commercialisation	Degree of importance							
	High		Medium		Low		Not at all important	
	Number	%	Number	%	Number	%	Number	%
Quality of the research base	145	81.0	32	17.9	1	0.6	1	0.6
Availability of companies willing and able to take up the results of research	108	61.0	51	28.8	15	8.5	3	1.7
Maintenance of science and technology skills	98	56.6	61	35.3	11	6.4	3	1.7
Strength of links between research base and industry	98	56.6	60	34.7	15	8.7	0	0.0
Availability of venture capital	69	41.8	68	41.2	25	15.2	3	1.8
Quality of management skills	69	43.7	64	40.5	22	13.9	3	1.9
Appropriateness of legal and regulatory environment	79	46.7	69	40.8	18	10.7	3	1.8
Competitiveness of business environment	80	46.8	66	38.6	19	11.1	6	3.5
Publication rate	78	47.6	66	40.2	19	11.6	1	0.6
Success in achieving external research grants	82	51.6	67	42.1	9	5.7	1	0.6
Innovation (ideas, processes)	103	64.4	54	33.8	3	1.9	0	0.0
Openness in sharing information from research	95	59.0	56	34.8	9	5.6	1	0.6
Number of patents	34	22.8	80	53.7	27	18.1	8	5.4
Legal framework for IP that clearly spells out the ownership of IP	69	44.2	68	43.6	17	10.9	2	1.3
Supportive IP policies that encourage sharing of benefits from research	68	43.6	73	46.8	12	7.7	3	1.9
Timely disclosure of discoveries	62	39.2	72	45.6	21	13.3	3	1.9
Timely protection of discoveries	60	38.5	76	48.7	13	8.3	7	4.5
Recognition of the researcher	4	57.1	3	42.9	0	0.0	0	0.0

Table 15.8: IP and research practices necessary for value

Perceptions of IP and research practices necessary to generate value from publicly funded research	Degree of importance							
	High		Medium		Low		Not important	
	Number	%	Number	%	Number	%	Number	%
Creating the right academic environment	141	77.5	35	19.2	6	3.3	0	0.0
Developing effective commercialisation support structures	51	31.1	82	50.0	26	15.9	5	3.0
Developing and expanding relationships with existing companies/industries	70	41.7	61	36.3	31	18.5	6	3.6
Facilitating and increasing the number of new spin-off companies derived from university research activities	50	29.9	74	44.3	37	22.2	6	3.6
Strengthening the corporate base	34	22.1	69	44.8	42	27.3	9	5.8
Increasing the amount of finance available for the commercialisation of research and technological innovation	77	45.8	65	38.7	20	11.9	6	3.6
Increasing the amount of funding allocated to research	93	55.7	58	34.7	16	9.6	0	0.0
Innovation	109	66.5	44	26.8	10	6.1	1	0.6
Openness in sharing information from research	99	58.6	58	34.3	11	6.5	1	0.6
Institutions' reward systems to innovators	69	42.6	68	42.0	21	13.0	4	2.5
Financial and taxation reward systems	38	23.9	66	41.5	40	25.2	15	9.4
An appropriate legal and regulatory environment for IP	57	36.3	72	45.9	25	15.9	3	1.9
Protection of inventions and processes	56	36.1	80	51.6	17	11.0	2	1.3
IP policies in universities and institutions	68	41.7	75	46.0	17	10.4	3	1.8

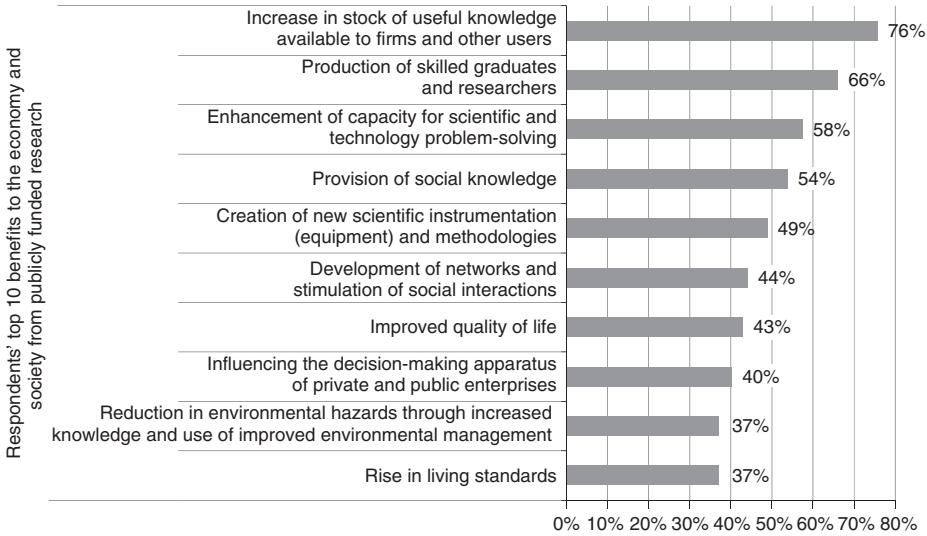

Figure 15.9: Benefits to economy and society from publicly funded research

and researchers (66%); enhancement of capacity for scientific and technology problem-solving (58%); provision of social knowledge (54%); improved quality of life (43%); development of networks and stimulation of social interactions (44%); influencing the decision-making apparatus of private and public enterprises (40%); and improving living standards (37%).

Institutional roles

Research institutions in Botswana are expected to play a key role in ensuring that IP policies encourage researchers to harness benefits from publicly funded research. These roles include, but are not limited to: providing an enabling environment for research; helping researchers patent the most promising concepts and license the work to firms that commercialise them into new products and services; and ensuring that important ideas generated from publicly funded research enter the marketplace. Government policy expects research institutions to provide funding to scale and commercialise ideas, business expertise to commercialise, human capital to build start-up companies, and mentoring and educational support for new entrepreneurs.

Table 15.9 shows respondents' views regarding the role institutions should play in generating benefits from publicly funded research. An overwhelming majority of the respondents (92%) stated that their institutions should notify

Table 15.9: Roles of institutions

Principal roles of your institution in harnessing benefits from publicly funded research	Type of institution				Total
	Academic institutions	PROs	Industry/ consulting firms	Government/ NGOs	
Notification of funding bodies of any identified valuable inventions created using public funds	95%	84%	67%	83%	92%
Taking ultimate responsibility for commercialising inventions by adopting a time limit for applying for a patent	74%	40%	67%	50%	67%
Establishment of an IP management infrastructure	91%	68%	67%	83%	87%
Allocating a certain proportion of granted funds towards exploitation of IP rights	83%	84%	67%	50%	81%
Ensuring the inclusion of knowledge transfer or commercialisation as an express component of mission statement	69%	72%	100%	67%	86%

funding bodies of any identified, valuable inventions created using public funds. The establishment of an IP management infrastructure was also considered important (87%). Respondents were also strongly concerned (86%) about ensuring the inclusion of knowledge transfer or commercialisation as an express component of their institutions' mission statements. Notifying funding bodies of valuable inventions created using public funds was a top priority of researchers in academic institutions and PROs (95% and 84%, respectively). Conversely, respondents from industry felt that the top priority of their institutions should be the inclusion of knowledge transfer or commercialisation as an express component of the institution's mission statement (100%).

Institutional IP environments

Respondents were asked to indicate if there were government IP policies that potentially inhibited their institution's innovation and generation of value from publicly funded research. It was found that 66% felt there were no policies that were having an inhibiting effect, while 34% took the opposite position. Several respondents pointed to non-IP obstacles, including the attitude of institutional policy-makers towards researchers and the fact that, in some institutions, non-researchers seem to benefit more from research outputs than do researchers.

The study also asked respondents how institutional IP policies could be improved so as to enhance the value gained from publicly funded research. As Figure 15.10 shows, 29% of respondents were unsure of what should be done, while 20% were content with the *status quo*. Others felt that IP policies should be disseminated to researchers through academic bodies (8%); that protective legislation for researchers' IP rights should be introduced (5%); that there should be IP policies developed at institutions that lacked them (5%); and that additional incentives – e.g. increased research funding, reduction in time allocated to teaching, and hiring of additional staff to assist in marking of class tests and tutorials – should be introduced to boost the activity of researchers (5%).

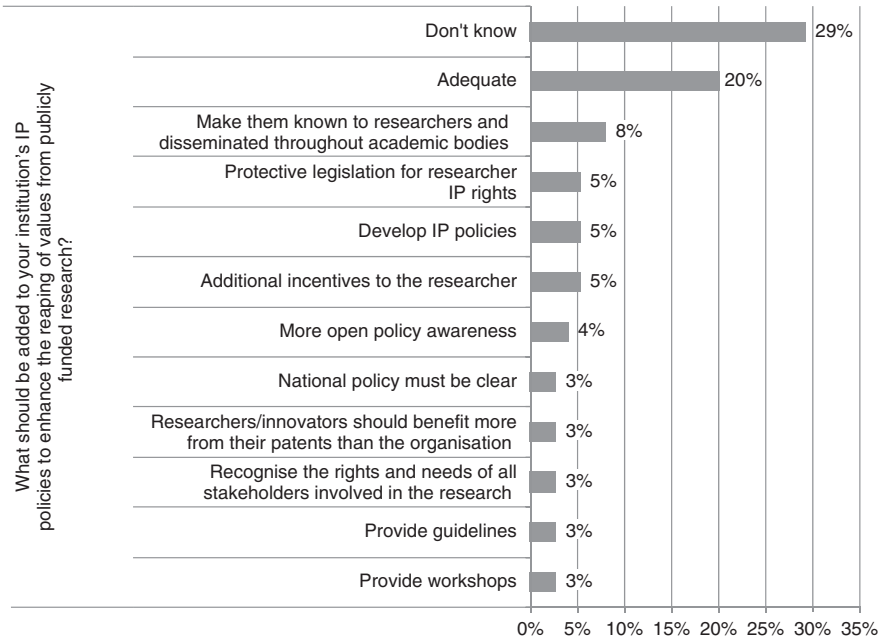

Figure 15.10: Institutional IP policies

Institutional funding for research

Respondents were asked to rate the level of funding for research at their institutions from four sources: government, NGO, international and institutional. As Table 15.10 shows, 66% of the respondents rated government research funding support to their institutions as low, while 9% said it was high. A majority of respondents (63%) rated funding support from NGOs as low. International funding support for research was rated by 40% as medium, while 25% said it was high. Institutional funding for research was assessed to be low by 46%, medium by 40% and high by 14%.

Table 15.10: Funding levels from different sources

Rating of research funding from	High		Medium		Low	
	Number	%	Number	%	Number	%
Government (n = 161 respondents)	15	9.3	40	24.8	106	65.8
Institution (n = 160 respondents)	23	14.4	64	40.0	73	45.6
International bodies (n = 159 respondents)	40	25.2	64	40.3	55	34.6
NGOs (n = 152 respondents)	16	10.5	40	26.3	96	63.2

6. Conclusions

The study found a lack of knowledge of the prevailing legal and policy frameworks governing IP at the institutional and national levels in Botswana. Although 54.2% of the researchers indicated that their institutions had IP policies, the majority of the researchers were unaware of the content of such policies. This lack of knowledge of the legal and regulatory framework is likely to hinder IP development and may be contributing to the low usage of IP rights. Maister *et al.* (2011) made similar observations about the lack of awareness of IP frameworks at research institutes and universities in Burundi and Rwanda, respectively.

The lack of knowledge about commercialisation of research output from publicly funded research indicates that most researchers have failed to engage with their institutional IP policies. Botswana has a very low level of patenting (MCST, 2005). The lack of knowledge about commercialisation may also point to the poor quality of research institutions' IP policies. Creating awareness of IP and its utility in generating value from research outputs is a key area that requires urgent

intervention among researchers. The quality of the research base, innovation and the availability of companies willing and able to incorporate research were identified by researchers as major incentives for commercialising IP.

The key priorities identified by the researchers related to an improved scholarly setting. Researchers want: the right academic environment (77.5%); innovation (66.5%); openness in sharing information from research (58.6%); and an increase in the amount of funds allocated to research (55.7%). These findings correspond with the findings of other studies (Altschuld and Zheng, 1995; Jordan *et al*., 2003; Ransley and Rogers, 1994; Ulwadia, 1990). It is thus important that an academic environment is created which includes: a reduced teaching load; availability and accessibility of research resources, including publications; and an IP environment that balances commercialisation efforts with encouragement of open sharing of research data and findings. University and PRO roles in research are measured in terms of attracting more students, retaining good scientists, and enhancing access to additional research and development funding opportunities. The extent to which they are able to accomplish this role depends on their ability to create the enabling and conducive environment cited as necessary by the majority of respondents to this study. Universities and PROs need to have guaranteed levels of research funding and strong links with funding agencies. Universities and PROs should take an active role in IP management by, *inter alia*, establishing clear and realistic objectives, ensuring adequate resources and setting up dedicated, professional technology transfer offices (TTOs). Creating awareness of existing IP policies at institutions should be prioritised.

At the same time, the study found that researchers believe that value from publicly funded research can be improved by openness in sharing information from research (58.6%). Access to research data was seen by the respondents as likely to increase the returns from public investment and reinforce open scientific inquiry. This is in line with the OECD view that openness encourages diversification of study and intellectual opinion by researchers, promoting the exploration of topics that had not been envisioned (OECD, 2007). According to the OECD, research policies, practices, support systems and cultural values all affect the nature of new discoveries, the rate at which they are made and the degree to which they are made accessible and used. Sharing and open access to publicly funded research data help not only to maximise research potential, but also to provide greater returns from public investment in research. Open publication or display of knowledge should be seen as an essential aspect of publicly funded science. Publications expand opportunities for access to the knowledge and skills of the scientific community, as created and supported by public investment in research (Dasgupta and David, 1994; Salter and Martin, 2001).

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