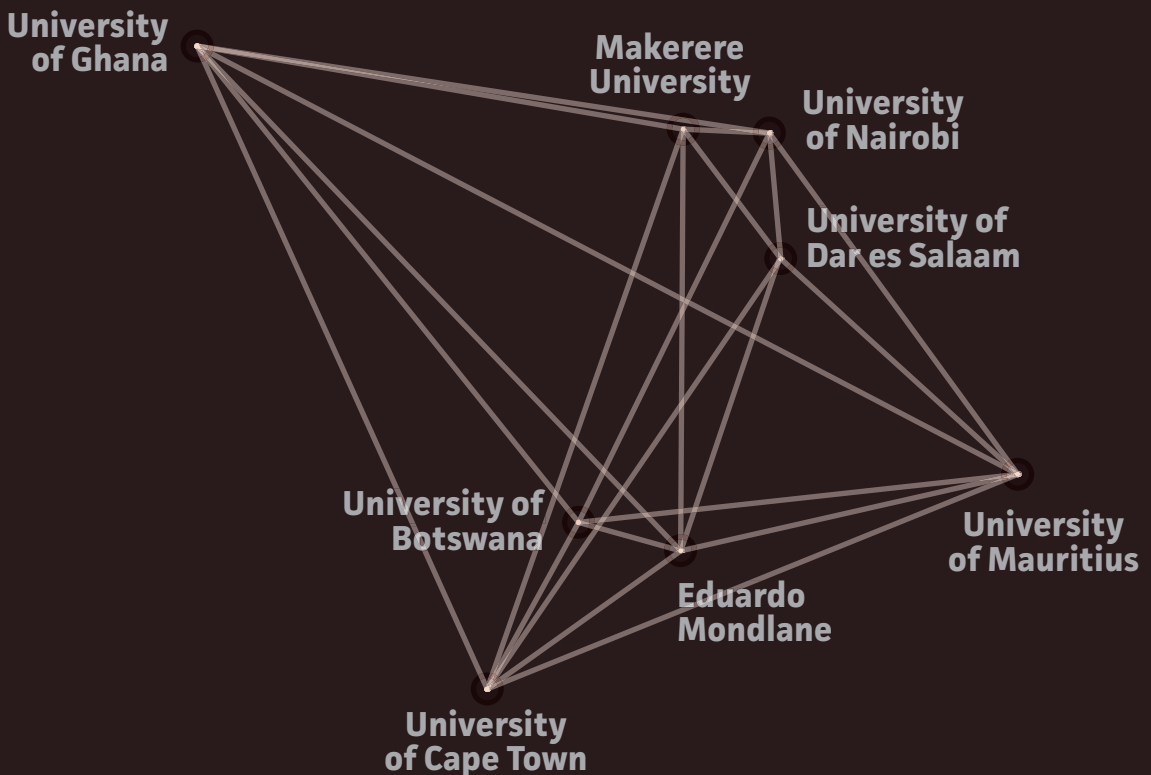


Research Universities in Africa

NICO CLOETE, IAN BUNTING & FRANÇOIS VAN SCHALKWYK



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Acronyms & abbreviations

AOSTI	African Observatory of Science, Technology and Innovation
ARUA	Alliance of African Research Universities
AU	African Union
BUS	business, economics and management
CHET	Centre for Higher Education Trust
CWTS	Centre for Science and Technology Studies, Leiden University
EHSS	education, humanities and social sciences
G8	Group of eight highly industrialised nations: Canada, France, Germany, Italy, Japan, Russia, the United Kingdom and the United States of America
GNI	gross national income
Herana	Higher Education Research and Advocacy Network in Africa
NDP	National Development Plan (South Africa)
NEPAD	New Partnership for Africa's Development
NGO	non-governmental organisation
Norad	Norwegian Agency for Development Cooperation
OECD	Organisation for Economic Co-operation and Development
PHEA	Partnership for Higher Education in Africa
SCIE	Science Citation Index Expanded
SET	science, engineering and technology
SPHERE	Science Productivity, Higher Education, Research and Development and the Knowledge Society project
STEM+	science, technology, engineering, mathematics plus health
UCT	University of Cape Town, South Africa
UDSM	University of Dar es Salaam, Tanzania
UEM	Eduardo Mondlane University, Maputo, Mozambique
UK	United Kingdom
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organisation
US	United States of America
USD	United States dollars

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Preface

As a brief background, the Higher Education Research and Advocacy Network in Africa (Herana) project evolved from a confluence of factors. From the early 2000s, a new discourse emerged, in Africa and the international donor community, that higher education was important for development in Africa. Within this 'zeitgeist' of converging interests, a range of agencies agreed that a different, collaborative approach to linking higher education to development was necessary. The US Partnership for Higher Education in Africa (Ford, Carnegie, Rockefeller, Kresge and Mellon) collaborated with the Norwegian Agency for Development Cooperation (Norad) in a new approach to funding. The Centre for Higher Education Trust (CHET), the network coordinator, changed its focus from the South African preoccupation with equity and access (broadly conceived as transformation) to concentrate on research and advocacy about the possible role and contribution of universities to development in Africa.

This book is the final publication to emerge from the Herana project. Three previous books have been published from the activities and discoveries of Herana: *Universities and Economic Development in Africa* (2011), *Knowledge Production and Contradictory Functions in African Higher Education* (2015) and *Castells in Africa: Universities and development* (2017). The project has also published more than 100 articles, chapters, reports, manuals and datasets (see Appendix), and many presentations have been delivered to share insights gained from the work done by Herana. Given its prolific dissemination, it seems reasonable to ask whether this fourth and final publication will offer the reader anything new.

This book is certainly different from previous publications in several respects. First, it is the only book to include an analysis of eight African universities based on the full 15 years of empirical data collected by the project. It is true that the data are available in the report 'An Empirical Overview of Emerging Research Universities in Africa 2001–2015' and as open data on the web. But this book is the only publication to put the 15-year data to work in an analysis of the participating eight universities' status as research universities. Second, previous books and reports were published mid-project. This book has benefited from an extended gestation period allowing the authors and contributors to reflect on the project without the distractions associated with managing and participating in a large-scale project. For the first time, some of those

who have been involved in Herana since its inception have had the opportunity to at least make an attempt to see part of the wood for the trees.

Different does not necessarily mean new. An emphasis on the 'newness' of the data and perspectives presented in this book is important because it shows that it is more than a historical record of a donor-funded project. Rather, each chapter in this book brings, to a lesser or greater extent, something new to our understanding of universities, research and development in Africa.

To differentiate itself from discussions about higher education in Africa that take place in a vacuum, Chapter 1 combines a qualitative assessment of the state of higher education in Africa with empirical data on the place of research on the continent and in its leading universities. The chapter also introduces the Herana project and charts the evolution of the project from its focus on flagship universities and their national higher education systems toward a more narrow focus on the participating universities' contribution to the production of new knowledge (research) and, consequently, their contribution to development. The systematic classification of the eight universities in terms of their research performance and orientation in Chapter 2 is a new contribution. As a classification rather than a ranking, the approach may prove useful to universities seeking a reality-check against the visions for their universities, or it may prove useful to external stakeholders seeking to support universities in Africa in meaningful ways as they transition to research-led universities. Regardless of its application, the classification provides a more nuanced understanding of the characteristics of research universities in Africa.

The chapters in the second part of this book focus more narrowly on how Herana has advanced our understanding of the research university in Africa. Chapter 3 explores the role of the university in its national context. It considers whether national governments that may espouse notions of a knowledge economy do in fact provide the kind of support required by research universities.

In Chapter 4 the discussion on the historical functions of universities is placed in a context of the African university's response to demands placed on it by society. A consequence of a dominant instrumental development model is the relative neglect of universities' function as knowledge producer. As universities become more research-orientated varying interpretations of what constitutes the production of scientific knowledge can be brought to bear in plotting the strategic direction to be followed by the university and, subsequently, in the implementation of that strategy. These interpretations are often shaped by discordant and even competing global, national and institutional expectations. The

chapter provides a new perspective to illustrate the tensions that emerge within the university as it seeks to fulfil its ambition to produce new knowledge and simultaneously remain relevant and responsive to external demands.

Chapter 5 is a reminder of the need to consider social dynamics when attempting to transition to a research university. Without incentives to change entrenched patterns of behaviour, university academics are less likely to adopt practices that will create a corps of productive knowledge producers. The chapter explores a range of possible incentive regimes with reference to work done by the Herana network.

Chapter 6 sets out the value of the consensus indicators and of the data collected by the Herana project for planning and for governing a research university. And for the first time, the previously underappreciated value of developing standards and protocols for the collection of data are brought to the fore.

Chapter 7 brings networks squarely into the discussion. The chapter presents Herana through the lens of networks to introduce a new perspective on the relationship between the university, knowledge and development. It is a perspective that remains underappreciated and, we would suggest, deserves greater attention from those governing and supporting universities. There are always many moving parts in complex social systems such as science, but turning a blind eye to their networked nature is likely to leave future investments in Africa's research universities hamstrung.

Part 3 of this book presents more detailed profiles of each of the eight participating Herana universities. The profiles are framed by the academic core indicators developed by the Herana project and by salient in-country conditions relevant to the production of knowledge by universities in Africa. These profiles focus on research performance at the university level in a way that has not been done in previous publications.

The book concludes by taking a broader perspective on knowledge as a non-rivalrous and public good. The chapter draws attention to the special role of universities as primary propelling agents in the global knowledge economy.

* * *

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The authors, September 2018

Part 1

**TOWARDS RESEARCH
UNIVERSITIES IN AFRICA**

Chapter 1

From flagships to research universities

Discourses on the role of higher education in development in Africa¹

It is now widely accepted that for a country to thrive in the knowledge economy, it must develop high-level skills and competencies (human capital), as well as its scientific research, innovation and technological development capacity. Higher education, and universities in particular, are regarded as key to delivering these knowledge capabilities for development, based on their traditional role of producing, applying and disseminating knowledge, as well as educating the next generation of knowledgeable and suitably qualified workers. Research has suggested a strong association between higher education participation rates and levels of development (Bloom et al. 2006; Cloete & Gillwald 2014; Marginson 2018; Salmi 2017). Furthermore, there is evidence that high levels of education in general, and of higher education qualifications in particular, are essential for the design and productive use of new technologies, provide the foundations for a nation's innovative capacity, and contribute more than any other social institution to the development of society (Carnoy et al. 1993; Powell et al. 2017). In short, as the main knowledge-producing institutions in any society, it is assumed that universities are well-placed to leverage their research and education capacities to foster more innovative and dynamic economic growth.

Today, many advanced industrialised countries have coordinated knowledge and innovation policies, and a national higher education system as the core of their development strategies. Increasingly, the importance of higher education for national development and global

¹ We have written more extensively on this subject in previous publications; in particular, *Universities and Economic Development in Africa* (Cloete et al. 2011) and *Knowledge and Contradictory Functions in African Higher Education* (Cloete et al. 2015).

economic competitiveness is being recognised by emerging economies such as China, India and Brazil. Research has suggested that investing in higher education can help developing country economies to compete in the knowledge economy through technological catch-up with advanced industrialised societies via, for instance, the production of graduates who are better able to use and generate new technologies (Bloom et al. 2006; Powell et al. 2017). Similarly, it is suggested that the ability of developing countries to absorb, use and modify technology developed at home or elsewhere will drive more rapid transition to higher levels of development and standards of living. Higher education also has a range of private and public benefits (Bloom et al. 2006) – the latter including ‘entrepreneurship, job creation, good economic and political governance, and the effect of a highly educated cadre of workers on a nation’s health and social fabric’ (Pillay 2011: 26). At the same time, others have warned of the exclusionary effects of global networks if developing economies and their knowledge-producing universities have little of value to contribute to science and innovation (Castells 2017).

To what extent has the idea of the university’s role in development become manifest in the African context? We begin to answer this question with reference to the dominant discourses that have emerged in the post-colonial era.

The post-independence ‘development university’ discourse

Since gaining independence in the 1960s, African countries have been faced with tremendous national development challenges and, to greater or lesser extents, have been grappling with whether and how higher education more broadly, and universities in particular, might contribute to development. Like so many aspects of Africa’s post-independence progress, higher education on the continent has been shaped, limited and skewed by colonial legacies, internal political wrangling, and the influence of international donor agencies’ agendas and aid.

Colonial rule left few universities behind. Most African countries lacked even a single university at independence. The development of higher education institutions remained limited until after the Second World War because the colonial authorities were generally suspicious of, and opposed to, the creation of a substantial modern, educated African elite and wished to suppress their nationalist demands for equality and freedom (Zezeza 2016). As a result, Africans seeking higher education were often forced to go abroad, including to the imperial metropolises themselves. Furthermore, the existing universities were elitist and based on European models.

Key challenges for the newly independent states included establishing or expanding their national higher education system and reforming the universities to make them more relevant to Africa's socio-cultural contexts, and to increase access for students from different social backgrounds. The new governments embarked on ambitious development programmes in which universities were supposed to train highly skilled labour forces, create and reproduce national elites, and enhance national prestige. The new reformed institutions were often larger than their colonial predecessors and their missions were broader. They expanded their disciplinary and curricula offerings from the arts and social sciences to include professional fields of study such as business, medicine and engineering. They also incorporated graduate programmes. The growth in higher education after independence was exponential across the continent – from an estimated 120 000 students in 1960 to 782 503 in 1975, and to 3 461 822 by 1995 (Zezeza 2016). Enrolments doubled after 2000 from 6 million to more than 12 million by 2015 (Chipperfield 2016).

Following independence, many African countries, as well as international agencies such as the World Bank and UNESCO, turned their focus to the development and stabilisation of the new states. Talk of the potential role for universities in reconstruction and development began almost immediately, and a discourse of the 'development university' emerged in the 1970s with the associated idea that national governments should take some responsibility for steering universities in support of national development. However, realisation of this vision would face numerous challenges and opposition, both internally and externally, which kept African universities in the back seat of development efforts.

Politically, post-independence universities were viewed by governments as sites of opposition as they became embroiled in political and ideological debates about the development choices being made by the new governments, as well as a lack of service delivery, including funding for higher education institutions. While some academics were in support of a steering role for governments to move universities in a development direction, others were defensive of the traditional self-governing model (i.e. governed primarily by scholars) which, following the predominant model in the UK and US at the time, had been the status quo during the post-independence era. As a result, government steering of higher education towards a development role was often experienced as interference in university operations, and many governments, academics and other stakeholders became increasingly sceptical of the extent to which African universities could support national development. The development university discourse also came up against the existing broad consensus among university leaders and liberation governments

that the role of elite public higher education institutions was to produce human capital to service the new African states.

The prospects for a strong role for the 'development university' were also thwarted by the influential agendas of international agencies and donor organisations, which had a significant influence on the trajectory of developments in African higher education. During the 1980s, the World Bank in particular presented a counter position to the development university idea which essentially devalued the contribution of higher education to development in Africa, in favour of an emphasis on primary education. At a meeting with African vice-chancellors in 1986, the World Bank went so far as to argue that higher education in Africa was a 'luxury', and that most African countries would be better off closing their universities at home and, instead, training graduates abroad. This had dire and long-term consequences for the nascent higher education systems in many African countries, including massive reductions in funding for universities, the closure of a number of institutions, and the introduction of various privatisation drives which had further negative consequences for the state of African higher education. A few years later the World Bank shifted its perspective on the role of higher education in Africa, partially influenced by a seminar it had hosted in the early 1990s on 'Improving Higher Education in Developing Countries' during which Manuel Castells presented his well-known paper on universities as engines of development (Castells 1993), but this turnaround did not result in any significant action by the World Bank.

Thus, despite calls for countries to find ways of incorporating universities into their development efforts, much of this remained at the level of rhetoric and, in most cases, the structure, focus and presumed functions of universities was business-as-usual. A handful of elite institutions, accompanied by a private sector of mainly low-quality institutions, and growth in undergraduate student enrolments was confined largely to the lower degree or diploma level in traditional fields such as law, humanities and social sciences. In addition, African universities were characterised by very weak research capacity which, Castells (2001: 215-217) argued, was owing to the difficulties they had faced in attracting and retaining talented local scholars, and in managing the often contradictory functions assigned to them – in particular, their political and ideological functions – alongside their core academic activities.

'Revitalisation' of the university for development and the knowledge economy

This bleak picture of African higher education persisted for a number of decades. By the turn of the century, research performance at African

universities was at an all-time low, and Africa was at the bottom of almost every indicator-based ranking and league table in science and higher education. The tide began to turn when, during the late 1990s and early 2000s, some influential voices on the international and continental stages began calling for the revitalisation of the African university and, once again, for the need to link higher education to development. Early on this was encapsulated by a statement made by then United Nations Secretary General Kofi Annan in a speech in 2000 that ‘the university must become a primary tool for Africa’s development in the new century’ (Annan quoted in Bloom et al. 2006: 2).

Two major donor-driven events – the G8 summit held at the Gleneagles Hotel in Scotland in 2005 and the World Conference on Higher Education held at the headquarters of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) in Paris in 2009 – served to stimulate further efforts towards, and to some extent galvanise commitment to, the revitalisation of higher education in the continent among African regional bodies and international agencies. Three documents emerging from the G8 summit had particular significance for African higher education. The first, a report from a workshop hosted by the African Union and the New Partnership for Africa’s Development, titled *Renewal of Higher Education in Africa* (AU/NEPAD 2005), signalled the importance attached to the topic on the continent. A second report, *The Africa Action Plan* (World Bank 2005) of the World Bank Group Africa Region, focused on developing research and higher education capacity, as well as information and communication technologies. A third document, *Our Common Interest: Report of the Commission for Africa* (Commission for Africa 2005), identified four developmental priorities – professional skills, physical infrastructure, human resources and research capacity – and called for the creation of a substantial fund to revitalise African institutions of higher education and to strengthen science, engineering and technological capacity. While the subsequent allocation of funds by the UK’s Department for International Development to the Association of African Universities in 2006 was significantly smaller than expected, the summit did see an important policy shift in support of African higher education and its role in development.

On the continent, the most positive outcome from the preparations for the 2009 UNESCO conference was unanimous support for the importance of higher education expressed by a group of 16 African ministers of education at a meeting on ‘New Dynamics on Higher Education and Research: Strategies for Change and Development’ held in Dakar in 2008. Discussions at this meeting revealed that these leaders exhibited a considerable awareness of the role of knowledge in driving development with a concomitant emphasis on reforming higher education

systems in this regard, and called for ‘improved financing of universities and a support fund to strengthen training and research in key areas’ (MacGregor 2009).

However, closer examination of the different calls for a developmental role for universities reveals two somewhat contradictory notions: the first a direct instrumental (or service) role in which university expertise should be applied to solving pressing social and health problems; the second, strengthening knowledge production and innovation and hence contributing to the knowledge economy in direct and indirect ways. The instrumental discourse was the more predominant and had been strongly driven by foreign donors and multilateral agencies. This discourse was counterproductive for the aim of higher education playing a role in the knowledge economy. Furthermore, as Maassen and Cloete noted in their study of bilateral country investments and foundation partnerships to support higher education in Africa: ‘none of the donor countries involved subscribe to the engine-of-development approach in their development cooperation policies with respect to higher education’, although this is a core discourse in their own home countries (Maassen & Cloete 2009: 268).

In summary, into the first decade of the new millennium, African higher education was back in focus both on the continent and internationally. However, statements about the importance of higher education for development failed to clarify either what the university’s development role should be, and how such a role would fit with other expectations of the institution, or the role of governments or universities in pursuit of these aims.

International funding for higher education in Africa

A discussion of the nature of higher education in Africa at the start of the 21st century and its potential role in contributing to development would be incomplete without mention of the influence of the international funding landscape.

There is no doubt that international aid agencies have made significant contributions to the development of higher education in Africa. However, as is often the case (and as was highlighted earlier with regard to the World Bank in the 1990s), donors make specific choices on what to fund which, in turn, has various implications for the trajectories of higher education. This is evident in the African higher education context in that some aspects have been well-supported while others have been neglected.

In a study of development aid in Africa between 2000 and 2005, Maassen and Cloete (2009) reported that funding for higher education generally fell into three broad categories: capacity building, specifically institutional capacity such as academic programme development, quality

enhancement and networks; the provision of programmes and/or facilities relating to academic support activities and access; and policy focusing on strengthening the structure and functioning of higher education systems. However, the authors also noted three important gaps. The first was a lack of funding for the establishment or further development of any types of higher education institution other than the traditional university, which is necessary for the development of intermediate vocational/technical skills for African economies. A second gap was a lack of support for institutional capacity building in the area of research, and a third was relatively little support for strengthening the central government departments tasked with steering the higher education sector.

A separate survey (Maassen et al. 2007) showed that a strategic area which received virtually no direct support was higher education studies. Many of the externally-funded development programmes were either implemented around non-African expertise or were not empirically informed. In the words of Jeffrey Fine, an economist with considerable experience in Africa: 'If you want to develop higher education in Africa, then you must study higher education in Africa' (CHET 2006). More systematic knowledge about African higher education is required to improve higher education delivery, engage in a more informed manner with donors, and enable development agencies to make better investment and capacity-building choices.

In addition to the gaps in funding for higher education in Africa, as studies on development aid have shown (De Gast 2005; Maassen et al. 2007; Maassen & Cloete 2009), a lack of concentration, coordination and consistency among funding agencies resulted in somewhat haphazard contributions to the sector's development on the continent. An important development in this regard was the formation in 2000 of the Partnership for Higher Education in Africa (PHEA), a joint project established by four major foundations in the US including the Carnegie Corporation of New York, the Rockefeller Foundation, Ford Foundation, Kresge Foundation and the Mellon Foundation. The formation of PHEA contributed to what De Gast (2005) described as a notable exception of coordination.

PHEA's coordinating role among the foundations led to the creation of a comprehensive donor strategy that directed funds to particular higher education institutions with the aim of establishing centres of excellence in a range of fields relevant to the sector and to national development objectives. The risk of overlap (and oversight) in addressing project themes and objectives was reduced by PHEA's leadership in ensuring cooperation among the foundations. Alas, the partnership disintegrated, leaving the recipients of donor funding wondering whether it was perhaps easier to advise others to cooperate and coordinate, than it was

to implement one's own advice.² Nevertheless, PHEA was instrumental in the conceptualisation and initiation of the Higher Education Research and Advocacy Network in Africa (Herana), a project that stretched over ten years, and in many ways filled some important knowledge gaps about universities in Africa.

Empirical evidence on universities in Africa

Higher education and science systems in sub-Saharan Africa have in the post-independence period been characterised as fundamentally lagging behind the rest of the world when it comes to the quality and productivity of their primary processes, the material conditions under which the higher education institutions had to operate, including the institutional capacity for enrolling students and conducting research, as well as their engagement with and relevance for their societies (e.g. Altbach & Balán 2007). This situation has started to change in the early 2000s, with especially the last five to ten years showing an impressive transformation of (especially sub-Saharan) African higher education and science in a number of core areas.

Even though higher education and science performance in a number of African countries is improving, there is still the general impression outside the continent that the quality of African higher education and science is in general too weak to form a strong enough foundation for academic cooperation, and the integration of African universities and scholars in global research projects and networks. This situation is often characterised as being part of a set of asymmetries between Africa and the rest of the world. At the same time, in the cooperation agreements especially the EU and China have reached with Africa, there is a strong emphasis on the need to invest in higher education and science as a crucial field for reducing the asymmetries.

One key challenge in this is the lack of data that are available outside Africa on the (recent) performance of African higher education and science systems as a whole, as well as of individual universities, research centers and scholars. This includes data on the collaboration between African and non-African scholars, as well as intra-African scientific collaboration. Myths and assumptions often dominate the political discourse, and there is clearly a need for a set of empirically-based academic publications showing amongst other things that the asymmetries in higher education and science performance are growing strongly within the continent, while the asymmetries between the

2 Additional reasons for the collapse of PHEA was changes in presidential leadership in several of the member foundations, the new presidents either being antagonistic to their predecessors' programmes or disinterested in higher education in Africa, or both.

strongest performing higher and science systems in Africa and the rest of the world are decreasing.

Bok (2013) argues that evidence-based policy and management is a discourse or set of methods based on empirical information which informs the policy process, rather than aiming directly to affect the eventual goals of the policy. Policy based on systematic evidence is considered to not only produce better outcomes, but also to provide more opportunity for democratic participation.

While evidence or data are the building blocks, evidence alone does not provide policy information as it is sometimes possible to read different policy implications from the same data. Research implies that the evidence has been given meaning, that there is, for example, a relationship between or a pattern observable in the data that is informative for policy-makers. Research is also more open-ended, communal and subject to verification or falsification, meaning that it is experimental rather than instrumentally-driven.

The problem for policy-makers, at the institutional and national levels, and for donor funders, was a gap in the broader literature on higher education and development and, in particular, the dearth of empirical work on higher education in the African context. Despite the growing global discourse about the relationship between higher education and development, the topic had largely been neglected in the academic literature. While a relatively small, but growing, number of scholarly studies have emerged over the past couple of decades,³ for the most part these have been econometric in nature, focusing on aspects such as the impact of higher education on economic growth; the rates of return of higher education; the role of higher education in producing human capital for the labour market; and the contribution of higher education to the absorptive capacity of private firms (Pillay 2010). By comparison, little research had been done on the characteristics and dynamics of the relationships between higher education and development, or on the contextual and institutional factors (at national or university levels) which facilitate or inhibit these relationships. This was especially so in the African context. These empirical gaps further indicated a relative absence of sociologically-oriented theory to explain the interrelated dimensions and dynamics at the institutional, national or broader contextual levels shaping the relationships between education and society and either impeding or fostering development.

3 For an overview and review of studies on higher education and development, see Kimenyi (2011) and Pillay (2011).

The Higher Education Research and Advocacy Network in Africa (Herana)

Launched late in 2007, Herana spanned just over a decade, during which time it developed a network of scholars in higher education studies across countries in Africa, Europe and the United States; produced over 50 books, reports and articles; disseminated information and analytical commentary via its partnership with *University World News*, including supporting the publication of an African edition; and supervised more than 20 masters students in the field of higher education studies.⁴

The idea for the establishment of Herana was the result of a confluence of developments, including the emergence of a discourse around the necessity for universities to play a role in development in Africa, as outlined above; influential interactions with international scholars, and especially Manuel Castells who had been writing about higher education in developing countries and theorising, among others, about the (contradictory) functions of universities;⁵ and the establishment of a coordinated partnership of US donor organisations (PHEA) with a focus on higher education in Africa, which provided a funding opportunity for a project like Herana.

Herana was conceived as a project that would tackle the problem of the absence of a clear idea about how African universities could actually contribute to development beyond the rhetoric; focus on research performance which had been ignored by governments and international agencies alike, and was both lacking but necessary for development and the knowledge economy; develop a set of performance indicators and collect systematic empirical evidence, also then lacking in the African context; include an advocacy component that would assist governments, institutions and donors to undertake evidence-based policy and planning; and build the capacity of a new generation of researchers in higher education studies.

The work of Herana was carried out in three overlapping phases from 2007 to 2017. *Phase 1* (2007–2010) focused on the broader topic of the relationship between higher education and development in eight sub-Saharan African countries – Botswana, Ghana, Kenya, Mauritius, Mozambique, South Africa, Tanzania and Uganda – and their ‘flagship’

4 The masters in higher education studies programme was funded by the Norwegian Agency for Development Cooperation and was presented jointly by the University of Oslo, the University of the Western Cape and the Centre for Higher Education Trust (CHET).

5 For a detailed overview of Castells’s scholarly contributions on higher education in Africa, see *Castells in Africa: Universities and development* (Muller et al. 2017).

universities.⁶ The over arching aim of the project was to investigate the complex relationships between higher education and economic development through the lens of the context in which the universities were operating, the internal structure and dynamics of the universities, and the interactions between the national and institutional contexts. It also aimed to identify factors and conditions that were facilitating or inhibiting universities' ability to make a sustainable contribution to development. Phase 1 provided the groundwork for the Herana project as a whole and included a review of the literature on higher education and development internationally (Pillay 2011); case studies of three systems (Finland, South Korea and North Carolina in the US) which had successfully linked economic development and higher education policy and planning (Pillay 2010); the development of the analytical framework for the project; and case studies of the eight African higher education systems and the selected universities. These case studies and the associated synthesis report explored the three dimensions of the analytical framework; namely, the extent to which there was agreement about the role of the universities in development, the strength of the academic core of these institutions, and the extent of knowledge policy coordination and the connectedness of university activities to national development objectives. (The analytical framework is discussed in greater detail below). The main output of Phase 1 was the book *Universities and Economic Development in Africa* (Cloete et al. 2011) together with the individual case study reports.⁷ The first publication of the performance indicators and measurement of the eight Herana universities was *Cross-National Performance Indicators: A case study of eight African universities* (Bunting & Cloete 2012). In addition to empirical data which covered the period 2001–2007, this report also outlined the process of developing the performance indicators and the rationale underpinning their construction.

Phase 2 (2010–2014) continued the focus on the performance of the eight Herana universities, updating the data from Phase 1 to 2011, with an additional focus on building institutional information capacity and evidence-based policy-making in the participating universities. The main output of this component of the project was *An Empirical Overview of Eight Flagship Universities in Africa 2001–2011* (Bunting et al. 2014). In

6 The flagship universities were the University of Botswana, the University of Ghana, the University of Nairobi, Eduardo Mondlane University (Mozambique), the University of Dar es Salaam (Tanzania) and Makerere University (Uganda). In South Africa, the Nelson Mandela University was initially selected for inclusion because it was comparable in size and profile to the other institutions in the group. The University of Cape Town, Africa's top-ranked institution at the time, replaced Nelson Mandela University at the start of Phase 2 at the request of the other participating universities.

7 The case study reports are available at <http://www.chet.org.za/higher-education-and-economic-development-african-case-studies>.

response to the weak institutional capacity to collect and analyse institutional data for policy and planning that became evident during Phase 1, the report was accompanied by a manual intended for use by institutions (Bunting 2014) which deals with the conceptual definitions and steps required to produce Herana data and the use of this data in specific instances of institutional planning. In addition, a number of smaller projects were undertaken which explored more specific aspects of higher education in Africa, including academic incentives for knowledge production, doctoral production, the role and functions of science granting councils and higher education councils, university engagement as interconnectedness, and student engagement and citizenship competencies.

These topics and others are captured in the main output of Phase 2, *Knowledge Production and Contradictory Functions in African Higher Education* (Cloete, Maassen & Bailey 2015). As the title suggests, a key focus of the book was a consideration of the aspirations of the participating universities to become research universities, and the realities and complexities of managing a research function with other, often contradictory, roles and commitments.

Phase 3 (2014–2017) focused more on the performance indicator component, and the data were updated to 2015. This project had two additional objectives: to institutionalise data collection and analysis that could contribute to evidence-based research information, and to contribute to the process of strengthening knowledge production, in this group of emerging research-intensive flagship universities. The primary output of this phase was *An Empirical Overview of Emerging Research Universities in Africa 2001–2015* (Bunting et al. 2017). The complete dataset is available online on the CHET website⁸ for use by universities to assess their performance relative to their own institutional targets and to the performance of their peers across the continent, and by other interested parties such as higher education researchers, analysts and policy-makers who seek a detailed, empirically-based picture of African higher education. An additional output in Phase 3 of the Herana project was the book *Castells in Africa: Universities and development* (Muller et al. 2017), an attempt to revisit the ‘sustained and serious academic conversation carried out over nearly 20 years, between a group of South African scholars engaged in thinking about the future of higher education, and a prominent and provocative international scholar’ (Case 2018) and to bring this into productive dialogue with the insights provided by the 15 years of empirical university data collected by Herana.⁹

8 African Higher Education Open Data: <http://www.chet.org.za/data/african-he-opendata>

9 See CHET (2017) for further information.

Researching the link between higher education and development

The analytical framework

As a point of departure, and in order to reach a better understanding of the relationship between higher education and development, the Herana research group studied three large-scale systems –Finland, South Korea and the state of North Carolina in the US – in which higher education had been closely integrated into their development strategies (Pillay 2010). In all these systems, a rethink of major economic policies had been accompanied by a deliberate attempt to link higher education to economic development. The study sought to identify the core conditions present in each of these systems that had enabled their higher education sectors to successfully and sustainably contribute to development.

All three systems featured a strong, agreed-upon development framework aimed at realising an advanced, competitive knowledge economy, and had assigned an important role to higher education in this regard. Despite major contextual differences, the three systems all exhibited the following conditions for harnessing higher education to economic development:

- They had been built on a foundation of equitable, quality schooling. There was also a common emphasis on achieving high-quality higher education.
- They had achieved high tertiary participation rates. The three higher education systems were differentiated as part of achieving national or state-wide human capital, research and innovation objectives for economic development.
- The relevant national and state governments ensured a close link between economic and higher education planning.
- There were effective partnerships and networks among the state, higher education institutions and the private sector to ensure effective education and training, and to stimulate relevant research and innovation.
- There was strong state involvement in other areas, including providing adequate funding for the sector, using this funding to steer higher education institutions to respond to labour market requirements, and incentivising research and innovation in the sector.

Referring to the findings of this study as well as the review of the international literature (Pillay 2011), the research group developed an

analytical framework which articulated the following three core theoretical propositions for the project:

1. The existence of a broad agreement among government, universities and key socio-economic actors, referred to as a 'pact', about the nature of the role of universities in development is essential for these institutions to contribute effectively to development.
2. As knowledge institutions, universities can only participate in the global knowledge economy and make a sustainable contribution to development if their academic cores are quantitatively and qualitatively strong.
3. A range of forms and methods of national knowledge policy coordination must be in place to link universities and development. The nature of the connections between the larger policy context, universities and development is crucial.

The analytical framework was first and foremost founded on the concept of a 'pact' defined by Gornitzka et al. (2007: 183–184) as 'fairly long-term commitment to and from the university, as an institution with its own foundational rules of appropriate practices, causal and normative beliefs, and resources, yet validated by the political and social system in which the university is embedded'. The analytical framework was also informed by Burton Clark's (1983) notion of a 'coordination triangle' comprising the state, the market and the academic oligarchy, the coordination of which, he argued, was essential for the integration of higher education systems. The Herana research group adapted Clark's triangle to depict the three main nodes as government, universities and external stakeholders. The relationships among these three nodes described the dynamics of the analytical framework for the project and produced a range of working hypotheses about their interrelationships, including the following:

- without an implicit agreement, or a pact, coordination becomes almost impossible;
- without national policies and implementation of these policies, it is difficult for universities to develop strong academic cores (particularly in developing countries where the domestic markets are weak);
- strong academic capacity that is disconnected from development activities results in universities becoming insulated and isolated from their surrounding communities; and

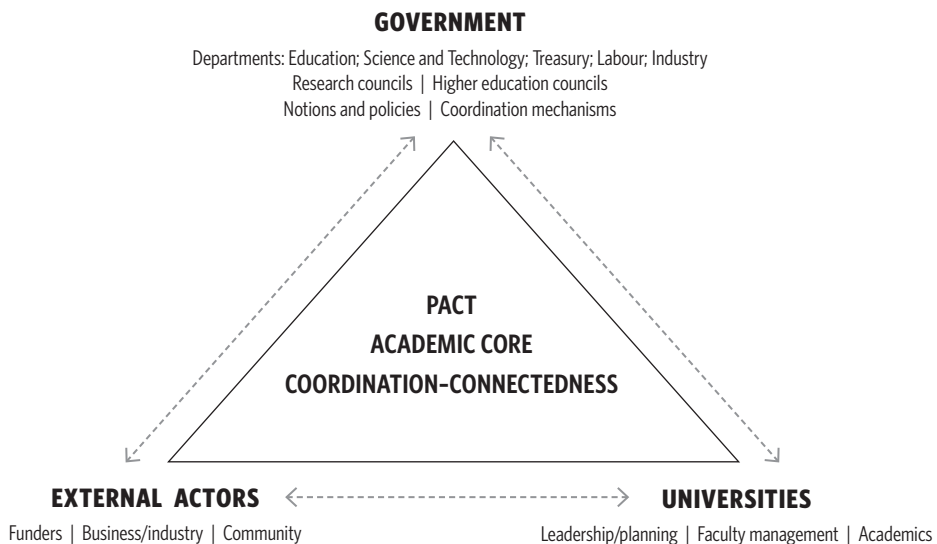
- conversely, the contributions that universities can make to development are also undermined when these institutions are strongly connected to development but lack academic capacity.

The primary elements of the analytical framework and the key actors involved are depicted in Figure 1.1.

Finally, the analytical framework had to operationalise notions of the roles that universities could be understood to play in relation to development. Our point of departure was formed by the four visions of university organisation and governance identified by Olsen (2007: 28–33), that is, the university as a rule-governed community of scholars, the university as a representative democracy, the university as an instrument for shifting national political agendas, and the university as a service enterprise embedded in competitive markets. Drawing on these ideas, and borrowing from Castells (2017) the concept of the university as an ‘engine for development’, the Herana analytical framework proposed the following four notions of universities in relation to development:

1. *The university as ancillary*: National development policies and strategies emphasise investments in basic healthcare, agricultural production and primary education, and are not evidence-based. Therefore, no direct role is ascribed to universities in furthering development. Instead, their main function

Figure 1.1 Analytical framework for studying higher education and development in Africa



is seen to be the production of educated civil servants, professionals and community-service workers.

2. *The university as self-governing institution:* While the knowledge produced by universities is considered important for national development, particularly for the improvement of healthcare and agricultural production, universities are considered to be most effective when they are left to themselves and can follow their own institutional priorities rather than steered by the state, independent of their specific socio-economic context.
3. *The university as instrument for development agendas:* Universities have an important role to play in national development – but through sharing expertise and capacity-building, rather than through the production of new scientific knowledge. The focus of universities' development efforts tends to be on contributing to reducing poverty and disease, improving agricultural production, and supporting small business development, primarily through consultancy for government agencies and as part of donor-funded projects and through engagement with local communities.
4. *The university as engine of development:* Knowledge is seen to play a central role in national development, not only in relation to improving healthcare and agricultural production, but also in relation to innovations in the private sector, especially in areas such as information and communication technology, biotechnology and engineering. Universities are thus seen as crucial to national development, the assumption being that they are the only institutions that can provide an adequate foundation for the complexities of the emerging knowledge economy, producing the relevant skills, competencies and use-oriented knowledge.

National development models and a pact about the role of higher education

To explore the views on the role of universities in the development of the eight countries interviews were conducted at the national level with central actors in selected ministries, the higher education councils/commissions and other key stakeholders, as well as with the institutional leadership, senior academics, administrators and project leaders within the universities. The analysis also drew on various policy and strategy documents, at both national and institutional levels, as well as quantitative data including national development indicators and statistics relating to the higher education systems and universities in the sample (Cloete et al. 2011).

Aside from different emphases and orientations across the eight countries, there were differences between the perspectives of national and university stakeholders about the role of the university in development. On the whole, national policy-makers favoured the instrumental notion of universities making a direct contribution to national development objectives via the deployment of academic expertise to addressing pressing socio-economic concerns such as poverty reduction and unemployment through consultancies and engagement activities. While the engine-of-development notion appeared in science and technology policies and in national vision statements, except for Botswana and Mauritius these were not translated into strategies and implementation plans. By contrast, university leadership generally favoured the self-governance or instrumental notions, which reflect the traditional debates about academic autonomy and community engagement, respectively. The University of Mauritius, in line with its government's perspective, was the only institution at which the engine-of-development discourse predominated among the university leadership.

In addition to dominant discourses, the classification of national economies in relation to the value placed on the university as an engine of development was explored. The development model adopted by the three Organisation for Economic Co-operation and Development (OECD) systems studied in the first phase of the Herana project (Pillay 2010) all fall within the World Economic Forum's classification of 'innovation-driven' – in other words, these countries have agreed that knowledge and education are key productive factors in development. Among the national economies of the eight Herana African countries, three (Mauritius, South Africa and Botswana) could be characterised as 'efficiency-driven' – a phase conceived as preceding the 'innovation-driven' phase, meaning that improved efficiency and higher education and training were playing an increasingly important role in economic development. The other African countries in the study were in the process of moving from the 'factor-driven' phase, characterised by an emphasis on exploiting natural resources and a low skills base, towards the 'efficiency-driven' phase and were, by implication, increasingly prioritising education and training.

The study revealed that the three efficiency-driven systems already had substantially higher participation rates in higher education, although, with the exception of Mauritius, none of the Herana countries had established a consistent, broadly accepted model for national development or reached agreement that knowledge was a key productive factor in such development. Although knowledge policies were emerging in the other seven countries, they tended to be located mainly in one government department and lacked adequate coordination and implementation

strategies. In most of the countries in the sample, grand national visions had been forged as a kind of substitute for the absence of an actual development model. These visions, some of which looked forward as far as 2030, were not accompanied by implementation plans or systematic monitoring mechanisms. Mauritius was the only country where, at both the national and institutional levels, knowledge was seen as a key driver of development, and where the government and the higher education institutions were in broad agreement about the role of universities. However, even here, the pact had not been properly operationalised in relation to its coordination and implementation, or its impact on the academic core.

In summary, with regard to the pact in the Herana countries, there was a lack of clarity and agreement about the national development models and the roles of the higher education sector in development, at both central government and university levels. There was, however, an increasing awareness, particularly at government level, of the importance of universities within the context of the global knowledge economy. Furthermore, in none of the countries in the sample was there a coordinated effort among the government, external stakeholders and universities to strengthen the contribution that the universities could make to development in a systematic way.

The strength of the academic core

Our interest in the academic core of the universities in the study was framed as follows: (1) What was the strength of the academic cores of these universities? and (2) Had there been a strengthening or weakening of these academic cores over time?

To rate the strength of the academic core of the universities in the study, eight performance indicators were identified, all of which refer to characteristics or activities that reflect the knowledge-based production of high-quality scholarship which, in turn, forms the basis of each university's potential contribution to development. Some of these indicators are based on traditional notions of the role of flagship universities (e.g. the production of new knowledge and the next generation of academics), while others (e.g. science, engineering and technology enrolments and student-staff ratios) are pertinent to the African context. The indicators were agreed to following consultation with the participating universities, and are divided into five input and three output indicators (see Bunting et al. 2017 for further detail on the indicators and data collection).

Based on the indicators for each university, the institutions were categorised based on their ratings into the following four groups:

1. 'Strong' ratings for all measured inputs and outputs: University of Cape Town;
2. 'Medium' or 'strong' ratings on both the input and output sides: University of Mauritius, Makerere University and Nelson Mandela University;
3. 'Medium' and 'strong' ratings for the measured inputs, but were 'weak' on the output side: University of Dar es Salaam, University of Nairobi and University of Botswana;
4. 'Weak' ratings for both the measured inputs and outputs: University of Ghana and Eduardo Mondlane University.

Overall, the Herana data indicated that, with the exception of the University of Cape Town, research production at the participating universities was not strong enough to enable them to build beyond their traditional undergraduate teaching roles and make a sustainable, comprehensive contribution to development through new knowledge production. A number of universities had manageable student–staff ratios and adequately qualified staff, but lacked sufficient funds for staff to engage in research. In addition, the incentive regimes for research did not support knowledge production.

Nevertheless, some positive trends were noted. The majority of the universities could boast relatively strong inputs in terms of academics with doctorates, student–staff ratios, and increasing enrolments at the masters level. There was also an increase in research outputs, albeit from a very low base. However, the increase failed to keep pace with the rising productivity in the rest of the world, indicating that the relative position of Africa as knowledge producer was gradually weakening, at least in the early years of Herana (French Academy of Sciences 2006).¹⁰

Finally, what also emerged through the process of collecting the data was that there was a need to improve and strengthen the definition of key performance indicators, as well as the systematic, institution–wide capturing and processing of key data (Cloete et al. 2011).

From flagship to research universities

The eight universities that were selected for inclusion in the Herana project were chosen because they were the most prominent national universities in their respective countries since independence, and because each had incorporated broad flagship goals into their vision and mission

¹⁰ However, by 2015 Africa's proportion of global knowledge production had started to increase (Beaudry et al. 2018).

statements. According to Cloete et al. (2011), each of the eight universities aimed to:

- attain a high academic rating which would make it a world-class university or at least a leading or premier university in Africa;
- be a centre for academic excellence;
- engage in high-quality research and scholarship; and
- produce knowledge products that would enhance both national and regional development.

During Herana Phase 2 (2010–2014), the project's discourse shifted, and it increasingly referred to the objects of its inquiry as 'research-intensive' universities rather than 'flagship' universities, in line with the global discussion about the nomenclature for higher education institutions and the use of the terms 'flagship', 'world-class' and 'research-intensive' in relation to universities.

According to Douglass (2014), a 'world-class university' may be defined as one that boasts highly ranked research outputs, a culture of excellence, top quality facilities, and a brand name that transcends national borders. Perhaps most importantly, such an institution should be included in the upper ranges of one or more world rankings, which are regarded as proof of excellence by many government ministers and much of the global higher education community. However, although such rankings are useful and informative, they represent a limited idea of what it means to be a leading university. Accordingly, Douglass advocates the notion of the 'flagship' university as an alternative and more relevant model for public, and even some private, institutions, a more attainable goal to be pursued by government ministries and universities in their drive for status and socio-economic impact. He defines a 'research-intensive flagship' university as an academic institution committed to the creation and dissemination of knowledge in a range of disciplines and fields, and featuring the appropriate laboratories, libraries and other infrastructure which permit teaching and research at the highest possible level. In this regard, the flagship model that Douglass proposes does not ignore international standards of excellence, which are focused largely on research productivity, but is grounded in an ethos of service to the nation and the region in which the university is situated. The characteristics and responsibilities that need to be adopted in pursuit of this model do not readily lend themselves to easy measurement and ranking regimes. Indeed, according to Douglass (2014) the advancement of the flagship model for universities entails forging a new path and articulating a new language for defining the

success of universities beyond research and the current international ranking system. The great challenge for such institutions, which should seek to lead their own national higher education systems, is to shape their missions in order to increase their role in, and impact upon, the societies that give them life and purpose.

Worldwide, the role of flagship universities includes delivering on the core mission of producing research and training students to engage in research (Altbach 2013). But flagship universities also have wider recognised goals (Douglass 2014), a view that is supported by Berdahl (2014) who argues that American flagship public universities, which compete for talent with the nation's best private higher education institutions, are an essential component of the US research enterprise. They serve the nation as well as their respective states.

The Herana project, which explicitly aimed to help planners strengthen knowledge production at flagship universities in order to contribute to development, found little use in the popular notion of 'world-class' universities or in the Shanghai Jiao Tong and Times Higher Education university rankings. However, this is not to imply that university leaders in Africa do not monitor such rankings closely. As Cloete et al. (2017: 141) observed: 'Rankings are interesting in how institutions use them, irritating (but not irrelevant) when your institution is not featured, and important for stimulating change [...] to achieve excellence.' The Herana team also concluded that the notions of 'flagship' and 'world-class' encompassed all university functions and that this would not focus the Herana universities on the knowledge production functions.

The focus on research universities also came about because it became clear within the Herana project that the study of the link between universities and development had provided much information and many insights, but that a key factor in the development chain is the university itself – only a university with certain research capacities can contribute to development. The assumption from many development agencies that universities had surplus capacity and therefore had an obligation to participate in development activities proved to be a fallacy. Equally problematic is the expectation of politicians and civil society that universities must produce knowledge *directly* linked to the national, regional or global grand challenges. Universities are not development agencies, they are knowledge producing and dissemination organisations that contribute indirectly to development. Moreover, universities are the core knowledge institutions; in Africa and elsewhere there are no substitutes (Maassen 2012; Powell et al. 2017; Beaudry et al. 2018). One of higher education's most important roles in development is to educate and train self-programmable knowledge workers (Castells 2017) and this is not equivalent to the mass certification of traditional qualifications.

Knowledge workers are those who are educated within the higher education complex, who can understand and use knowledge but who can also and should be expected to re-programme themselves in economies increasingly driven by information.

In the second phase of Herana, the focus was on expanding the network; on the research university and therefore, by implication, on the academic core; and on improving and institutionalising data collection to assess the performance of the university in relation to its core functions.

Herana Phase 3 (2014–2017) continued the focus on institutionalising data collection and analysis, and the contribution of evidence-based planning and steering the process of strengthening knowledge production in a group of research-aspirant universities in Africa. The goal was to support the institutionalisation of six years of capacity building in performance data collection within the universities, and to link this to the promotion of policies enhancing knowledge production capabilities (such as by enrolling and graduating more PhDs, increasing the proportion of staff with PhDs, and increasing research outputs). More broadly, the project aimed to support the development of a group of research-orientated universities as a model for other countries on the continent.

The importance of research universities for global science

The global comparative project ‘Science Productivity, Higher Education, Research and Development and the Knowledge Society’ (SPHERE) produced a comprehensive, longitudinal and worldwide dataset of scientific journal publications on science, technology, engineering and mathematics plus health (STEM+). The publications had been catalogued in the Science Citation Index Expanded (SCIE), and customised and acquired especially for this project from Thomson Reuters’ (now Clarivate Analytics) Web of Science (formerly ISI Web of Knowledge) (Powell et al. 2017).

The SPHERE project coded and analysed over 20 million records from the SCIE dataset to show that the number of STEM+ papers published in scientific journals over the twentieth century grew extraordinarily rapidly. Starting from just under 10 000 in 1900, the annual number of new publications grew to about 50 000 in 1960. This trend was called ‘big science’, one later transformed into ‘global mega-science’. There was an exponential growth in peer-reviewed publications between 1980 and 2010, resulting in over half a million SCIE publications in 1995 and doubling to reach more than 1 million by 2011 (Powell et al. 2017: 4). SPHERE also reported that coinciding with the massive rise in the absolute number of published STEM+ papers, especially post-1960, a

concomitant phenomenon was the globalisation of science. Furthermore, they found that while in 1900 only around two dozen countries and territories participated in the production of STEM+ papers, by 1950 the number had increased to three dozen, and by 2000, almost 200 countries and territories were producing published science. This remarkable expansion of research output was, among others, driven by rising competition across nations and universities at the macro and meso levels, combined with globe-spanning collaboration among universities and research groups.

These developments must be understood in the context of the global knowledge society, driven by three trends. The first is the institutionalisation of schooling and education at all levels and throughout the world (Baker 2014). The second is the massive and continuing expansion of university enrolments around the world that has transformed science into an everyday activity (Meyer et al. 2008). Thirdly, as new universities were founded around the world, and tertiary education became increasingly accessible as well as institutionally embedded, the research university 'became a global model for higher education and knowledge production and this strengthened research capacity worldwide' (Baker 2014: 6).

Altbach (2013) describes research universities as academic institutions that focus primarily on research, at times at the expense of teaching undergraduates. In order to fulfil their research mission, they offer instruction up to the doctoral level; possess the necessary infrastructure such as libraries, laboratories and information technology; employ high quality academic staff, generally holding PhDs; ensure the appropriate working conditions; and select the best students available. Research universities combine their research function with training future generations of scholars and researchers.

While research universities are regarded as the most effective institutions for conducting research, they are not the only bodies in which research is conducted. Others can include publicly- and privately-funded research institutes, private company R&D divisions, laboratories and agencies, often connected to the global scientific community. In some countries – for example, Russia – networks of research institutes have been established, particularly in the hard sciences and engineering in which research universities play a relatively minor role except as suppliers of appropriately trained academics. Although research universities have been key sites of knowledge production, some scholars have questioned the role of universities in knowledge production and innovation, and even predicted that the locus of scientific research would shift away from largely state-funded higher education to a variety of other organisational forms (Nowotny et al. 2001). But, Powell et al. (2017: 8) concluded that

even if ‘tremendous diversity exists in the organizations producing science today, our analyses show that the very centre of scientific productivity has become and remains the research university.’

Research universities are important for Africa

At the same time that scholars such as Douglass emphasised the importance of knowledge-producing flagship research universities, a broader international discourse emerged lauding the crucial role that research universities in low- and middle-income countries can play in developing differentiated and effective academic systems, and in making it possible for their countries to join the global knowledge society to compete against sophisticated knowledge economies. This is well summed up by Olsson and Cooke (2013: 18) as follows:

Top research universities in industrialised countries (often referred to as the Super RUs) usually dominate the global ranking tables. In contrast, their counterparts in middle and low-income countries have, if anything, more important missions because they are the engines of local and regional knowledge development and natural leaders of their own evolving academic systems. As these systems become increasingly complex and the need to nurture knowledge networks for research grows ever more essential, the success of these institutions becomes even more crucial for national development policy.

Echoing these sentiments, Altbach (2013) noted that while research universities in the developing world have not yet ascended to the top level of the global rankings, they are very important in their countries and regions, and are steadily improving their reputations and competitiveness on the international stage. A key point is that research universities around the world are part of an active community of institutions which share values, foci and missions.

Most universities are not research universities. Indeed, such universities constitute a relatively small percentage of the higher education sector. In America, the ratio is about 5% (220 research universities in a system of more than 4 000 post-secondary institutions); in Britain 25% (25 research universities among 100 universities); and in China 3% (100 research universities out of more than 3 000 institutions countrywide). In many smaller developing countries there is often only one research university, and many countries have none.

A clearly differentiated academic system is needed for research universities to flourish. For that, developing countries need to clearly

differentiate the missions of the institutions in their post-secondary systems, and to organise these institutions in a rational way. However, according to Altbach (2013: 328):

The fact is that few if any developing countries have a differentiated academic system in place; and this central organisational requirement remains a key task [...] These institutions must be clearly identified and supported. There must be arrangements so that the number of research universities will be sufficiently limited so that funding is available for them and that other resources, such as well-qualified academics, are not spread too thinly.

Discussions of university performance in the post-independence period in sub-Saharan Africa have often been dominated by perspectives that emphasise the ineffectiveness of African states (see Evans & Rauch 1999), and the idea of 'African exceptionalism' – that is, the notion that the continent constitutes a special case to which the standards for analysis elsewhere cannot be applied. In relation to the latter, some scholars have considered models for examining university performance in the OECD states applicable to developing countries in (East) Asia and Latin America, but less relevant to those in Africa. Such exceptionalism is arguably justified by a lack of available data or experts, or assumed differences in governance challenges and institutional formation in sub-Saharan Africa. For example, Altbach and Balán (2007) elected not to include Africa in their discussion of the transformation of research universities in Asia and Latin America in their book, *World Class Worldwide*. They justified the continent's exclusion on the basis that it faced greatly different academic challenges from those encountered in Latin America and Asia without providing any empirical evidence for this omission (Altbach & Balán 2007: vii).

Such views of the continent also persist in the 'failed-state' narrative for Africa. Many media outlets, development cooperation agencies and academics emphasise the governance problems facing the continent, including corruption, nepotism, a lack of expertise, and weakly functioning, ineffective institutions. Such analysis continues despite the continent's *Wirtschaftswunder* ('economic miracle') since the early 2000s during which many countries have shown clear signs of progress in three core institutional spheres or 'pillars': civil society, science and the (market) economy (Olsen 2007: 28). For example, between 2012 and 2013, more than one third of the 49 countries in sub-Saharan Africa posted growth rates of over 6% (Africa Progress Panel 2014), suggesting that the economic gap between sub-Saharan Africa and the rest of the

world might have stopped growing (Huntington 2006). It should be noted that actual growth rates and economic performance differ greatly among countries on the continent.

At the same time as the continent's economic prospects have apparently improved, the national development strategies of African countries have shifted from emphasising the realisation of targets similar to those of the Millennium Development Goals, which included halving poverty rates and providing universal primary education, towards the active inclusion of a long-term vision aimed at creating knowledge economies. This change was expressed in the African Union's *Agenda 2063: The Africa we want* (African Union Commission 2015), a long-term vision and action plan agreed upon in January 2015 by African heads of state and government. Although the first two strategic targets listed in the action plan (the eradication of poverty and the provision of affordable housing) may be regarded as conventional, the third target concerns the building of an 'African knowledge economy', and goes beyond the 'Education for All' goals agreed to at the World Education Forum in Dakar in 2000. The Agenda 2063 target is to 'catalyse [the] education and skills revolution and actively promote science, technology, research and innovation, to build knowledge, human capital, capabilities and skills to drive innovations' (African Union Commission 2015: 14).

This political focus on building an African knowledge economy resembles the goal promoted by the European Union's Lisbon Strategy 2000 to strengthen Europe's economic competitiveness and bolster its social cohesion by making the continent the most competitive knowledge economy (Maassen & Olsen 2007). Just as officials and experts gathered after the Lisbon 2000 summit in Europe (Gornitzka 2007), so have they been meeting in Africa to interpret and operationalise Agenda 2063's strategic aims in the areas of (higher) education and research. The first such meeting, a political summit of Africa's ministers of education and science, took place in Dakar in March 2015, under the title 'Revitalizing Higher Education for Africa's Future'. The summit's final declaration and action plan addressed governance-related concerns in Africa's higher education sector, innovation issues, and the harmonisation of relevant policies across the continent. The plan's overall aim was to support the higher education sector in becoming a driving force for the vision of inclusive growth and sustainable development outlined in Agenda 2063. In this regard, it sought in particular to strengthen the research productivity of the continent's universities.

Can we talk of research universities in Africa?

A range of indicators may be considered in order to assess the level of research outputs globally: international rankings, the number of scientific journal citations relative to a country's population, the production of patents, and the capacity of higher education systems to prepare PhD graduates.

In order to consider the performance of African universities as sites of new knowledge production, it is useful to review their positions in the global university rankings. Generally speaking, universities in developing countries, particularly in Africa, fare poorly in the Shanghai ranking¹¹ (Table 1.1), which measures the research outputs and strength of universities. The developing world did not have a single university in the top 100 in 2015 and represented less than 10% of the total number of universities among the 500 that are ranked. The big 'winner' in this rankings competition is China: in 2000, it had only nine universities in the top 500, but this had increased to 44 by 2015. Tsinghua and Peking were the first developing country universities to be included in the top 100 in 2016.

Five African universities appear in the top 500 of the Shanghai ranking for 2015: the University of Cape Town and the University of the Witwatersrand were placed in the 201–300 range; and Stellenbosch University, the University of KwaZulu–Natal, and Cairo University in the 401–500 range. In the same year, the Times Higher Education Supplement placed the University of Cape Town at position 103, Stellenbosch and Witwatersrand in the 251–275 range, and Alexandria University in Egypt in the 301–400 range. Of the six African universities in the top 500 in these two main ranking systems, four were from South Africa and two from Egypt.

Table 1.1 Shanghai ranking results for low- and medium-income country universities: 2015

Country groupings	1-100	101-200	201-300	301-400	401-500
East Asia and the Pacific	0	10	9	19	8
Eastern Europe and Central Asia	0	0	0	0	0
Latin America and the Caribbean	0	2	1	1	1
Middle East and North Africa	0	0	1	0	2
South Asia	0	0	0	0	1
Sub-Saharan Africa	0	0	2	0	2
Total	0	12	13	20	14

Source: Shanghai Ranking Consultancy, *Academic Ranking of World Universities (ARWU)*

11 See <http://www.shanghairanking.com/index.html>

Another ranking, the CWTS Leiden Ranking,¹² measures not only the number of publications but also their impact (based on citations). This provides a further assessment of the research performance of universities in developing countries (Table 1.2). The 2016 CWTS Ranking is based on the Web of Science bibliographic database produced by Clarivate Analytics. Universities worldwide are ranked according to their publication outputs in five broad scientific fields: biomedical and health sciences, life and earth sciences, mathematics and computer sciences, natural sciences and engineering, and social sciences and humanities.

While the proportion of universities in low- and medium-income countries in the Leiden ranking is higher than in the Shanghai ranking, this is largely because of the progress of Chinese universities (67 ranked universities). Only a handful of universities from 12 other low- and medium-income countries have a scientific output sufficient to be included: India (7), Brazil (6), Iran (6), Malaysia (4), South Africa (3), Thailand (2), Argentina (1), Chile (1), Egypt (1), Mexico (1), Serbia (1) and Slovenia (1). The results show that sub-Saharan Africa, with the exception of South Africa, performs very poorly. The continent's performance is quite comparable to South Asia (India, Bangladesh), but not East Asia (Singapore, Taiwan, China), Latin America (Chile, Uruguay), or the Middle East and North Africa (Israel, Saudi Arabia, Egypt).

Table 1.2 Leiden ranking results for low- and medium-income country universities: 2016

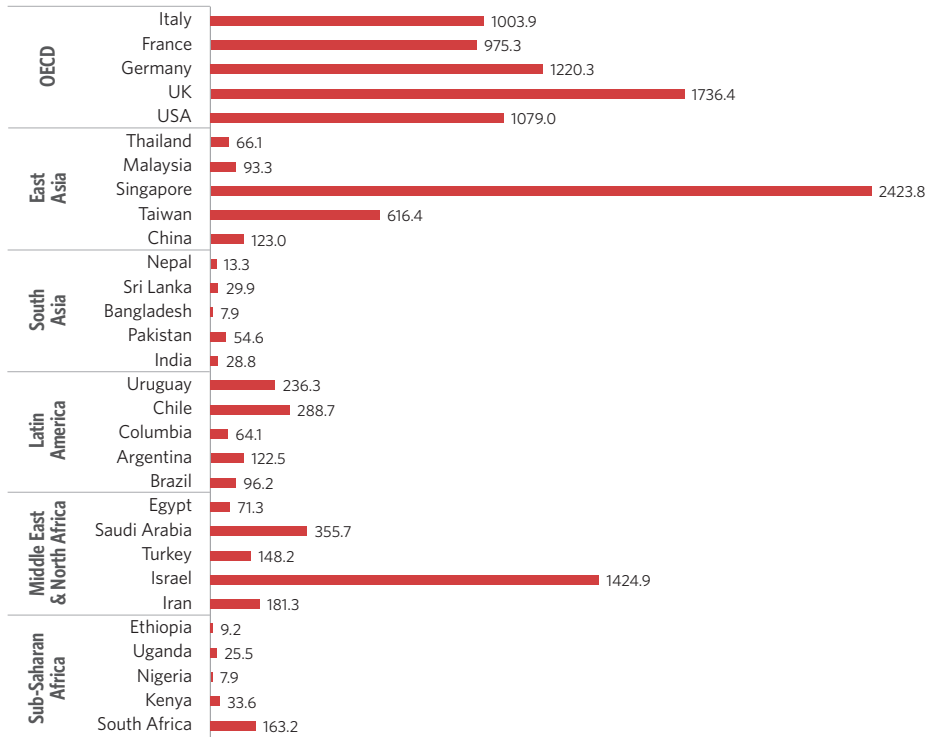
Country groupings	1-100	101-200	201-300	301-400	401-500
East Asia and the Pacific	15	11	17	17	13
Eastern Europe and Central Asia	0	0	1	1	0
Latin America and the Caribbean	1	3	2	2	2
Middle East and North Africa	0	0	1	3	3
South Asia	0	0	1	2	3
Sub-Saharan Africa	0	0	0	0	3
Total	16	14	22	25	24

Source: Salmi 2017: 76

Figure 1.2 presents the number of scientific citations of the top five countries in each region of the world and among OECD countries, relative to their population size. It shows that the research outputs of low- and medium-income countries lag far behind those of OECD economies. China is the only research powerhouse in this group of countries reflecting the low performance of their research universities. By this measure, it is five times more productive than India. Brazil, Iran and South Africa are the only other low- and medium-income countries with significant research outputs.

12 See <http://www.leidenranking.com/>

Figure 1.2 Number of scientific citations of the top five countries in each region of the world and among OECD countries, relative to their population size: 2015

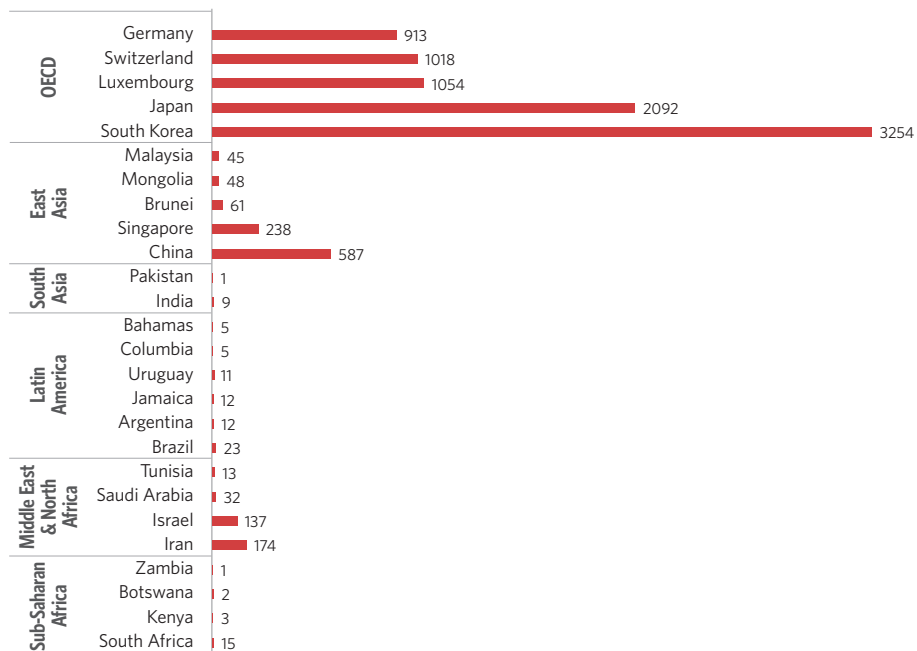


Source: Scimago & World Bank (in Salmi 2017: 73)

Another indicator of impact and knowledge transfer and development to which research universities are expected to contribute is registered patents. Figure 1.3 shows the annual number of registered patents per one million inhabitants in the top five countries of each region of the world, as well as among the OECD economies. China and, to a lesser extent, Iran are the only two low- and medium-income countries with a substantial output. Sub-Saharan Africa barely registers in the count. According to Salmi (2017), the lagging research outputs of most universities in developing countries is largely caused by the lack of a critical mass of PhD graduates, as is reflected in the low numbers of new PhD graduates (Figure 1.4). South Africa is the only sub-Saharan African country producing a significant number of doctorates, although it should be noted that more than 30% of doctoral enrolments were from other African countries (Cloete et al. 2015: 92) (see Figure 1.5).

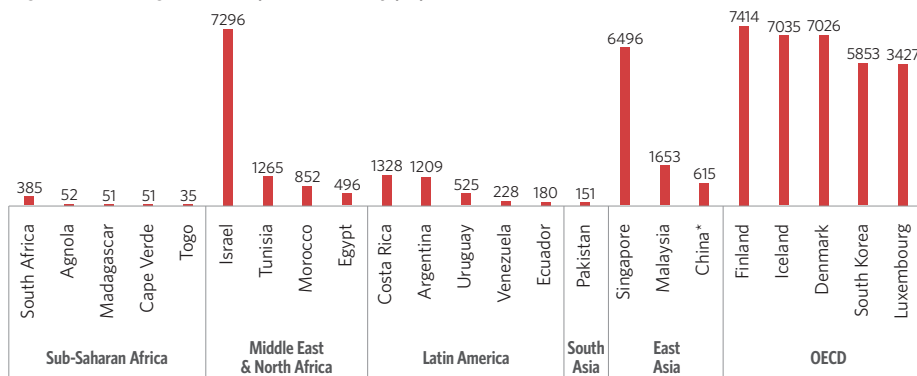
However, there have been areas of improvement. Following a study by Tijssen (2007) showing that Africa's annual output (as measured by articles in the Web of Science) was stagnating, more recent studies

Figure 1.3 Registered patents by origin for low- and medium-income countries per million inhabitants: 2014



Source: World Intellectual Property Indicators (in Salmi 2017: 78)

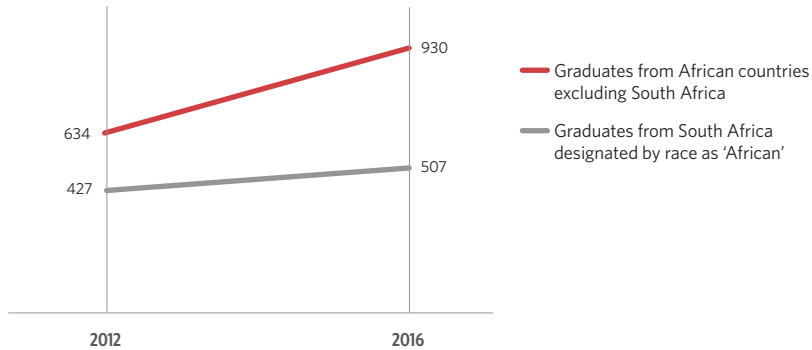
Figure 1.4 PhD graduates per million of population: 2011



Source: World Bank (in Salmi 2017: 74)

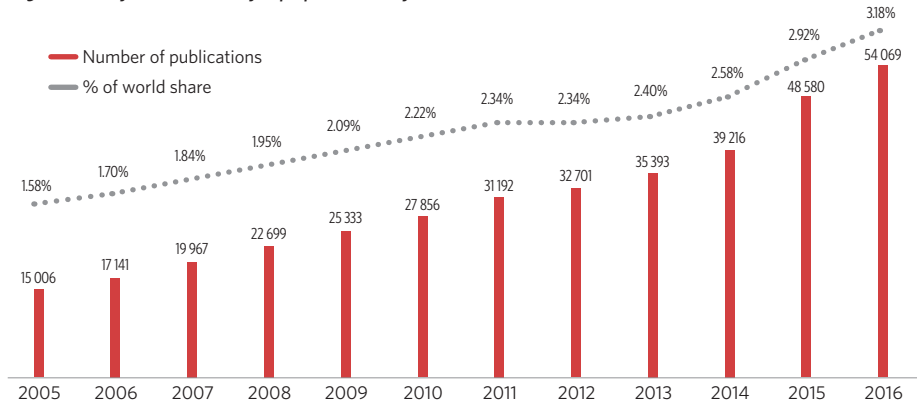
(AOSTI 2014; Mouton & Boshoff 2010) have noted the beginnings of an increase in the number of African-authored papers. Updating these reports from an analysis of African-authored papers in the Web of Science shows that annual outputs have been steadily increasing over the past

Figure 1.5 Africans graduating with a doctoral degree from South African public universities: 2012 & 2016



Source: Department of Higher Education and Training (2018), compiled by Charles Sheppard

Figure 1.6 Africa's scientific papers in all fields: 2005-2015



Source: Beaudry et al. (2018)

decade: from 15 285 in 2005 to 49 015 in 2015 (Figure 1.6). What is perhaps most striking is that this rate of increase has surpassed growth rates globally over the same period, with the result that Africa's share of world publication outputs more than doubled from 1.58% in 2005 to 3.18% in 2016 (Beaudry et al. 2018). Considering the increase in scientific production from East Asia over the past decade, this is an encouraging trend for African science.

Herana universities are the most research-productive in their countries

Table 1.3 shows the relative share of the Herana universities in relation to publication outputs in each country over time.

Table 1.3 *Relative share of the Herana universities in relation to publication outputs in each country: 2000–2016*

University	Country	2000–2016
University of Botswana	Botswana	2 074 of 3 397 (61.1%)
University of Cape Town	South Africa	23 209 of 133 385 (17.4%)
University of Dar es Salaam	Tanzania	2 499 of 9 411 (15.9%)
Eduardo Mondlane University	Mozambique	768 of 1 956 (39.3%)
University of Ghana	Ghana	3 761 of 8 586 (36.3%)
Makerere University	Uganda	5 146 of 9 263 (55.5%)
University of Mauritius	Mauritius	858 of 1 311 (65.4%)
University of Nairobi	Kenya	3 191 of 17 893 (17.8%)

Source: *Clarivate Web of Science*, compiled by the Centre for Research on Evaluation, Science and Technology (CREST), Stellenbosch University.

Note: In compiling this data, if a paper had multiple authors from different institutions (e.g. the University of Botswana and Harvard University), each university was credited with a paper.

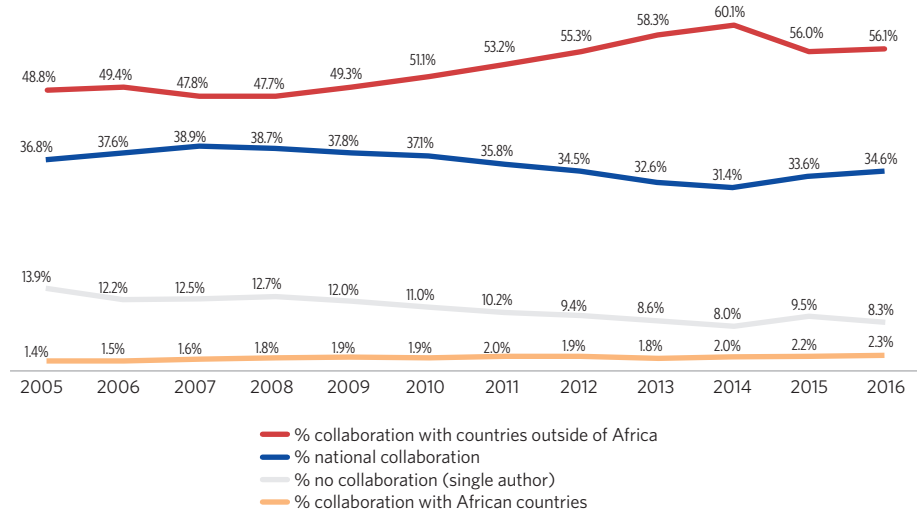
In Botswana, the next best-performing institution after the University of Botswana was the Botswana College of Agriculture with 4.8%. In South Africa, the next best-performing institution after the University of Cape Town was the University of Witwatersrand (12.6%) followed by the University of KwaZulu-Natal and the University of Pretoria. In Tanzania, the University of Dar es Salaam was followed by the School of Medicine at the Muhimbili University of Health and Allied Sciences (12.6%) and the Sokoine University of Agriculture (11.5%). Both of these institutions were originally part of the University of Dar es Salaam. In Mozambique, the Manhiça Health Centre, a non-governmental organisation funded by ISGlobal, produced 12.6% of national research outputs.

Ghana and South Africa were the only countries where other universities made a substantial contribution to research outputs. In Ghana, Kwame Nkrumah University of Science and Technology produced 22.9% of outputs, University of Cape Coast 7.7%, and Ghana Health Service 5.8%. In Uganda, Makerere University accounted for 56.5% and Mbarara University of Science and Technology only 7%. Of all the Herana universities, the University of Mauritius accounted for the highest percentage of national research outputs (65.4%), with the second biggest contributor the Mauritius Wild Life Foundation producing only 5.1%. In Kenya, the second highest contributor was the Kenyan Government Medical Research Centre (11.3%), followed by Moi University (5.2%) and the University of Kenyatta (4.9%).

A surprising feature of this analysis is that apart from South Africa, Ghana and Tanzania, the second highest author citations were from the University of London, Harvard University and the University of Barcelona. This highlights the existence of strong international collaboration. At the

same time, Figure 1.7 shows that while there has been an increase in international collaboration, there has not been an increase in research collaboration amongst scholars within Africa. This suggests that Africa-based researchers seek global rather than continental collaboration.

Figure 1.7 Research collaboration among African scientists: 2005–2016



Source: Beaudry et al. (2018)

Conclusion

This chapter began by exploring the various discourses on the role of the university in development on the African continent. African universities have relatively recently come back into focus as productive forces for development. However, the exact role of universities within defined national development frameworks has remained unclear. This lack of clarity permeates through different levels of national higher education systems, from the universities themselves to their governments and the donor funders that support the development of universities in Africa countries. Nevertheless, an attempt at coordinating international donor funders in higher education to introduce some consistency in their funding programmes and a scarcity of empirical evidence on the actual state of universities in Africa, led to the establishment of the Higher Education Research and Advocacy Network in Africa (Herana) in 2007.

Having provided an overview of the context within which the Herana project emerged, the chapter turned its attention to the research undertaken by the project to provide an empirical basis for the link between higher education and development. This second half of the

chapter provided an outline of the analytical framework, the key concepts of the project and of the evolution of the project.

The Herana project was not one that stuck religiously to its original design. There was a narrowing of focus from one phase to the next. In Phase 1 of the project, the project team were interested in exploring national higher education systems, their flagship universities and the relationship between the university, the national system and development. By Phase 3 of the project, the focus was exclusively on the university and the project no longer talked about 'flagship' universities but about 'research' universities. In effect, the Herana project's focus shifted from the university as an agent of development to the development of the university.

The reason for this shift was that by the end of Herana Phase 1, the evidence showed that, with exception of the University of Cape Town, the levels of new knowledge produced by the other seven universities were unlikely to contribute to national development. It was therefore necessary to change tack so that the participating Herana universities could develop an appreciation of the characteristics of a research university and work towards strengthening their knowledge production to realise their aspirations of becoming research universities. From the project's point of view, this focus on the institutions themselves would place universities in a more favourable position to contribute to the development of their countries.

To do so required the identification of the characteristics of a research university in Africa, the development of measurable indicators, and the collection of performance data by each participating university. In the end, the development of indicators for, and measurement of, the research performance of the eight participating universities was the central thread that ran through all three phases of the Herana project but became the singular focus of the project by Phase 3. These characteristics and their associated indicators were to define the standards of an emergent network of African research universities (see Chapter 7) and came to define by the end of the third phase of the project the extent to which the participating universities could be categorised empirically according to their research performance.

Chapter 2

The research performance of eight universities in Africa

The purpose of this chapter is to assess the performance of the Herana universities in terms of a set of indicators which represent some of the characteristics of a research university.

The chapter begins by outlining the key principles employed by Herana in measuring the performance of a university. These principles stress that empirical data related to knowledge production provide the foundation for Herana's performance measurements, that these data must be collated into a set described as the university's 'academic core', and that the data in the academic core must be related to sets of quantitative targets. The principles add further that these targets should be consistent with the visions, missions and strategic plans of the participating universities, and must be accepted by each university.

The second half of the chapter presents (a) the collection of academic core data, (b) summaries of key features of these data elements, (c) the setting of Herana's performance targets, and (d) assessments of the research performance of the eight universities.

Measuring institutional performance: Herana principles

A basic Herana principle has been that measurements of institutional performance must be based on empirical data and must be relative to goals and targets which the institution is expected to achieve. Herana's view has been that further principles flow from this first, basic principle. These additional principles are summed up in the set of propositions which follows:

- *Proposition 1:* It is their knowledge activities which enable universities to make sustainable contributions to social and

economic development. These knowledge activities involve both the production of new knowledge and the transmission of knowledge to students.

- *Proposition 2:* The knowledge activities of a university are defined by its academic core.
- *Proposition 3:* The academic core contains at least the following empirical data elements: (a) student enrolments by qualification type and fields of study, (b) graduate totals by qualification type, (c) academic staff totals, (d) high-level knowledge inputs in the form of doctoral student enrolments by fields of study and academic staff with doctoral degrees, and (e) high-level knowledge outputs in the form of doctoral graduates by fields of study and of research publications also by fields of study.
- *Proposition 4:* Provided that standard data definitions and rules are applied, consistent and comparable cross-national sets of academic core data can be collected for groupings of African universities.
- *Proposition 5:* Performance goals can be extracted from the visions, missions and strategic plans of a grouping of African universities. Cross-national performance targets can be generated when these goals are linked to standardised academic core data.
- *Proposition 6:* Linkages to academic core data can be made through quantitative input and output targets, provided that (a) the academic core data employed are collected within a common conceptual framework, (b) that the goals are those espoused by the universities, and (c) the quantitative targets have been accepted by all the universities involved.

Collecting academic core data

The Herana team collected, from the eight participating universities, the academic core data referred to in Propositions 3 and 4 of the Herana principles over three time periods: Herana Phase 1 covered the eight-year period 2001 to 2008; Herana Phase 2 covered the three-year period 2009 to 2011; and Herana Phase 3 covered the four-year period 2012 to 2015.

The data collection method used in 2008 involved sending high-level summary tables to each university, asking that it complete these tables for the years 2001 to 2006. These tables covered student enrolments, student graduates, academic staffing, and institutional income and expenditure. Guidelines in the form of explanatory notes and definitions of terms were attached to each summary table.

The team had further interactions with the participating universities during 2009 and 2010 to resolve the problems evident in their data tables. During this process, the universities added data for 2007 to the first set of tables. The final set of tables for 2001 to 2007 was, as a result, of a considerably higher quality than the first submissions made by the universities.

To move forward with the achieving of a dataset which would be understood and accepted across all eight Herana universities, the Herana team implemented a new method of data collection for the years 2008 to 2015. In this new method, the data collecting process was divided into three streams: Stream A: academic programmes, student enrolments and graduates; Stream B: academic staff; and Stream C: research publications.

Because a number of the universities participating in Herana did not produce regular annual research reports, the Herana team took responsibility for ensuring that the required research publication data were extracted from an international citation index, the Clarivate Web of Science index; an index to which the Herana team had access via its partnership with the Centre for Research on Evaluation, Science and Technology (CREST) at Stellenbosch University. The Herana team was aware of the bias of such indexes in terms of representation, particularly in the case of research produced in Africa. However, in the absence of another reliable data source, the Herana team and the Herana participants agreed to use the publication data from the Web of Science.¹³

The Herana team prepared detailed data templates and summaries for the first two streams of Herana Phase 2, covering the period 2009 to 2011. These data tables were more substantial than the original summaries used for Herana Phase 1. They drilled down in detail into the academic programmes offered by each university, into their enrolments and graduates, and into their academic staffing structures.

Updated versions of Herana 2 instructions and templates were consolidated and published in *African Universities Performance Indicator Data: A manual on collecting academic programme, student and academic staff data* (Bunting 2014). This manual became the basic tool used in interactions with participating universities. The analyses flowing from Herana Phase 2 were published in the report *An Empirical Overview of Eight Flagship Universities in Africa: 2001–2011* (Bunting et al. 2014), while the analysis from the third and final phase of the project were published in

13 The Herana team did explore the extent to which the Web of Science under-represent publications produced by the Herana group. It worked with the University of Mauritius as test case to identify peer reviewer publications produced by academics at the University of Mauritius from 2012 to 2014 and not indexed in the Web of Science. The results showed that while there were 267 publications indexed in the Web of Science for the three-year period, the university could account for an additional 115 peer reviewed publications not in the index.

An Empirical Overview of Emerging Research Universities: 2001–2015 (Bunting et al. 2017). The latter publication provides further detail on the methods of data collection glossed over in this chapter.

The quality of the data submitted improved steadily over the project period, as issues around interpretations of data concepts and data elements were resolved. Improvements in data quality were particularly noticeable in the case of universities in which there had been stability over a number of years in the participation of data and planning staff.

Trends in academic core data

This section offers examples of changes that occurred in the following five key indicators in the academic core data of the eight Herana universities:

1. student enrolment totals (for the period 2001 to 2015);
2. graduate totals (for the period 2001 to 2015);
3. academic staff totals (for the period 2001 to 2015);
4. high-level knowledge inputs (for the period 2010 to 2015); and
5. high-level knowledge outputs (for the period 2010 to 2015).

Student enrolments

Table 2.1 summarises the head-count enrolment totals submitted by the eight Herana universities. The table shows that there were, in 2015, four large universities with more than 35 000 students (Nairobi, Ghana, Makerere and Eduardo Mondlane), two medium size universities with enrolments between 20 000 and 29 000 (Cape Town and Dar es Salaam), and two small universities with enrolment totals below 20 000 (Botswana and Mauritius). The average annual growth rates were mixed, ranging from a low 1.5% for Botswana to high growth rates of 9.4% for Ghana, 11.9% for Nairobi, and 12.2% for Eduardo Mondlane.

The shape of a university, in terms of (a) the fields of study and (b) the qualification types for which students are enrolled, is a major element in the academic cores of the Herana universities. In Herana Phases 1 and 2 (the period up to 2011), academic core data were collected under three broad fields of study groupings:

1. *Science and technology*: a grouping which includes life and physical sciences, medical sciences, engineering, computing and information sciences, and agricultural sciences.

2. *Business, economics and management*: a grouping which includes management studies, economics, finance, financial accounting and auditing.
3. *Education, humanities and social sciences*: a grouping which includes education policy and teacher training at all levels, fine and applied arts, literature and languages, and all other standard social science disciplines.

Table 2.1 Size and growth of Herana universities 2001–2015

University	Institutional size	Head count enrolment totals		Average annual increases
		2001	2015	2001- 2015
Botswana	Small	11 736	14 400	1.5%
Mauritius	Small	5 292	11 700	5.8%
Cape Town	Medium	16 800	28 000	3.7%
Dar es Salaam	Medium	8 385	23 925	7.8%
Eduardo Mondlane	Large	7 705	38 400	12.2%
Ghana	Large	11 400	40 100	9.4%
Makerere	Large	21 705	38 700	4.2%
Nairobi*	Large	15 983	68 900	11.9%

Note: Nairobi = 2001 and 2014 (latest available data)

Table 2.2 and summarises the shape of the enrolments of the eight Herana universities using the above three groupings of fields of study.

Table 2.2 Percentage of total student enrolments by fields of study: 2015 compared to 2001

University	Science & technology		Business, economics & management		Education, humanities & social sciences	
	2001	2015	2001	2015	2001	2015
Botswana	22%	27%	27%	20%	51%	53%
Cape Town	42%	42%	27%	26%	31%	32%
Dar es Salaam	53%	21%	11%	8%	36%	72%
Eduardo Mondlane	61%	44%	11%	19%	28%	37%
Ghana	22%	28%	16%	20%	62%	63%
Makerere	17%	33%	15%	21%	68%	46%
Mauritius	50%	40%	24%	33%	26%	26%
Nairobi*	38%	29%	17%	37%	45%	34%

Note: Nairobi = 2001 and 2014 (latest available data)

Specific changes in the shape of three of the universities are worth noting. Dar es Salaam's proportion of enrolments in science and technology declined sharply from 53% in 2001 to 21% in 2015, after its average annual growth rate in this field between 2001 and 2015 had been only 1% (primarily the result of its medical school becoming an independent institution). Its average annual growth rate in education, humanities and social sciences was 13%, which raised its proportion of

enrolments in this field of study grouping from 36% in 2001 to 72% in 2015.

Eduardo Mondlane's proportion of enrolments in science and technology also declined sharply; from 61% in 2001 to 44% in 2015. Its average annual growth rate between 2001 and 2015 in science and technology was nevertheless a high rate of 9.6%. Eduardo Mondlane's average annual growth rate in education, humanities and social sciences was 4.5%, which raised its proportion of enrolments in the broad fields of study grouping from 28% in 2001 to 37% in 2015.

Makerere was the only university whose proportion of enrolments in science and technology increased in 2015 compared to 2001. Its proportion rose from 17% in 2001 to 33% in 2015, with its major decline in enrolment proportions being in education, humanities and social sciences, which dropped from 68% in 2001 to 46% in 2015. Makerere's average annual growth rates between 2001 and 2015 were 9.1% for science and technology and only 1.4% for education, humanities and social sciences.

A further aspect of the academic core of the Herana universities concerns their enrolment shape by qualification type. Table 2.3 lists their head count enrolments within four broad qualification type categories.

Table 2.3 Headcount enrolments by qualification type: 2001 & 2015

University	Undergraduate enrolments		Postgraduate below masters level		Masters enrolments		Doctoral enrolments		Total enrolments	
	2001	2015	2001	2015	2001	2015	2001	2015	2001	2015
Botswana	10 896	12 672	339	57	493	1 587	8	84	11 736	14 400
Cape Town	11 383	18 267	1 991	3 246	2 728	4 741	698	1 746	16 800	28 000
Dar es Salaam	6 624	22 011	91	98	1 654	1 617	16	199	8 385	23 925
Eduardo Mondlane	7 705	34 940	0	0	0	3 376	0	84	7 705	38 400
Ghana	10 135	34 419	0	0	1 198	5 010	67	671	11 400	40 100
Makerere	20 368	35 955	255	71	1 059	1 994	23	680	21 705	38 700
Mauritius	4 828	10 578	0	2	350	1 048	114	72	5 292	11 700
Nairobi*	13 955	55 797	240	200	1 746	11 800	42	1 103	15 983	68 900

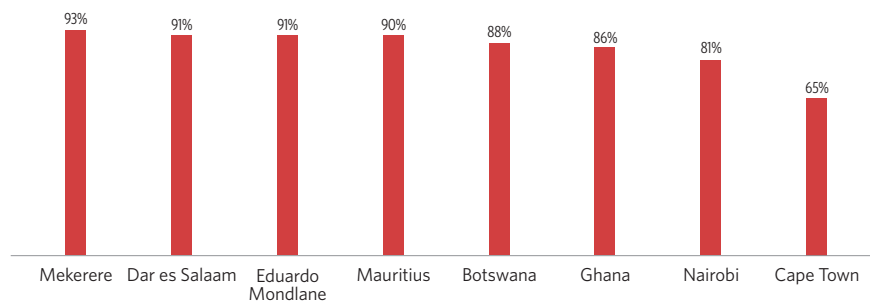
Note: Nairobi = 2001 and 2014 (latest available data)

Table 2.3 shows that average annual growth rates by qualification type have been mixed. Examples of differences in average annual growth rate are: Botswana 1.1% growth rate in undergraduates and 8.7% in masters enrolments; Ghana 9.1% growth rate in undergraduates and 10.8% in masters enrolments; Mauritius 5.8% growth rate in undergraduates and 8.1% in masters enrolments. Masters enrolment totals reflect high numerical growth totals. The highest growth totals in masters enrolments in 2015 compared to 2001 were Ghana (+3 812), Eduardo Mondlane

(+3 376), Cape Town (+2 013). Higher still was Nairobi (+10 054) even though the latest data available is for the 14-year period (2001–2014). Doctoral enrolments totals also reflect high numerical growths. The highest growth totals in doctoral enrolments in 2015 compared to 2001 were Cape Town (+1 048), Ghana (+604), Makerere (+657) and Dar es Salaam (+183). Again, Nairobi had the biggest increase in doctoral enrolments (+1061) despite the period being one year shorter than the 15-year period for the other seven universities.

Figure 2.1 shows that seven universities are primarily undergraduate institutions in terms of their qualification shape. Four of these had undergraduate student proportions of 90% or more (Makerere, Dar es Salaam, Eduardo Mondlane and Mauritius), and three (Botswana, Ghana and Nairobi) had undergraduate enrolment proportions between 80% and 90%. Cape Town had in 2015 an undergraduate enrolment proportion of 65% because of its relatively high proportions of masters, doctoral and other postgraduate enrolments.

Figure 2.1 Proportions of undergraduate enrolments: 2015



Note: Nairobi = 2014 (latest available data)

Graduates

Table 2.4 compares the 2015 and 2001 totals of graduates produced by the eight Herana universities. In the table the totals of graduates produced (a) by undergraduate programmes and (b) by postgraduate programmes below masters level have been combined. This has been done because of the low numbers of enrolments and graduates in postgraduate programmes below masters level, which consist of qualifications such as postgraduate diplomas and postgraduate bachelors degrees.

Table 2.4 shows that Botswana was the only university which did not report a substantial increase in graduates in undergraduate programmes. Its increase in 2015 compared to 2010 was only 176 (or 16%). Makerere had the largest increase in graduates in undergraduate programmes. Eduardo Mondlane had, in terms of numerical change, a substantial

increase in graduates in its undergraduate programmes, which moved from 445 in 2001 to 2 169 in 2015. Highest of all for increases in undergraduate graduates, was Nairobi (7 503) even though the latest data available is for the 14-year period (2001–2014)

Ghana (+1 294) had the largest numerical increases in masters degree graduates in 2015 compared to 2001; followed by Makerere (+634) and Dar es Salaam (+613). Nairobi had by far the biggest increase in masters graduates (+2 478) despite the period being one year shorter than the other seven universities.

For doctoral graduates, Cape Town (+119), Dar es Salaam (+50) and Makerere (+54) had the largest numerical increases in 2015 compared to 2001. Nairobi's increase of 74 doctoral graduates for the period 2001 to 2014 was second-highest despite the shorter reporting period.

Table 2.4 Graduate totals by qualification type: 2001 & 2015

University	Graduates to masters level		Masters graduates		Doctoral graduates		Total graduates	
	2001	2015	2001	2015	2001	2015	2001	2015
Botswana	3 076	3 252	124	241	3	15	3 203	3 512
Cape Town	3 064	5 817	555	1 202	104	223	3 723	7 242
Dar es Salaam	1 740	6 640	204	817	11	61	1 956	7 518
Eduardo Mondlane	445	2 169	0	92	0	19	445	2 280
Ghana	2 332	6 062	207	1 501	2	25**	2 541	7 588
Makerere	3 368	8 983	337	971	10	64	3 715	10 018
Mauritius	1 241	3 374	69	351	17	21	1 327	3 746
Nairobi*	2 796	10 299	303	2 781	26	100	3 125	13 180

* Note: Nairobi = 2001 and 2014 (latest available data)

** This figure has consistently been contested within the university.

Academic staff

An academic staff member is defined as an employee of the university who spends at least 50% of her/his official time on duty on research activities and/or instruction activities such as lecturing, conducting tutorials or practical sessions, marking assignments or examinations, and preparing new curricula. The permanent staff category can be defined in two ways: a staff member can be classified as permanent if he or she contributes to an approved retirement fund of the university, or if he or she holds a full-time contract of more than three years.

Herana differentiates between permanent academics and full-time equivalent (FTE) academics. An FTE academic is defined as an employee who works at the university on a full-time basis for the 12 months of the

reporting year. The FTE value of an academic will be less than 1.0 if he or she is either employed on a part-time contract or is on the payroll for less than 12 months. The FTE academic staff totals of a university should normally be higher than its permanent staff totals, because of the inclusion in these totals of temporary staff such as part-time lecturers, part-time tutors and part-time laboratory assistants. The emphasis in academic core discussions is placed on the totals and properties of permanent academic staff members:

The data in Table 2.5 show that the academic staff total of each university increased in 2015 compared to 2001.

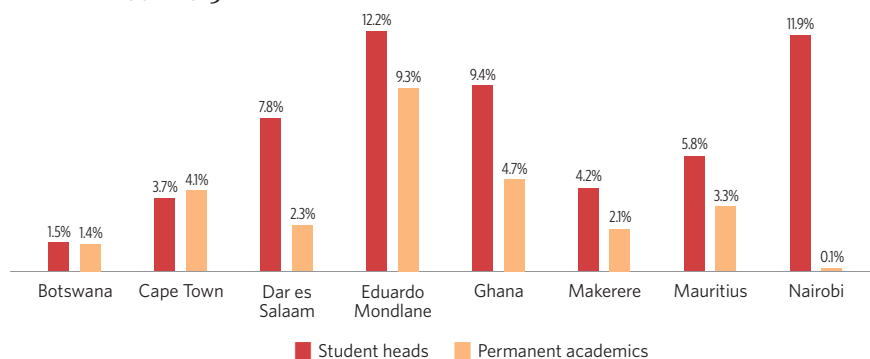
Table 2.5 Permanent academic staff member totals: 2001 & 2015

University	2001	2015	Change 2015 compared to 2001	
Botswana	674	818	149	21%
Cape Town	673	1 179	506	75%
Dar es Salaam	848	1 173	325	38%
Eduardo Mondlane	514	1 790	1 276	248%
Ghana	664	1 270	606	91%
Makerere	1056	1 417	31	34%
Mauritius	194	307	113	58%
Nairobi*	1 217	1 232	16	1%

* Note: Nairobi = 2001 and 2014 (latest available data)

Figure 2.2 compares average annual growth rates in total academic staff and total head count student enrolments. The graph shows that, in all eight universities, student enrolment growth was higher than growth rates in academic staff members employed.

Figure 2.2 Average annual increases in head count enrolments & permanent academics: 2001–2015



Note: Nairobi = 2001 and 2014 (latest available data)

In a headcount enrolled total, a student is counted as a unit no matter what proportion of a standard curriculum he or she is following. In an FTE-enrolled total, a student counts as a unit only if he or she is enrolled for all of the courses set by a standard full-time curriculum for a given academic year. So, a part-time student following 25% of a standard curriculum would equal 0.25 FTE students, one following 60% of a standard curriculum would equal 0.6 FTE students, and so on. Table 2.6 summarises, by broad field of studies, ratios of FTE students to FTE academics for 2001 and 2015.

Table 2.6 Ratios of FTE students to FTE academics by major fields of study: 2015 compared to 2001

University	Science & technology		Business, economics & management		Education, humanities & social sciences		Average for institution	
	2001	2015	2001	2015	2001	2015	2001	2015
Botswana	9	11	50	34	15	20	15	18
Cape Town	9	10	18	23	11	11	11	12
Dar es Salaam	9	10	27	21	14	28	11	19
Eduardo Mondlane	10	17	56	34	8	25	10	22
Ghana	6	12	33	126	16	44	13	29
Makerere	6	16	106	123	34	37	20	33
Mauritius	25	24	20	28	26	30	24	22
Nairobi*	6	15	19	150	16	48	9	34

* Note: Nairobi = 2001 and 2014 (latest available data)

Table 2.6 shows that academic programmes in science and technology are clearly better resourced in terms of the availability of academic staffing resources than the other two groupings of fields of study. Mauritius was the only university which in both 2001 and 2015 had ratios above 20 of FTE students to FTE academic staff in the science and technology fields of study grouping. The data also show that the ratios in the business, economics and management fields of study varied widely between the eight universities. For example, in 2015, these ratios ranged from 21:1 and 23:1 for Dar es Salaam and Cape Town to 123:1 for Makerere, 126:1 for Ghana and 150:1 for Nairobi.

A point to note about the ratios in education, humanities and social sciences is that, apart from Cape Town, they all became less favourable in 2015 compared to 2001. The largest changes occurred in Nairobi (up from 16:1 to 48:1), Ghana (up from 16:1 to 44:1), Dar es Salaam (up from 14:1 to 28:1), and Eduardo Mondlane (up from 8:1 to 25:1).

In the case of business, economics and management there was a mix of movements in ratios. Two universities experienced a substantial worsening in their ratios in this grouping: Nairobi from 19:1 in 2001 to 150:1 in 2015, and Ghana from 33:1 in 2001 to 126:1 in 2015.

These large variations between different fields of study means that talking about a student–staff ratio for a university as a whole in Africa is meaningless.

Introduction to discussion of academic core indicators 4 and 5

The focus in the discussions of indicators 4 and 5 of the academic core is on high–level knowledge production. These analyses follow the Organisation for Economic Co–operation and Development (OECD) view (a) that the high–level knowledge inputs of universities are doctoral enrolments and academic staff, and (b) that high–level knowledge outputs are doctoral graduates and published research articles.

These high–level inputs and outputs which follow are more detailed than those of elements 1 to 3, because they have used Herana data which only became available after 2009. The time periods in the graphs and tables of academic core elements 4 and 5 cover only the period 2010 to 2015, but include (a) additional data on the formal qualifications and ranks held by permanent academic staff members and on the fields of study in which they are active, and (b) further data on the fields of study of doctoral enrolments, doctoral graduates and research articles.

The fields of study groupings, which are used in the more detailed discussions, move the category of health and clinical sciences out of the broad science and technology used in the tables and graphs used for elements 1 to 3. The revised fields of study groupings to be used are these:

- *Science and technology*: a grouping which includes life and physical sciences, engineering, mathematical sciences, computing and information sciences, agricultural sciences, architecture and building sciences.
- *Health and clinical sciences*: a grouping which includes medicine, surgery, dentistry, pharmacy and veterinary sciences.
- *Business, economics and management*: a grouping which includes economics, finance, financial accounting and auditing, general management; and specific management fields such as office management, tourism management and sports management.
- *Education, humanities and social sciences*: a grouping which includes training of primary and secondary school teachers, education curriculum and policy studies, language studies, literature, communication, visual and performing arts, law, psychology, history, political studies, philosophy and sociology.

Permanent academic staff as high-level inputs

All eight Herana universities have used a standard hierarchy of rank categories when reporting on their permanent academic staff resources: (full) professor, associate professor, senior lecturer, lecturer, and junior lecturer. They have also used the following categories when reporting on the highest formal academic qualifications held by their permanent academic staff members: doctoral degree, masters degree, or qualification below masters level.

In the tables and analyses which follow, in order to simplify the presentation of data, only two categories of ranks of permanent academic staff are used (a) senior academic = professor or associate professor or senior lecturer, (b) junior academic = lecturer and below. A further step in the simplification of the data has been the using of only two categories in the analyses of the highest formal qualifications of permanent academic staff members. They are (a) doctoral degree and (b) masters degree and below.

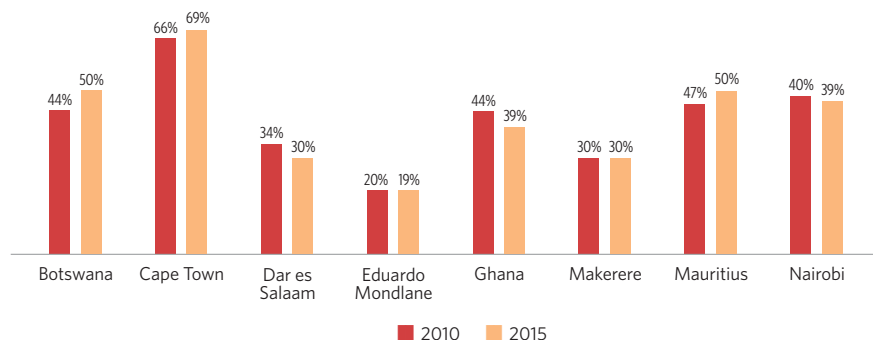
The first of the new data are contained in Figures 2.3 and 2.4, which summarises for 2010, 2013 and 2015 academic staff proportions by rank and by highest formal qualification.

Figure 2.3 shows that Cape Town is the only university which had, over the period 2010 to 2015, a large majority of its permanent academic staff in the senior ranks of professor + associate professor + senior lecturer. Its total of senior permanent academics rose from 649 in 2010 to 815 in 2015; an increase of 166 or 26%. A high proportion of senior academics is clearly an advantage to any university which wishes to be active in research, because this is the group from which research leaders and mentors should be selected.

Eduardo Mondlane had at 20% and 19% the lowest proportions of senior academics in both 2010 and 2015. Its total of senior academics in the senior ranks of professor + associate professor + senior lecturer did increase by 96 (or 38%) in 2015 compared to 2010, but this was off-set by its substantial numerical increase of 407 (or 39%) in permanent junior staff at lecturer level and below.

The proportions of senior academics employed by Dar es Salaam and by Ghana fell by 5 and 4 percentage points in 2015 compared to 2010. Ghana's proportion of permanent senior academics dropped from 44% in 2010 to 39% in 2015, probably because of an imbalance in its recruitment of new academic staff. Its total of permanent senior academics rose by only 16 (or 3%), and its total of junior academics by 254 (or 48%). In the case of Dar es Salaam, its total of permanent senior academics fell by 31, while its total of permanent academics at junior level rose by 82 in 2015 compared to 2010.

Figure 2.3 Proportion of professors + associate professors + senior lecturers to total academic staff: 2010 & 2015

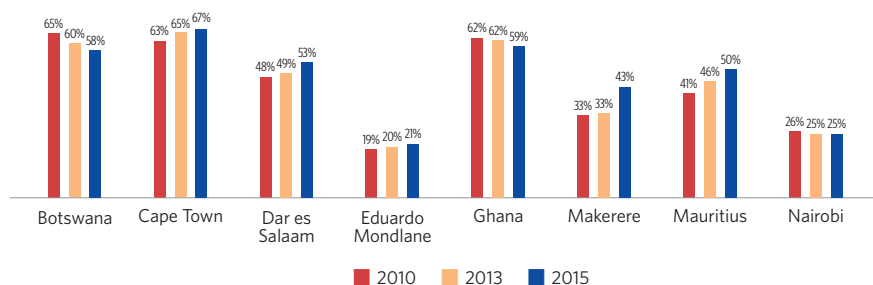


Note: Nairobi = 2010 and 2014 (latest available data)

Figure 2.4 shows the effects of the increased employment of junior compared to senior academics in the data for Ghana. Ghana reflected a decline in 2015 compared to 2010, in its proportion of academic staff with doctorates and its proportion of senior staff. Its proportion of staff with doctorates fell from 62% in 2010 to 59% in 2015, while its proportion of senior academics fell from 44% to 39% over the same period. Dar es Salaam could also be an anomaly in this context. Its proportion of academic staff with doctoral degrees rose from 48% in 2010 to 53% in 2015, while its proportion of senior academics fell from 34% in 2010 to 30% in 2015. In international terms, where in the majority of universities a PhD is now an entry requirement, the fact that the average is still around 50% certainly contributes to the low reproduction of doctorates and the low research outputs.

Table 2.7 and Figure 2.5 deal with a final aspect of academic staff as high-level knowledge inputs. This concerns the fields of study in which academics with doctoral qualifications are active. These academics with doctorates are important input elements because they, even more so

Figure 2.4 Proportions of permanent academics with doctoral degrees: 2010, 2013, 2015



Note: Nairobi = 2010, 2013 and 2014 (latest available data)

than senior academics, should be involved in the research activities of a university. They should be the supervisors of doctoral students, and the producers of doctoral graduates and research articles. In the remaining subsections dealing with high-level knowledge production, the data in Table 2.7 will be used as a base for further analyses.

Table 2.7 Permanent academics with doctorates by fields of study: 2010 & 2015

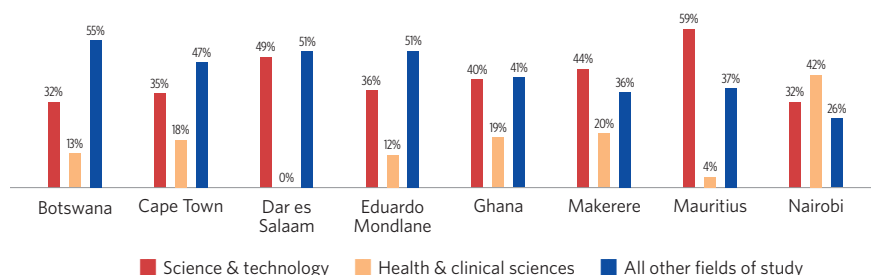
	Science, engineering & technology		Health & clinical sciences		Business, economics & management		Education, humanities & social sciences		Total with doctorates	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Botswana	167	151	45	60	24	39	250	224	486	474
Cape Town	272	276	109	139	39	71	181	300	601	786
Dar es Salaam	282	299	0	0	32	54	221	268	535	621
Eduardo Mondlane	100	138	30	46	20	28	95	168	245	380
Ghana	269	303	128	141	30	41	241	269	668	754
Makerere	160	272	64	123	28	18	142	202	394	615
Mauritius	88	91	8	6	9	26	19	31	124	154
Nairobi*	101	96	133	126	12	13	68	67	314	302

* Note: Nairobi = 2010 and 2014 (latest available data)

Figure 2.5 offers a picture, for 2015 only, of the distribution of academics with doctorates across fields of study.

The average proportion of academics with doctorates allocated to the health and clinical sciences grouping was 16% in 2015. The outliers in this grouping were Dar es Salaam which had no academics with doctorates (partially influenced by the medical university becoming independent) and Nairobi which had a high proportion of 42%. The Herana average proportion of academics with doctorates allocated to the science and technology grouping was 40% in 2015. The only outliers were Mauritius which had 59% of its academics with doctorates in this grouping, and Dar es Salaam which had a proportion of 49%. What is somewhat

Figure 2.5 Distribution of permanent academics with doctorates: 2015 only



Note: Nairobi = 2014 (latest available data)

surprising is that the 'All other fields of study' have, with the exception of Mauritius and Ghana, a higher proportion of staff with doctorates. The relatively low proportion of doctorates in the clinical and health sciences (except Nairobi) could be attributed to the classification system of 'doctorates' and 'PhDs'.

Doctoral enrolments as high-level inputs

Doctoral enrolments are the second main input of the high-level knowledge production of universities. Table 2.8, which summarises these doctoral enrolments by fields of study groupings for the years 2010, 2013 and 2015, provides the base data for analyses of supervisory capacity which follow.

Table 2.8 Doctoral enrolments by fields of study: 2010, 2013 & 2015

	Science, engineering & technology			Health & clinical sciences			Business, economics & management			Education, humanities & social sciences			TOTAL		
	2010	2013	2015	2010	2013	2015	2010	2013	2015	2010	2013	2015	2010	2013	2015
Botswana	35	42	48	0	2	1	0	1	0	24	24	35	59	69	84
Cape Town	611	731	855	113	210	272	96	132	168	291	355	451	1110	1428	1746
Dar es Salaam	56	11	44	0	0	0	0	3	12	51	29	198	107	43	254
Eduardo Mondlane	0	0	41	0	0	4	0	0	4	17	38	35	17	38	84
Ghana	128	150	232	28	78	162	5	16	54	80	128	223	241	372	671
Makerere	227	253	317	66	105	131	0	29	16	178	167	216	471	554	680
Mauritius	38	22	55	0	0	0	0	0	11	7	17	49	29	72	
Nairobi*	142	182	213	13	60	62	36	471	664	26	146	164	217	859	1103

* Note: Nairobi = 2014 (latest available data)

Table 2.9 relates, for the years 2010 and 2015, the doctoral enrolment totals in Table 2.8 to the totals in Table 2.7 of permanent academics with doctorates. It does this by calculating for the four fields of study groupings, ratios of doctoral enrolments in that grouping to permanent academic staff with doctorates in the same grouping.

The final row in Table 2.9 sets out Herana's target ratios for doctoral enrolments. These target ratios, as agreed to by the participating Herana universities, are used at this point because they do not appear in any direct way in later measurements of the institutional performance. These ratios indicate the following about the high-level knowledge inputs of the eight Herana universities:

- In the science and technology grouping, a university should have at least 2.5 doctoral enrolments per permanent academic staff with a doctorate.

- In the health and clinical sciences grouping, a university should have at least two doctoral enrolments per permanent academic staff with a doctorate.
- In the (a) business, economics and management grouping, and (b) education, humanities and social sciences grouping, a university should have at least one doctoral enrolment per permanent academic staff with a doctorate.

Table 2.9 Ratios by fields of study of doctoral enrolments to academics with doctorates: 2010 & 2015

	Science, engineering & technology		Health & clinical sciences		Business, economics & management		Education, humanities & social sciences	
	2010	2015	2010	2015	2010	2015	2010	2015
Botswana	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.2
Cape Town	2.2	3.1	1.0	2.0	2.5	2.4	1.6	1.5
Dar es Salaam	0.2	0.1	-	-	0.0	0.2	0.2	0.7
Eduardo Mondlane	0.0	0.3	0.0	0.1	0.0	0.1	0.2	0.2
Ghana	0.5	0.8	0.2	1.1	0.2	1.3	0.3	0.8
Makerere	1.4	1.2	1.0	1.1	0.0	0.9	1.3	1.1
Mauritius	0.4	0.6	0.0	0.0	0.0	0.0	0.6	0.5
Nairobi*	1.4	2.2	0.1	0.5	3.0	51.1	0.4	2.4
Herana target ratios	2.5		2.0		1.5		1.5	

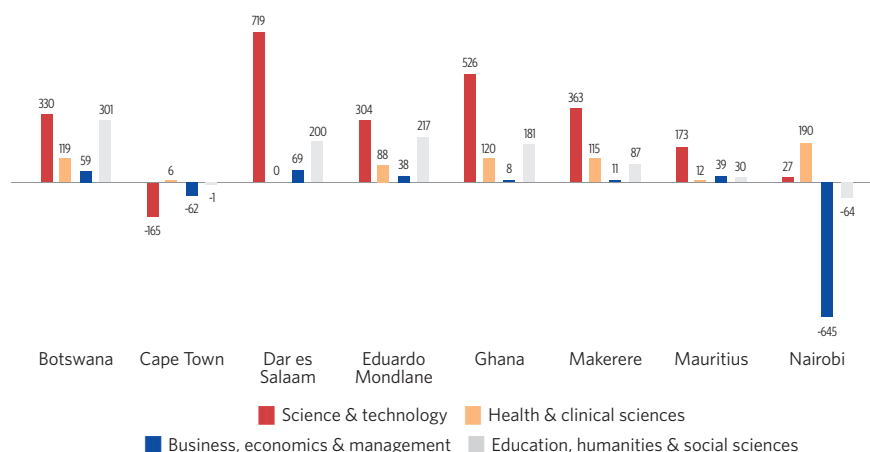
* Note: Nairobi = 2010 and 2014 (latest available data)

The detailed ratios in Table 2.9 can serve in the following way as indicators of supervisory capacity: If a university's ratio in any field of study grouping is below the numerical Herana target, then it will obviously have spare supervisory capacity. If a ratio is above the Herana target, then it may be making efficient use of its available academic staffing resources. The possibility of over-enrolment rather than of efficient use of academic staffing resources could however arise if a ratio is too far above the Herana target. An obvious example can be seen in Nairobi's ratio for 2015 in business, economics and management. This ratio indicates that Nairobi in 2015 had enrolled 51 doctoral students for each academic in this field holding a doctoral degree.

The highlighting of ratios in Table 2.9 shows that in 2015 Cape Town met or exceeded all four of the target ratios, that Nairobi met or exceeded the target ratios for two of the targets, and that the six other universities met none of the targets of doctoral enrolments to academic staff with doctorates.

The data employed in the calculations in Table 2.9 can be used to estimate the numbers of additional doctoral students which could have been enrolled in 2015 if the Herana supervision targets had been met. These new data are set out in Figure 2.6. It should be noted that a number above 0 indicates that the university has, on this measure, spare supervisory capacity in the sense that its academics with doctorates could have supervised more doctoral students in the field concerned than were actually enrolled in 2015. A negative number is an indication that the institution was ‘above capacity’ in its enrolment of doctoral students in that field of studies in 2015.

Figure 2.6 Additional doctoral students possible on Herana supervision targets: 2015



Note: Nairobi = 2010 and 2014 (latest available data)

Doctoral graduates as high-level knowledge outputs

Doctoral graduates are the first of the two high-level research outputs included in the academic core of a Herana university. The second component consists of research publications.

Table 2.10 offers a breakdown by broad fields of study of the doctoral graduate outputs of the eight universities, using 2010 and 2015 as marker dates. Table 2.11 sets out the total numbers of doctoral graduates produced by the universities over the full six-year period 2010 to 2015. These doctoral graduate totals are headcounts in which each graduate counts as a unit in the year in which he/she graduates.

Table 2.10 shows that all universities increased their doctoral graduates. However, Ghana and Makerere show decreases in the number of doctoral graduates in science and technology, and Mauritius a negligible increase in the same field of study when comparing 2015 and

2010. Cape Town shows a decrease in health and clinical science graduates while Makerere shows a decrease in education, humanities and social sciences doctoral graduates. Many universities show two- or three-fold increases in the total number of doctoral graduates but all of these are from a low base compared with the number of doctoral students graduated by Cape Town.

Table 2.10 Doctoral graduates by fields of study: 2010 & 2015

	Science, engineering & technology		Health & clinical sciences		Business, economics & management		Education, humanities & social sciences		Total doctoral graduates	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Botswana	2	10	0	1	0	0	4	4	6	15
Cape Town	89	115	36	29	5	23	48	56	178	223
Dar es Salaam	10	23	0	0	2	3	11	35	23	61
Eduardo Mondlane	0	10	0	1	0	1	0	7	0	19
Ghana	8	5	0	10	2	2	7	8	17	25
Makerere	25	23	12	27	0	2	18	12	55	64
Mauritius	12	13	0	0	0	0	1	8	13	21
Nairobi*	27	58	0	1	5	28	11	13	43	100

* Note: Nairobi = 2010 and 2014 (latest available data)

Table 2.11 shows that the highest producer of doctoral graduates was Cape Town at an annual average of 188 doctoral graduates. This was followed by Nairobi with an annual average of 61 over the five-year period 2010 to 2014, Makerere with an average annual total of 56, Dar es Salaam 41 and Ghana 37. The other three universities had far lower average annual totals of doctoral graduates over the six-year period: Mauritius (13), Botswana (10) and Eduardo Mondlane (5).

Table 2.11 Total doctoral graduates produced: 2010-2015

	Science, engineering & technology	Health & clinical sciences	Business, economics & management	Education, humanities & social sciences	Total	Annual average
Botswana	34	1	0	26	61	10
Cape Town	603	178	84	262	1127	188
Dar es Salaam	91	0	19	138	246	41
Eduardo Mondlane	10	1	1	15	27	5
Ghana	117	10	9	83	219	37
Makerere	131	73	18	115	337	56
Mauritius	60	0	0	20	80	13
Nairobi*	198	3	98	61	332	61

* Note: Nairobi = 2010-2014 (latest available data)

Research publications as high-level knowledge outputs

This section offers a brief account of the research publications of the eight Herana universities. It should be noted that the units reported by Herana are whole and not fractional counts. In a whole count, each publication is assigned as a full unit to every institution listed in the author–affiliate address information. In a fractional count, a single publication unit is divided as fractions between the authors, with the total of fractions not being permitted to exceed 1.0.

Table 2.12 summarises, by broad fields of study, the research publication totals of the eight universities in 2010 and 2015. Table 2.13 sets out the total numbers of research publications produced over the full six-year period 2010 to 2015.

Table 2.12 Research publication units by fields of study: 2010 & 2015

	Science, engineering & technology		Health & clinical sciences		Business, economics & management		Education, humanities & social sciences		Total	
	2010	2015	2010	2015	2010	2015	2010	2015	2010	2015
Botswana	50	151	37	20	9	4	46	18	141	192
Cape Town	778	1311	696	765	47	109	208	396	1728	2582
Dar es Salaam	78	80	10	17	1	7	10	23	98	127
Eduardo Mondlane	23	26	29	45	2	2	1	8	55	80
Ghana	94	198	80	39	8	11	18	64	199	312
Makerere	130	147	254	408	7	20	38	38	429	613
Mauritius	34	32	4	33	6	2	4	7	48	74
Nairobi*	80	107	116	195	9	5	15	12	219	319

* Note: Nairobi = 2010 and 2014 (latest available data)

Table 2.13 Total research publications produced: 2010–2015

	Science, engineering & technology	Health & clinical sciences	Business, economics & management	Education, humanities & social sciences	Total	Annual average
Botswana	475	206	42	179	901	150
Cape Town	5 725	4 425	415	1 629	12 193	2 032
Dar es Salaam	421	79	27	83	610	102
Eduardo Mondlane	126	187	15	28	355	59
Ghana	623	473	49	162	1 307	218
Makerere	763	1 805	65	235	2 867	478
Mauritius	257	51	21	38	367	61
Nairobi*	560	854	31	78	1 524	254

* Note: Nairobi = 2010–2014 (latest available data)

The data in Tables 2.12 and 2.13 show that the overall total of research publications produced by the eight universities increased by 1 382 (or

47%) in 2015 compared to 2010. Cape Town had the largest increase, in 2015 compared to 2010, of 854 (or 49%), followed by Makerere 184 (43%), Ghana 113 (57%), and Nairobi 100 (46%). Cape Town dominated the output of research publications, producing 12 193 (or 61%) of the six-year Herana total of 20 125 research publications. The next highest six-year totals and shares were Makerere 2 867 (14%), Nairobi 1 524 (8%) and Ghana 1 307 (6%). Research publications in science and technology and in the health and clinical sciences dominated the six-year Herana totals summarised in Table 2.13. These two groupings had 44% and 40% of the six-year Herana total of 20 125 research publications. The next highest share was 12% for education, humanities and social sciences, and 4% for the business, economics and management grouping.

Determining cross-national performance goals and targets

Proposition 5 of the Herana methodological principles is central to the determining of the cross-national targets used in assessment of the research performance of the eight universities. The proposition, which appears in the second subparagraph of this chapter, states that:

Performance goals can be extracted from the visions, missions and strategic plans of a grouping of African universities. Cross-national performance targets can be generated when these goals are linked to standardised academic core data.

The starting point for Herana's implementation of Proposition 5 involved web-based searches for documents dealing at national level with the higher education systems of the eight Herana countries, which are: Botswana, Ghana, Kenya, Mauritius, Mozambique, South Africa, Tanzania and Uganda. The searches tried to locate the following national documents:

- a national higher education act approved by the parliament of the country;
- formal higher education white papers published in an official government gazette;
- a national statement, which need not be free standing, of government's views of the purposes and goals of the national higher education system;
- a national strategic plan for higher education which should flow from the national policy on the purposes and goals for higher education, and which should indicate what objectives

the national higher education system is expected to meet over a period of time.

The implementation of Proposition 5 then moved to an institutional level. This involved making web-based searches being made for the following documents:

- each Herana university's institutional statement of its purposes and goals;
- the strategic plan, linked to the university's statement of its purposes and goals, which should indicate what specific objectives the university has set for itself; and
- an institutional self-assessment which indicates what the university considers its successes or failures in the implementation of the objectives of its strategic plan.

Table 2.14 summarises the results of the web-searches used to implement Proposition 5. The first column in the tables lists the eight Herana universities in alphabetical order. The third and fourth columns serve the following functions:

- Column 3 summarises the major points concerning the purposes and goals of the national higher education system which emerge from the national documents identified in the various web-based searches.
- Column 4 summarises the major points concerning the goals of each of the university as these emerge from institutional documents extracted from searches of the websites of the eight Herana universities.

The second main column of the table contains background data on each of the countries in which the Herana universities are based. References to these national data will be made when final assessments are made of the research performances of the eight Herana universities. Some initial explanatory points about the national background data in Column 2 which could be noted are these:

- The population total is the latest found in statistics reports produced either by the country itself or by the World Bank.
- Participation rate calculations follow the UNESCO method. The total of higher education enrolments in the country is divided by the total in the population in the age band 20–24 years. For example, if a country has (say) a total higher education student

enrolment of 500 000 and a total of 5 million of its population in the age group 20–24, then its gross participation rate would be $500\,000/5\text{ million} = 10\%$.

- The table uses the World Bank’s classification of a country’s economy, which is based on estimates of gross national income (GNI) per capita. For the purposes of the table which includes World Bank calculations for 2015, a low-income country is one with a GNI per capita of USD 1 025 or less in 2015, a lower middle-income country is one with a GNI per capita of between USD 1 026 and USD 4 035; and an upper middle-income country is one with a GNI per capita between USD 4 036 and USD 12 475.
- The count of institutions includes all those which a country classifies as following the final year of secondary schooling. These are described as either ‘tertiary’ or ‘higher education’ institutions. The term ‘tertiary’ is used only when it has been the specific choice of the country concerned.
- The enrolment total is that for a given year for all the higher or tertiary institutions listed by the country concerned.

The national goals summarised in the fourth columns of Table 2.14 have a number of broad themes in common. These national goals often begin with requirements that the higher education system take steps to improving equity of access to higher education for female students and for groups described as ‘disadvantaged’. The goals also include requirements that higher education institutions be involved in national social and economic development, in finding applications for knowledge, and in producing new knowledge.

The goals listed by the individual Herana universities tend to be consistent with the requirements of the national system, and also contain a number of common elements, apart from those concerned with equity. These common features of the goals of the eight Herana universities can be summed up in these ways:

- *Reputation*: they aim to be regarded as world-class universities, or at least leading universities in Africa;
- *Knowledge production*: they aim to produce high level new knowledge and to promote innovation and applications of existing knowledge;
- *Development*: they aim to respond to national, regional and global social and economic development needs; and
- *Human resources*: they aim to produce the high-level knowledge skills required by their national economies.

Table 2.14 Summary of national background, national goals and goals set by Herana universities

University (Country)	National background	National goals for higher education system	Goals set by Herana university	
University of Botswana (Botswana)	<ul style="list-style-type: none"> Population (2015): 2.2 million HE participation rate (2015): 26% Upper middle income country 	Tertiary institutions (2015): <ul style="list-style-type: none"> 2 public universities 21 other public institutions 15 private institutions Total tertiary enrolment (2015): 57 000	<ul style="list-style-type: none"> Access must increase Universities must provide highly skilled graduates to advance the economic and social development of Botswana The research and knowledge creation capacity of the university sector must be strengthened 	<ul style="list-style-type: none"> To be a leading centre of academic excellence in Africa and the world To advance knowledge through excellence in research and its application To improve economic and social conditions for the nation
University of Cape Town (South Africa)	<ul style="list-style-type: none"> Population (2015): 55 million HE participation rate (2015): 21% Upper middle income country 	Higher education (2015): <ul style="list-style-type: none"> 26 public universities 124 private colleges Total public + private higher enrolment (2015): 1.1 million	<ul style="list-style-type: none"> Universities must be the dominant producers of new knowledge Universities must assess and find new applications for existing knowledge Universities must educate people with high-level skills for the labour market Universities must provide opportunities for social mobility 	<ul style="list-style-type: none"> To be an engaged research-intensive African university To advance more equitable and sustainable social order To influence the global higher education landscape To engage with the key issues of the natural and social worlds To advance the status of African scholarship in Africa
University of Dar es Salaam (Tanzania)	<ul style="list-style-type: none"> Population (2014): 53 million HE participation rate (2014): 5% Low income country 	Higher education (2013): <ul style="list-style-type: none"> 11 public universities 4 public university colleges 18 private universities 11 private colleges Total public + private higher enrolment (2014): 219 000	<ul style="list-style-type: none"> Equitable access by gender and by special needs must be improve Admissions must be coordinated Universities must develop and process knowledge for the benefit of humanity Universities must harness knowledge for the production of usable goods and services 	<ul style="list-style-type: none"> To become a reputable world-class university To be responsive to national, regional and global development To advance frontiers of knowledge through research To meet high-level human resource needs
Eduardo Mondlane University (Mozambique)	<ul style="list-style-type: none"> Population (2014): 27 million HE participation rate (2014): 7% Low income country 	Higher education (2011): <ul style="list-style-type: none"> 10 public universities + university colleges 14 private universities + university colleges Total public + private higher enrolment (2014): 218 000	<ul style="list-style-type: none"> Universities must engage in scientific research Universities must engage in technical/professional training Universities must engage in extension service processes 	<ul style="list-style-type: none"> To become national, regional and international in the production of scientific knowledge To produce scientific knowledge and promote innovation through research in support of teaching and learning and extension

University (Country)	National background		National goals for higher education system	Goals set by Herana university
University of Ghana (Ghana)	<ul style="list-style-type: none"> Population (2015): 28 million HE participation rate (2015): 15% Lower middle income country 	<p>Higher education (2015):</p> <ul style="list-style-type: none"> 9 public universities 8 other public tertiary 69 private tertiary institutions <p>Total public + private higher enrolment (2015): 389 000</p>	<ul style="list-style-type: none"> Access equity for disadvantaged students must be achieved Universities must contribute to national social and economic development 	<ul style="list-style-type: none"> To become a world class research-intensive university To become increasingly relevant to national and global development, through cutting edge research and high quality teaching
Makerere University (Uganda)	<ul style="list-style-type: none"> Population (2015): 35 million HE participation rate (2015): 15% Low income country 	<p>Higher education (2015):</p> <ul style="list-style-type: none"> 9 public universities 6 other public tertiary 36 private universities 4 other private tertiary <p>Total public + private higher enrolment (2015): 258 000</p>	<ul style="list-style-type: none"> Access for women and needy students must be improved Universities must promote research, particularly applied research, and publications Universities must deliver graduates prepared to be innovative and entrepreneurial 	<ul style="list-style-type: none"> To be the leading institution for academic excellence and innovations in Africa To provide innovative teaching, learning, research and services responsive to national and global needs
University of Mauritius (Mauritius)	<ul style="list-style-type: none"> Population (2015): 1.3 million HE participation rate (2015): 38% Upper middle income country 	<p>Higher education (2015):</p> <ul style="list-style-type: none"> 4 public universities 6 other public tertiary 45 private tertiary institutions <p>Total public + private higher enrolment (2015): 49 000</p>	<ul style="list-style-type: none"> Participation rates in tertiary education must increase Mauritius must become a regional centre or hub for tertiary education Universities must increase knowledge production 	<ul style="list-style-type: none"> To promote knowledge creation and dissemination through research and innovative teaching To respond to the developmental needs of the country and the global community
University of Nairobi (Kenya)	<ul style="list-style-type: none"> Population (2015) 44 million HE participation rate (2015): 13% Lower middle income country 	<p>Higher education (2015):</p> <ul style="list-style-type: none"> 31 public universities 6 other public tertiary 18 private universities 5 other private tertiary institutions <p>Total public + private higher enrolment (2015): 486 000</p>	<ul style="list-style-type: none"> Universities must promote gender balance and equality of opportunity Universities must promote equity for those with disabilities, and for other marginalised groups Universities must advance knowledge through teaching, research and scientific investigation Universities must support and contribute to national economic and social development Universities must educate high level professional staff 	<ul style="list-style-type: none"> To be a world-class university committed to scholarly excellence To provide quality university education and training To embody the aspirations of the Kenyan people and the global community through creation, and utilization of knowledge

Setting cross-national quantitative targets

Proposition 6 of the Herana methodological principles provides the final preparatory step for the assessing of the research performance of the eight Herana universities. The proposition states that:

Linkages to academic core data can be made through quantitative input and output targets, provided that (a) the academic core data employed are collected within a common conceptual framework, (b) that the goals are those espoused by the universities, and (c) the quantitative targets have been accepted by all the universities involved.

The commonality of goals enabled the Herana project to set out broad cross-national academic core requirements, which had by 2012 been regarded as acceptable by all the Herana universities. These requirements are summarised in Table 2.15.

Table 2.15 Summary of input and output academic core requirements

	Academic core requirements	Notes to core requirements
Inputs	<ul style="list-style-type: none"> High proportions of student enrolments in (a) science and technology programmes, and (b) in masters and doctoral programmes 	<ul style="list-style-type: none"> In African governments and foreign development agencies, there is a strong emphasis on science and technology as an important driver of development
	<ul style="list-style-type: none"> Upper limit on proportions of undergraduate enrolments 	<ul style="list-style-type: none"> The knowledge economy demands increasing numbers of people with postgraduate qualifications
	<ul style="list-style-type: none"> High proportions of (a) academic staff in senior ranks, and (b) senior and junior academic staff holding doctoral degree 	<ul style="list-style-type: none"> Academics at ranks above senior lecturer and academic staff with doctorates are needed to be research leaders and mentors
	<ul style="list-style-type: none"> Favourable full-time equivalent student to academic staff ratios 	<ul style="list-style-type: none"> The academic workload should allow for the possibility of research and doctorate supervision.
Outputs	<ul style="list-style-type: none"> High ratios of total graduates to total enrolments 	<ul style="list-style-type: none"> Universities must achieve high success rates in all fields to respond to the skills shortages in the African labour market
	<ul style="list-style-type: none"> High ratios of masters graduates to total masters enrolments 	<ul style="list-style-type: none"> Masters graduates provide high level professional staff resources and first steps to doctoral programmes
	<ul style="list-style-type: none"> High ratios of doctoral graduates to academics with doctorates 	<ul style="list-style-type: none"> Doctoral graduates are critical both for the future reproduction of the academic staff, and for the knowledge economy
	<ul style="list-style-type: none"> High ratios of research articles to academics with doctorates 	<ul style="list-style-type: none"> Academics must produce peer-reviewed research outputs if the university is to participate in the global knowledge community

During discussions at Herana meetings held between 2012 and 2015, the requirements listed in Table 2.15 were linked, in accordance with Proposition 6, to quantitative elements contained in the academic core of each university. The new data available in Phase 3 of the project enabled

Herana to redefine some of the research output ratios which had been employed earlier in Phase 2. The revised ratios took account, within broad fields of study, not of *totals* of academic staff, but only of *those holding doctoral degrees*. The new ratios enabled the Herana project to take account of the different doctoral supervision and publication prospects and practices which exist within major groupings of fields of study. The annual targets for research publications became these ratios *per permanent academic with a doctorate*: science and technology 2.0; health and clinical sciences 2.0; business, economics and management 1.0; and education, humanities, and social sciences 1.0.

Table 2.16 sets out the final, adjusted goals and targets used in Phase 3 of the Herana project.

Table 2.16 Herana performance goals and quantitative targets

Academic core goals	Quantitative targets
Goal 1: A substantial proportion of student enrolments must be in major fields of study in science & technology	Target 1: 40% of enrolments to be in science & technology, including health & clinical sciences
Goal 2: An upper limit should be placed on undergraduate enrolments	Target 2: Undergraduates to be no more than 75% of total enrolments
Goals 3 & 4: Strong proportions of enrolments must be in masters and doctoral programmes	Targets 3 & 4: Enrolment proportions to be: masters 15%, doctorate 5%
Goal 5: A high proportion of permanent academic staff members must be in senior rank categories	Target 5: At least 60% of permanent academic staff to hold ranks of professor or associate professor or senior lecturer
Goals 6, 7 & 8: Permanent academic staff members must be well qualified	Targets 6, 7 & 8: At least 60% of permanent academic staff in all broad fields of study to hold doctoral degrees
Goals 9, 10 & 11: Student to academic staff ratios in (a) science & technology fields and (b) all other fields of study must be favourable	Targets 9, 10 & 11: Ratios of FTE students to FTE academics in science & technology, including health & clinical sciences, to be at most 15:1; in all other programmes to be at most 25:1
Goals 12: Outputs of total graduates must be high	Target 12: Total graduates in given year to be at least 25% of total enrolments in that year
Goal 13: Outputs of masters graduates must be high	Target 13: Total masters graduates in given year to be at least 25% of masters head count enrolments in that year
Goals 14, 15 & 16: New knowledge production in the form of doctoral graduates must be high	Targets 14, 15 & 16: Ratios of doctoral graduates to permanent academic staff with doctorates in science & technology, including health & clinical sciences to be at least 0.38, and 0.23 in all other fields
Goals 17, 18, 19 & 20: New knowledge production in the form of the publication of research articles must be high	Targets 17, 18, 19 & 20: Ratios of research publications to permanent academic staff with doctorates to be at least 2.0 in science & technology, including health & clinical sciences, and at least 1.0 in all other broad fields

Assessing the research performance of eight African universities

The conclusion to a Herana research assessment performance normally involves comparing three-year averages of academic core data to the quantitative targets contained in Table 2.16. Table 2.17 summarises these institutional averages for the three-year period 2013 to 2015.

Table 2.17 Quantitative targets and institutional averages: 2013–2015

	Numerical target	Botswana	Cape Town	Dar es Salaam	Eduardo Mondlane	Ghana	Makerere	Mauritius	Nairobi*
INPUT TARGETS									
1. High % science, technology & clinical science enrolments	40%	25%	45%	20%	43%	23%	41%	41%	29%
2. Upper limit on % undergraduate enrolments	75%	90%	65%	90%	92%	86%	92%	91%	81%
3. High % masters enrolments	15%	8.9%	16.8%	8.5%	7.9%	12.8%	5.8%	9.1%	17.1%
4. High % doctoral enrolments	5%	0.5%	6.2%	0.9%	0.1%	1.4%	1.6%	0.3%	1.5%
5. High % senior academics (professors + associate professors + senior lecturers)	60%	51%	71%	32%	19%	41%	29%	49%	46%
6. High % of science, technology & clinical science academics with doctorates	60%	62%	69%	49%	16%	63%	41%	53%	28%
7. High % business, economics & management academics with doctorates	60%	35%	44%	42%	8%	77%	27%	37%	15%
8. High % education, humanities & social science academics with doctorates	60%	63%	63%	33%	25%	55%	42%	42%	19%
9. Favourable student to academics ratios in science, technology & clinical science	15	11	10	12	15	8	18	21	15
10. Favourable student to academics ratios in business, economics & management	25	40	24	47	23	91	89	38	156
11. Favourable student to academics ratios in education, humanities & social science	25	23	11	20	28	44	40	21	49
OUTPUT TARGETS									
12. High ratio of total graduates to total enrolments	0.25	0.20	0.27	0.33	0.06	0.20	0.27	0.30	0.19
13. High ratio of masters graduates to total masters enrolments	0.25	0.13	0.27	0.44	0.03	0.34	0.48	0.32	0.24
14. High ratio of science, technology & clinical science doctoral graduates to academics with doctorates	0.38	0.06	0.43	0.12	0.03	0.06	0.14	0.16	0.24
15. High ratio of business, economics & management doctoral graduates to academics with doctorates	0.23	0.00	0.41	0.17	0.03	0.06	0.37	0.00	1.90
16. High ratio of education, humanities & social science doctoral graduates to academics with doctorates	0.23	0.03	0.28	0.23	0.06	0.09	0.13	0.22	0.30
17. High ratio of science, technology & clinical science research articles to academics with doctorates	2	0.65	4.79	0.36	0.32	0.43	1.30	0.67	1.17
18. High ratio of business, economics & management articles to academics with doctorates	1	0.10	1.25	0.10	0.06	0.14	0.18	0.18	0.22
19. High ratio of education, humanities & social science research articles to academics with doctorates	1	0.26	2.67	0.19	0.19	0.27	0.46	0.46	0.80

* Note: Nairobi = 2010–2014. (latest available data)

The analyses which follow are divided into subsections dealing with (1) the level of consistency between national and institutional commitments to research activities, (2) empirical evidence of the performance of each university relative to the Herana targets, (3) empirical evidence of changes in research performance over time, and (4) placing the eight Herana universities in research-activity categories.

National and institutional policy and planning contexts

The main elements in the national context should be either a national higher education act approved by the parliament of the country, or formal higher education white papers published in an official government gazette. This should be followed by a national statement of government's views of the purposes and goals of the national higher education system. Linked to this should be a national strategic plan for higher education and related sets of institutional policies and strategic plans. The available sources for these various national and institutional policies and plans are listed in Table 2.18.

Table 2.18 shows that in the case of four universities (Botswana, Eduardo Mondlane, Mauritius and Nairobi) the set of publicly available national and institutional documentation is incomplete. In the case of three of the remaining four (Dar es Salaam, Ghana and Makerere), while the documentation is complete, institutional documents either do not include goals expressly formulated in the national statements or include goals which fall outside the parameters of the national goals.

There are also indications that, in the case of these last three universities, national goals and related institutional goals are not expressed in consistent ways. Cape Town is the only university for which national and institutional documentation is completed in which national and institutional goals are set out in consistent ways.

Table 2.19 selects information from the summaries in Table 2.14 to highlight differences in the emphases placed on research in the national and institutional documents listed in Table 2.19. Other emphases concerned with national and economic development, the production of skilled professionals, and the improvement of equity can be found in the summaries in Table 2.14; but are not relevant for this purpose.

Table 2.18 National and institutional planning and policy documents

Research activity categories	National documents			Institutional documents		Alignment between national and institutional documents
	(A) Statutory framework for HE	(B) National HE purposes & goals	(C) National HE strategic plan	(D) Institution's purposes & goals	(E) Institution's strategic plan	
Botswana	1999 Tertiary Education Act & 2008 White Paper	Included in 2008 White Paper & 2008 Tertiary Education Council pamphlet	Not found	Published on University website	Not found	n/a
Cape Town	1997 HE Act & 1997 & 2013 White Papers	Included in HE Act & White Papers	2001 National HE Plan & 2012 Development Plan	Published on University website	Published on University website	YES
Dar es Salaam	2005 Universities Act establishes Tanzania Commission for Universities (TCU)	Not published by government but included in TCU rolling strategic plans	Not published by government but included in TCU rolling strategic plans	Included in University's strategic plans	Two strategic plans 2009-2013 & 2014-2023	NO
Eduardo Mondlane	References in secondary source on HE in Mozambique	References in secondary source on HE in Mozambique	Not found	References in secondary source on HE in Mozambique	Not found	n/a
Ghana	2008 Education Act 1993 National Council for Education Act	Published on Ministry of Education website	2010-2020 strategic plan of Ministry of Education	Published on University website & in strategic plans	Two strategic plans 2001-2014 & 2014-2024	NO
Makerere	2001 & 2006 Universities & Other Tertiary Education Acts	2001 & 2006 Acts & website of Ministry of Education	2004 & 2008 strategic plans of Ministry of Education	Published on University website & in strategic plans	Two strategic plans 2001-2007 & 2008-2015	NO
Mauritius	1988 Tertiary Education Commission (TEC) Act	1988 TEC Act; reports of TEC	Not found	Published on University website & in strategic plans	Three strategic plans 2001-2007 2008-2010 2015-2012	NO
Nairobi	2012 Universities Act	In 2012 Universities Act	Not found	In strategic plan 2008-2013	Strategic plan 2008-2013	NO

Note: 'Not found' indicates that information could not be found on either national or institutional websites.

Table 2.19 Comparison of emphases on research at national and institutional levels

	Research emphases in national documents	Research emphases in institutional documents
Botswana	Universities must: strengthen their research & knowledge creation capacities	University of Botswana must: be a leading centre for academic excellence in Africa & the world; advance knowledge through excellence in research & its application
Cape Town	Universities must: be the primary producers of new knowledge; find new applications for existing knowledge	University of Cape Town must: be a research-intensive university; be engaged with key issues in natural & social worlds
Dar es Salaam	Universities must: develop & process knowledge for the benefit of humanity	University of Dar es Salaam must: be a reputable world-class university; advance frontiers of knowledge through research
Eduardo Mondlane	Universities must: engage in scientific research	Eduardo Mondlane University must: be national, regional & international in the production of scientific knowledge
Ghana	[No specific reference to research activities]	University of Ghana must: be a world-class research university
Makerere	Universities must: promote research & publications	Makerere University must: be the leading institution for academic excellence & research in Africa
Mauritius	Universities must: increase knowledge production	University of Mauritius must: promote knowledge creation through research
Nairobi	Universities must: advance knowledge	University of Nairobi must: be a world-class university committed to scholarly excellence

The two striking features of the points summarised in Table 2.19 are (1) an emphasis on universities being the main or primary providers of new knowledge occurs only in the national context of Cape Town, while the national contexts of the other seven universities refer at most to universities advancing knowledge or increasing knowledge production; and (2) Cape Town is the only university which places little stress on its institutional reputation, saying only that it must be a research-intensive university. The other Herana universities place a strong emphasis on reputation. Their institutional documents state explicitly that they aim to be regarded as world-class universities, or at least leading universities in Africa.

The overall picture which emerges from Table 2.19 is that:

- Cape Town has a national and institutional context which places a strong emphasis on research as the generation of new knowledge.
- Ghana, Makerere and Nairobi have, through their reputation projections, displayed strong commitments to research as one of their major activities.
- Botswana, Dar es Salaam and Mauritius clearly aim to enhance their research reputations, but do not have strong support for this at national levels.
- Eduardo Mondlane offered no strong commitments to research activities and expressed no views on reputation enhancement.

Empirical evidence of research performance

Table 2.17 summarises the quantitative evidence used to assess the research performance of the eight Herana universities. This empirical evidence consists of averages of institutional data for the three years 2013, 2014 and 2015, linked to the 19 input and output performance targets which had been accepted by the Herana project. The paragraphs which follow indicate to what extent each university's three-year data averages match the quantitative performance targets listed in Table 2.17.

Botswana

Table 2.17 shows that Botswana met four input targets related to its provision of academic staff. In the fields of science and technology and of education, humanities and social sciences, its average proportions of academic staff with doctorates were above the target of 60%. It also had favourable student to academic staff ratios in these same broad fields. Botswana missed however one important input target concerning doctoral enrolments. Its average proportion of students in doctoral programmes was only 0.5% compared to the target of 5%. Apart from its overall ratio of graduates to enrolments which was close to the target (0.20 compared to target of 0.25), all seven of Botswana's three-year output data averages were well below the Herana quantitative targets.

Cape Town

The data averages in Table 2.17 show that Cape Town met 10 of the 11 input targets and satisfied all eight output targets. The input target missed was its proportion of academic staff in business, economics and management with doctoral degrees (average of 44% compared to target of 60%).

Dar es Salaam

Table 2.17 shows that Dar es Salaam met two input targets related to requirements for favourable student to academic staff ratios in the fields of science and technology and of education, humanities and social sciences. An important new knowledge target which Dar es Salaam missed was that of doctoral enrolments. Its three-year average of 0.9% of enrolments in doctoral programmes is well below the Herana target of 5%. On the output side Dar es Salaam met three targets related to the production of total graduates, total masters graduates, and doctoral graduates in the field of education, humanities and social sciences. Dar es Salaam however missed five of the other six targets concerned with high-level knowledge production. Its output ratio of doctoral graduates to academic staff with doctorates in the broad field of science and

technology was particularly low; 0.12 compared to the target ratio of 0.38. Dar es Salaam had furthermore, in all fields, ratios of published research articles to academic staff with doctorates which were well below the Herana targets.

Eduardo Mondlane

Eduardo Mondlane met 3 of 11 input data targets and none of the output targets. The input targets which it met concern science and technology students as a proportion of total enrolments, and student to academic staff ratios in the fields of science and technology, and of business, economics & management. Table 2.17 shows that Eduardo Mondlane met none of the eight output targets; achieving averages which were in numerical terms only about 20% of the set targets.

Ghana

The data in Table 2.17 show that Ghana met 3 of the 11 input targets. The three input targets which it met were in its provision of academic staff. In the fields of science and technology and of business, economics and management, its average proportions of academic staff with doctorates were 63% and 77%, which are above the target of 60%. Its student to academic staff ratios in science and technology was 8:1, which is highly favourable relative to the target of 15:1. Ghana met only one output target. This was its average ratio of masters graduates to masters enrolments; 0.34 compared to the target of 0.25. Ghana's main output weakness has been its low ratios (at most 30% of target) of doctoral graduates and of research articles to academics with doctorates in all fields of study.

Makerere

The data in Table 2.17 show that Makerere met only 1 of the 11 input targets, and 3 of the 8 output targets. Makerere's main input weaknesses were its low proportions of masters enrolments (5.8% compared to target of 15%) and of doctoral enrolments (1.6% compared to target of 5%), and its unsatisfactory FTE student to FTE academic staff ratios in fields other than science and technology. Two of the output targets which Makerere met were its ratios of total graduates to total enrolments (0.27 compared to target of 0.25) and of masters graduates to masters enrolments (0.48 compared to target of 0.25). One of Makerere's main output weaknesses has been its low ratios of doctoral graduates to academics with doctorates in the fields of study of science and clinical sciences, and of education, humanities and social sciences. Its other

major output weakness has been in its production of research articles. Account does however have to be taken of the reasonably narrow extent to which these average research article ratios missed the targets set. In the field of science and technology the Makerere's average ratio was 1.30 compared to the target of 2.0, and in the field of education, humanities and social sciences was 0.46 compared to the target of 1.0.

Mauritius

The data in Table 2.17 show that Mauritius met 2 of the 11 input targets. These related to its proportion of enrolments in science and technology (41% compared to the target of 40%) and its average student to staff ratio in the field of education, humanities and social sciences (21:1 compared to target of 25:1). An important new knowledge target which Mauritius missed is that of doctoral enrolments. Its three-year average of 0.3% of enrolments in doctoral programmes was well below the Herana target of 5%. On the output side Mauritius's averages were well above the targets related to total graduates and masters graduates. It missed however all six of the targets concerned with high-level knowledge production. Its average ratio of research articles published per academic with a doctorate was particularly low; 0.67 compared to the target of 2.0.

Nairobi

The data in Table 2.17 show that Nairobi met 2 of the 11 input targets. These were its average proportion of masters enrolments (17.1% compared to target of 15%), and its student to staff ratio in the field of education, humanities and social sciences (15 compared to the target of 15). Nairobi's main weaknesses relative to input targets were its low proportion of doctoral enrolments (1.5% compared to the 5% target), its low proportions in all fields of academic staff with doctorates (an overall three-year average of 21% compared to the average target of 60%), its unsatisfactory FTE student to FTE academic staff ratios in fields other than science and technology.

Nairobi met 2 of the 8 output targets. These concerned its outputs of doctoral graduates in the fields of business, economics and management and of education, humanities and social sciences. It should be noted that Nairobi met or came close to meeting output targets related to the production of total graduates of masters graduates, of doctoral graduates in science & technology and in business, economics and management. Nairobi also came close to meeting the research article target in science and technology (1.17 compared to the target of 2.0), and in education, economics and social sciences (0.80 compared to the target of 1.0).

Empirical evidence of changes in research performance over time

The analyses of changes in performance will not deal with all 18 of the indicators and data averages contained in Table 2.17. The analyses will be limited on the input side to changes in the ratios between doctoral enrolments and total student enrolments, and in the proportions of permanent academics with doctoral degrees. On the output side analyses will be limited to changes in the totals of doctoral graduates and research articles, and to the ratios between these totals and permanent academic staff with doctoral qualifications. These are key input and output elements in the production of high-level knowledge in the form of doctoral graduates and research publications.

Changes in input data: 2010–2015

Table 2.20 expresses doctoral enrolments for 2010, 2013 and 2015 as a percentage of total student enrolments in those same years. The ratios show that Cape Town was above the target for all years after 2010, and that those of Botswana and Eduardo Mondlane remained low and well below the target of 5%. The ratios for Ghana, Makerere and Nairobi improved, with all three moving above a barrier at 30% of the Herana target.

Table 2.20 Doctoral enrolments as % of total student enrolments: 2010, 2013 & 2015

	2010	2013	2015	Herana target
Botswana	0.40%	0.37%	0.58%	5.0%
Cape Town	4.90%	5.93%	6.24%	
Dar es Salaam	0.56%	0.19%	1.06%	
Eduardo Mondlane	0.08%	0.11%	0.22%	
Ghana	0.74%	0.98%	1.67%	
Makerere	1.40%	1.49%	1.76%	
Mauritius	0.53%	0.24%	0.62%	
Nairobi*	0.39%	1.22%	1.60%	

* Note: Nairobi = 2014 (latest available data)

Table 2.21 shows, in the form of averages for all fields, what the proportions were of permanent academic staff with doctoral degrees over the years 2010, 2013 and 2015. The table presents a mixed picture. Cape Town met the target ratio of 60% in all three years. Ghana and Botswana met the target in two of the three years. Nairobi and Eduardo Mondlane both had proportions of between 30% and 40% of the Herana target.

Table 2.21 Academics with doctorates as % of total academic staff: 2010, 2013 & 2015

	2010	2013	2015	Herana target
Botswana	65%	60%	58%	60%
Cape Town	61%	65%	60%	
Dar es Salaam	48%	49%	48%	
Eduardo Mondlane	19%	20%	19%	
Ghana	62%	62%	59%	
Makerere	33%	33%	43%	
Mauritius	45%	46%	50%	
Nairobi*	26%	25%	25%	

* Note: Nairobi = 2014 (latest available data)

Changes in output data: 2010–2015

Tables 2.22 and 2.23 summarise the total research output totals, across all fields of study, of the eight Herana universities covering the years 2010, 2013 and 2015. The table shows that there has been a mixed pattern of changes in doctoral degree graduates, primarily because of the low base from which all universities other than Cape Town started. In numerical terms the highest growth in doctoral graduates in 2015 compared to 2010 was at Dar es Salaam (165%), Botswana (150%) and Nairobi (133%).

Table 2.22 Doctoral graduate totals: 2010, 2013 & 2015

	2010	2013	2015	Changes: 2015 compared to 2010	
Botswana	6	13	15	9	150%
Cape Town	178	198	223	45	25%
Dar es Salaam	23	40	61	38	165%
Eduardo Mondlane	0	0	19	19	-
Ghana	17	62	25	8	47%
Makerere	55	50	64	9	16%
Mauritius	13	16	21	8	62%
Nairobi*	43	62	100	57	133%

* Note: Nairobi = 2014 (latest available data)

In the case of the totals of research publications reflected in Table 2.23, four universities improved their research publication totals by more than 100 in 2015 compared to 2010. They were Cape Town +854 (or 49%), Makerere +184 (or 43%), Ghana +113 (57%) and Nairobi +100 (or 46%). Botswana had the next highest increase of +51 (or 36%). The other three universities began from low bases of publication totals of under 100 in 2010, and increased their total in 2015 compared to 2010 by less than 30.

Table 2.23 Research publication totals: : 2010, 2013 & 2015

	2010	2013	2015	Changes: 2015 compared to 2010	
Botswana	141	142	192	51	36%
Cape Town	1 728	2 056	2 582	854	49%
Dar es Salaam	98	86	127	29	30%
Eduardo Mondlane	55	55	80	25	45%
Ghana	199	199	312	113	57%
Makerere	429	470	613	184	43%
Mauritius	48	66	74	26	54%
Nairobi	219	266	319	100	46%

Tables 2.24 and 2.25 examine changes in research outputs in terms of ratios of the outputs to permanent academics with doctoral qualifications. The Herana targets used in these two tables have been adjusted to take account of the different targets in Table 2.17 for the broad fields of science and technology, and of education, humanities and social sciences. The adjustments made were as follows:

- In the case of doctoral graduates in science and technology and in education, humanities and social sciences, the ratios of 0.38 and 0.23 doctoral graduates per academic with a doctoral degree were adjusted to an average for all doctoral graduates in all fields of 0.29 per academic with a doctoral degree.
- In the case of research publications in science and technology and in education, humanities and social sciences, the ratios of 2.0 and 1.0 articles per academic with a doctoral degree were adjusted to an average for all research publication in all fields of 1.40 per academic with a doctoral degree.

The ratios in Table 2.24 confirm the comment made earlier that the picture as far as doctoral graduates are concerned is mixed. Cape Town's ratio fell but was still close to the adjusted target in 2015. Universities that improved their ratios include Botswana, Dar es Salaam, Mauritius and Nairobi.

Table 2.25 gives a clearer picture of change and improvements, particularly in the case of Cape Town and Nairobi. Cape Town's total ratio of research articles per academic with a doctorate rose from 2.88 in 2010 to 3.28 in 2015, while Nairobi's ratio rose from 0.70 to 1.06.

Makerere's ratio remained constant at around 1.0 research article per academic with a doctorate. None of the other five universities displayed notable changes in their ratios, and all had over the period ratios which were well below the adjusted target of 1.40 research articles per academic with a doctorate. The 2015 ratios of Botswana, Ghana and Mauritius were approximately 30% of the adjusted target, and those of Dar es Salaam and of Eduardo Mondlane were less than 15% of the adjusted target.

Table 2.24 Ratios of doctoral graduates to academics with doctorates: 2010, 2013 & 2015

	2010	2013	2015	Herana target adjusted
Botswana	0.01	0.03	0.03	0.29
Cape Town	0.30	0.28	0.28	
Dar es Salaam	0.04	0.07	0.10	
Eduardo Mondlane	0.00	0.00	0.05	
Ghana	0.03	0.08	0.03	
Makerere	0.14	0.11	0.10	
Mauritius	0.10	0.12	0.14	
Nairobi*	0.14	0.21	0.33	

* Note: Nairobi = 2014 (latest available data)

Table 2.25 Ratios of research publications to academics with doctorates: 2010, 2013 & 2015

	2010	2013	2015	Herana target adjusted
Botswana	0.29	0.30	0.41	1.40
Cape Town	2.88	2.94	3.28	
Dar es Salaam	0.18	0.15	0.20	
Eduardo Mondlane	0.22	0.16	0.21	
Ghana	0.30	0.27	0.41	
Makerere	1.09	1.07	1.00	
Mauritius	0.39	0.50	0.48	
Nairobi	0.70	0.88	1.06	

Placing the Herana universities in research-activity categories

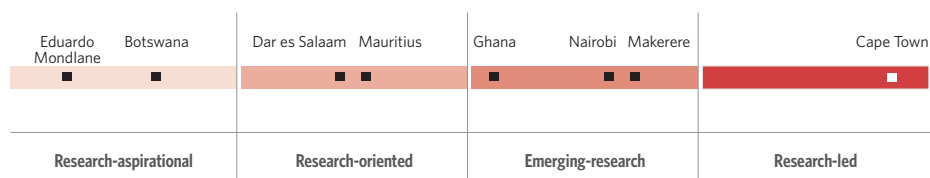
In terms of classification it should be kept in mind that this is not a hierarchical ranking based on a numerical score such as that produced by Shanghai Jiao Tong University. The tables and discussion which follow are different because they consider whether the eight Herana universities can be placed into four distinct research-activity categories which are summed up in Table 2.26.

Table 2.26 Herana definitions of research activity categories

Research activity category	Description of category
Research-led university	A research-led university functions in a national context which places strong emphasis on the generation of new knowledge as a key function of universities. It is also a university (a) whose institutional vision, mission and strategic planning are consistent with the national context, (b) which makes strong commitments to research, and (c) which provides compelling empirical evidence of being able to sustain research activities at the target levels set by the Herana project.
Emerging-research university	An emerging-research university functions in a national context which includes the generation of new knowledge as one of the functions of universities. It is also a university (a) whose institutional vision, mission and strategic planning demonstrate strong commitments to research while not being wholly consistent with the national context, (b) whose empirical evidence of research activities meets some of the targets set by the Herana project and (c) whose research inputs and outputs reflect some improvements over time.
Research-oriented university	A research-oriented university is one (a) whose national context is focused on improving access equity and training skilled graduates, (b) whose institutional vision, mission and strategic planning nevertheless include references and commitments to research, (c) whose empirical evidence of research related activities satisfies few of the targets set by the Herana project, and (d) which can provide little evidence of improvements in research performance
Research-aspirational university	A research-aspiration university is one (a) whose national context is focused on improving access equity and on training skilled graduates, (b) whose institutional vision, mission and strategic planning include commitments to research, (c) which fails to meet or come close to the targets set by the Herana project, and (d) which provides little evidence of movement towards satisfying any of the Herana research output targets.

The discussion and analyses above support arguments that the eight universities can be placed in the following research–activity categories defined in Table 2.26 and as illustrated in Figure 2.7.

Figure 2.7 Categorisation of eight universities by research activity



Research-led university: Cape Town

Cape Town is the only university which satisfies the criteria for being research-led. It can be placed in this category because Cape Town is the only university for which national and institutional documentation is complete and in which national and institutional goals are set out in consistent ways. It operated in a national and institutional context which place strong emphases on the centrality of university-based research as prime generator of new knowledge.

The empirical evidence presented shows that Cape Town met all but one of the targets related to the production of new knowledge, and displayed evidence of continued improvement in research outputs.

Emerging-research universities: Makerere, Nairobi and Ghana

Makerere and Nairobi meet quite clearly the Table 2.26 criteria for emerging-research universities, but Ghana is less clear. Support for classifying Ghana as an emerging research university is influenced by its strength in two key input variables; strong doctoral enrolments and percentage of staff with doctorates. The challenge for Ghana is to translate these strengths into stronger research and doctoral outputs.

A complete set of national and institutional data could not be found for Nairobi. While the documentation available on websites for Ghana and Makerere is complete, their institutional documents either do not include goals expressly formulated in the national statements, or include goals which fall outside the parameters of the national goals.

National and institutional commitments to research differ in all three cases. Ghana's national documents appear to make no reference to research as a major commitment, and in the case of all three the institutional commitment to research was couched in terms of high-level aspirations. None of the three institutional commitments to research were framed in a realistic way, but nevertheless expressed strong institutional commitments to research.

The evidence set out above shows that all three universities had major output weaknesses in the sense that they failed to meet most of the criteria linked to the production of doctoral graduates and research publications. Nairobi and Makerere displayed important improvements over time in their totals of doctoral graduates and research publications and in their ratios of these outputs to academic staff with doctorates. Ghana did not show improvements to the same extent as Nairobi and Makerere, but its totals of doctoral graduates and of research publications support its inclusion in this category.

Research-oriented universities: Dar es Salaam and Mauritius

Dar es Salaam and Mauritius fall into this category primarily because they failed to meet most of the input and output targets of the Herana project and because of problems with the documentation available on national and institutional websites.

A national strategic plan for higher education in Mauritius could not be found. The national documents available for both Dar es Salaam and Mauritius failed to express any strong commitment to universities being the main producers of high-level knowledge. Mauritius's institutional commitment was to it being a producer of new knowledge through research, while Dar es Salaam expressed a high-level ambition to be recognised as a world-class university as far as research was concerned.

Both universities failed to meet the Herana targets related to the production of doctoral graduates and research publications. Furthermore, neither university displayed substantial improvements in their outputs of doctoral graduates and research publications over the period 2010 to 2015.

Research-aspirational universities: Botswana and Eduardo Mondlane

The research commitments of these two universities can be classified as 'research-aspirational', first of all because of the incompleteness of their publicly available national and institutional documentation, and secondly because of their expressed intentions to acquire regional and international reputations for the production of high-level knowledge. The empirical evidence available shows that the performance of both fell well below the Herana output targets, and that there is little evidence that their performances in the production of doctoral graduates and research publications improved over the period 2010 to 2015.

Conclusion

It could be argued that one of the main contributions of the Herana project is that all the participating universities have strengthened their commitments to improving their research performance.

The findings presented in this chapter also indicate that while universities in Africa and their national governments make claims about their status as pre-eminent research universities on the continent, the reality on the ground is both uneven and at times even contrary to those claims.

At the same time, it is clear that some of the universities had made progress towards meeting the targets agreed to by the Herana group of universities and this suggests that they are now more likely than they were at the start of the project to contribute to development as producers of new knowledge.

Unevenness in research performance can also be interpreted in positive terms as it suggests a degree of differentiation amongst the group of eight universities. As we show in Chapter 7, the differentiation of higher education systems is important for creating and sustaining dynamic, heterogeneous networks.

It is acknowledged that an institution-wide classification of research performance can mask pockets of excellence and that the four admittedly broad fields of study employed by Herana in its analysis do little to ameliorate these effects. It should also be borne in mind that much of the research output of African universities, in common with the rest of the developing world, will be 'unseen' by indexes like Clarivate Analytics and therefore not placed on global record because this research is published in outlets not accessible to them (Wagner & Wong 2012).

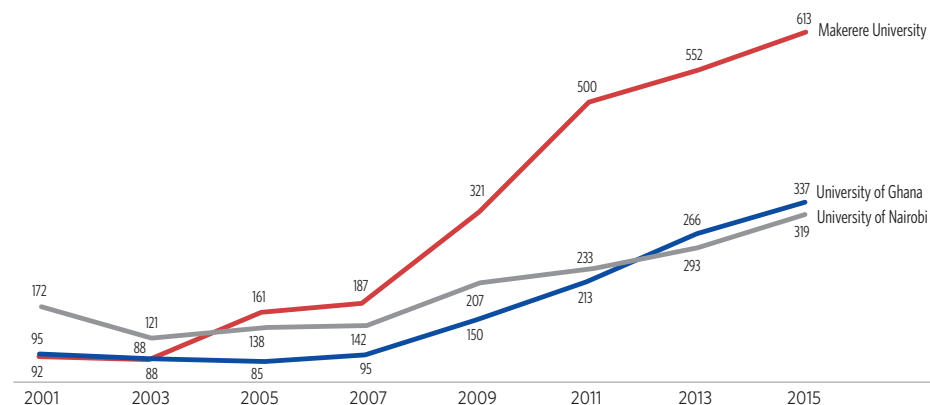
There are nevertheless signs of improvement in some areas as illustrated by the empirical evidence presented in this chapter. The 15-year trend data collected by Herana show that while some universities still fall short of the targets set by Herana for a research-led university, those universities are moving in the right direction. Two clear examples of positive trends are (1) the increases in doctoral enrolments combined with more modest growth in undergraduate enrolments at all but one university (Table 2.27), and (2) increases in the publication of scientific articles at the group of emerging research universities (Figure 2.8).

Table 2.27 Increases in total and doctoral enrolments: 2001–2015

	% increase 2001 to 2015	
	Total enrolments	Doctoral enrolments
Botswana	1.50%	18.10%
Dar es Salaam	7.80%	19.70%
Eduardo Mondlane	12.20%	34.80%
Ghana	9.40%	17.90%
Makerere	3.60%	27.40%
Mauritius	5.80%	-3.20%
Nairobi*	11.00%	26.30%

* Note: Nairobi = 2001 and 2014 (latest available data)

Figure 2.8 Total number of research articles (emerging-research universities): 2001–2015



The Herana project has provided the concepts, the indicators, the data standards as well as the raw data to enable the eight participating universities to continue assessments of their transition to becoming research-led. What remains is to understand the conditions under which new policies and strategies for improving research unfold. Such an understanding should allow the aspirant research university and other stakeholders to respond more effectively to the challenges and opportunities for creating research-led universities in Africa.

Part 2

**UNDERSTANDING
THE RESEARCH UNIVERSITY
IN AFRICA**

Chapter 3

The role of the research university

In Chapter 1 we showed that following the failed ‘development university’ discourse of the post-independence period in Africa, the international discourse about the role of higher education in development changed significantly from the early 2000s. Important role-players such as the World Bank (2000), the secretary-general of the UN (2002), the G8 (2005) and UNESCO (2009) created momentum for a new focus on higher education in Africa and the importance of higher education for development – summed up in the words of Kofi Annan ‘the university must become the primary tool for Africa’s development in the new century’ (quoted in Bloom et al. 2006: 2).

However, similar to the post-independence period, this new zeitgeist did not mean that there was clarity or agreement about the model of the university required to fulfil this aspirational role. The establishment of the Herana project was, to some extent, a consequence of this new thinking, particularly the collaboration amongst a number of development aid agencies in establishing a common project that involved eight universities in eight different sub-Saharan countries.

Four university models

At the global, national and institutional levels, there are many different understandings and ideas about the role of the university in society, particularly in relation to development. While the former colonial powers used the university mainly as a site for mid-level professional and administrative training aimed at building local bureaucratic capacity, Africa’s newly independent states saw public universities as both status symbols and providers of training for the new professional class and for the political elite. African governments have also emphasised that higher

education institutions should support the state in promoting national development, contributing to innovation and economic growth. However, the precise nature of the role to be played by universities in this has remained ill-defined, partly because most countries on the continent lack a widely agreed development model both in general as well as with respect to their universities.

During Herana Phase 1 the research team, informed by Johan Olsen's four visions of university organisation and governance (Olsen 2007) and Manuel Castells' notion of the university as an 'engine for development' (Castells 2017), identified four conceptual notions or models about the role of the university in development, which apply first and foremost to the situation of the university in low-income countries. To get a better understanding of the empirical relevance and applicability of these models, in an early stage of the Herana project a study of bilateral and multilateral development cooperation investments in higher education projects was conducted (Maassen et al. 2007). In addition, surveys were undertaken among leaders and senior academics at the eight Herana universities, and senior officials in education commissions and relevant national government departments, including those overseeing higher education, science and technology, and economic development. The methodology and detailed findings are described in *Universities and Economic Development in Africa* (Cloete et al. 2011).

Four main models of the role of higher education in national societies and economies were adopted to guide Herana. One model, initially promoted by national and international development agencies such as the World Bank, is that higher education has only an ancillary role to play in national development and that the focus for socio-economic development should be placed rather on primary education. A second model is that universities should be regarded as self-governing communities of scholars that should be protected from the exigencies of commercial and national developmental demands. This is a view commonly held by many senior academics and university leaders in Africa. A third model, which is widely held among senior government officials and policy-makers in Africa, is that universities should play an instrumental role in national development, producing skilled professionals and applied knowledge to service economic requirements. A fourth model, which is widely held among the governments of OECD countries, is that universities (and colleges) should be viewed as engines of development for the new knowledge economy that is emerging at national, regional and global levels

None of these four models can be observed in a pure form in practice. In addition, they are not mutually exclusive. Each is based on assumptions that make it unlikely that the practice of development co-operation can

be represented accurately by any of these models alone. Nevertheless, they crystallise four distinct views on the university and development.

Inconsistency in international development cooperation

An OECD (2008) review showed that, in their own countries, most of the organisation's members subscribed to some version of the model promoting the university as an engine of development for the knowledge economy. At the same time, and contradicting their domestic positions, practically all of these countries, through their national ministries and agencies responsible for global development cooperation, subscribed to a quite different approach for the role of higher education in low-income countries. Referring to the four models introduced above, a study by Maassen et al. (2007) showed that none of the donor countries involved subscribed to the engine-of-development model for higher education in their development cooperation policies. The donor countries had moved away from traditional-development and institutional-development approaches in their aid policies, increasingly adopting instead the instrumental development model, implying that support for higher education sectors in selected low-income countries had become an element in the political relationship between donor and recipient countries through their foreign affairs ministries and other government agencies, including their education departments (Maassen & Cloete 2009).

An important consequence of adhering to the instrumental model has been the relative neglect of universities' research functions. In practice this implies that such institutional capacity building as is stimulated and funded by donors tends to be limited to enhancing management and teaching capacity, with little serious effort made to connect the relatively marginal basic research activities in universities in low-income countries to investments in centres of, and programmes for, research excellence in the donor countries. Partly as a result of this approach, the gap between universities in low-income and high-income countries in relation to knowledge production and contributions to innovation continues to grow.

Despite many good intentions, expressed, for example, in the rhetorical support for sustainable development, aid is provided according to a logic in which internal policies in donor countries are disconnected from, and contradict, the imperatives of external development cooperation policies; and systemic gaps in the education systems of recipient countries remain largely unaddressed. Such improvements in higher education as are made as a result of development cooperation investments stem largely from the promotion of particular donor country interests and Santa Claus-type patronage, ensuring in many respects continual dependence on donors (Maassen & Cloete 2009).

Inconsistency in expectations among national and institutional stakeholders

Expectations at the national level

A range of views about the envisaged role of universities in development emerged from interviews with national and university stakeholders conducted as part of the Herana project. National policy-makers generally favoured the instrumental notion of universities, with less emphasis on the engine-of-development role, and the self-governing model. With the exceptions of Botswana and Mauritius, the engine-of-development model tended to feature in science and technology policies and in national vision statements, rather than in plans produced by the ministries of education (and science) in the countries studied. References to the knowledge economy, and the importance ascribed to it in vision statements, often seemed to be borrowed, particularly from the World Bank and OECD sources and websites. Meanwhile, most national government officials felt that universities were not doing enough to fulfil the instrumental role that they considered should be assigned to these institutions, although there were few policies actually articulating or incentivising such a role.

The conception of development was stronger among government stakeholders than within the universities, although this may be attributed to governments perceiving knowledge in a narrow, instrumental way, rather than as an engine of development.

Expectations at the university level

For their part, university leaders generally favoured self-governing and instrumental roles for their institutions. These views reflected the terms of traditional debates about the autonomy of universities versus their responsibilities to engage with local and national communities beyond the campus gates. The old idea of universities seeking to produce human capital for the nation persisted only at the University of Ghana and the University of Dar es Salaam. These two institutions also clung to the idea of universities 'knowing best what is required of them'. The leaders of neither of these two universities engaged in a knowledge-economy discourse. The University of Mauritius was the only institution at which the engine-of-development idea dominated the discourse, in line with the view of the national government there. At Makerere University, the institution's leaders also broadly agreed with the government on the university's instrumental development role, although there was an increasing awareness at the university about the knowledge economy and the engine-of-development notion (ibid.).

The Herana study found the professoriate to be riven between these rival models of the role of universities in development. Some academics

clung to a ‘golden-age vision’ of autonomy and independence, which no longer exists even in the university systems of the former colonial powers from which these education systems were transplanted. Others were burdened by teaching responsibilities and had become cynical about the prospects for positive change in their institutions. Yet others had turned to consultancy projects to supplement their university salaries (Mkandawire 2011; Wangenge-Ouma et al. 2015). Such responses by academics can be viewed as constituting survival or advancement strategies that seek to compensate for the systemic quandaries, including a lack of a common purpose, that they face. However, they are often criticised for failing to produce published research by the same foreign donors and state agencies who sponsor the consultancy activities that divert their energies away from academic publication and supervision. Such an academic milieu hinders serious scholarship, often leading highly productive academics to seek greener pastures in other countries, including in the global North.

In terms of ideas held by national policy-makers and university leaders about the role of universities in development, the largest unresolved tension was between the self-governance and instrumental models for these institutions, held respectively by key institutional and government figures. The tension between the leadership’s focus on institutional autonomy, and society’s growing expectations regarding the university’s engagement with society’s needs has been widely documented in the literature on this topic (Bladh 2007; Maassen et al. 2017).

Unresolved disagreements among the various stakeholders in the higher education sector in the eight countries involved in the Herana project – among government officials, university managers and academics, and donors – have contributed to a lack of agreement on the role for the higher education sector in national development. A key consequence of the lack of common ground regarding the role of the university is the persistence of systemic gaps within African higher education. The lack of an agreed-upon model has also undermined efforts to expand the research and knowledge-production capacity of higher education in Africa.

Research aspirations and their take-up

Research aspirations

As was indicated in Chapter 2, towards the end of Herana Phase 1, the participating universities decided to focus on becoming research-orientated or research-led universities. All eight universities developed new strategic plans with a focus on research during the period of the

Herana project. Makerere University and the University of Ghana are two examples. According to the vice-chancellor of Makerere University, its aim was to become a research-led university. Makerere University's 'Strategic Assessment Plan' explicitly articulates this aim:

- being a research-driven university in which research and teaching/learning are mutually reinforcing;
 - establishing innovation incubation centers; and
 - enabling knowledge transfer and networking partnerships.
- (CHET 2017: 30)

In similar vein, the University of Ghana's strategic plan commits it to becoming a 'research intensive university' in which research is central to the university's transformation process. The priority is to create a climate that will stimulate research and community engagement. To that effect, it has:

- adopted an integrated enterprise level software system;
- established an Institutional Research and Planning Office; and
- created a research management structure headed by a deputy vice-chancellor for research, innovation and development, with a director of research assisted by research development officers to identify research opportunities, create awareness of the opportunities, help with application and research administration. (CHET 2017: 32)

The commonalities in the aspirations of all eight participating Herana universities are spelled out in Chapter 2.

The research aspirations of these universities formed the basis for the formation of the African Research Universities Alliance (ARUA) at the Dakar Summit in 2015. The 16 universities with relatively strong research and postgraduate training capacities in the African context established the alliance to build research excellence as a vital precondition for the continent's development and to enable it to exert greater control over its future. The idea was not only to strengthen research among the alliance's members, but for the universities in the group to form a hub that could support excellence in other institutions across the continent through advocacy for research; joint research projects; postgraduate training; improved access to research facilities; and linkages to research universities globally. Five of the eight Herana universities are part of ARUA.¹⁴

14 See <http://arua.org.za/>

National realities

In the section above we alluded to the fact that there are differences between the national stakeholders and university academics in terms of their notions about the role of the universities in development. Keeping in mind one of Herana's original hypotheses that without national policies and implementation of these policies, it is difficult for universities to develop strong academic cores, the issue arises that while universities in Africa have developed strategic plans for becoming more research-led, the corresponding response from their respective national governments must also come into the reckoning. It is illuminating to mention, briefly, three country case studies from the Herana project.

In Mauritius, there was a very explicit role for higher education in development, as articulated in national policy documents such as the 'Draft Education and Human Resources Strategy' and, importantly, the policies formulated in the document *Developing Mauritius into a knowledge hub and centre of learning*. As a result of the coordinated efforts of the Ministry of Education, Culture and Human Resources, and the Ministry of Finance and Economic Empowerment, the country was beginning to translate the policy documents into first steps to move the country towards a fully-fledged knowledge economy. However, as we showed in Chapter 2, the national government had by 2015 not implemented these intentions to support the plans of the University of Mauritius to advance beyond a research-orientated institution.

In Kenya, the major education policy document, 'Kenya Education Sector Support Programme', and the Ministry of Higher Education, Science and Technology's plan for 2008–2012, were the key policy documents setting out the government's vision on the role of higher education and the commitment to the knowledge economy. The development planning document, 'Kenya Vision 2030', was supposed to help to translate this vision into policy reality, but as of 2015, this had not happened.

By 2011, when Herana Phase 1 was completed, the South African government had made some references to the knowledge economy in policy documents but did not have a tabled plan. This changed in 2012 with the publication of the National Development Plan 2030 (NDP) (NPC 2011). The NDP was presented as a road map (with targets) for all government departments. It made the assumption that the South African economy should shift from a resource-dependency economy, which requires a small highly-skilled elite and a large low-skilled labour force, towards a knowledge economy, which requires a much larger and more diversified, more skilled labour force. The NDP emphasised that 'higher education is an important driver of the information/knowledge system,

linking it with economic development'. The NDP summarises the role of universities as follows: 'In today's knowledge society, higher education underpinned by a strong science and innovation system is increasingly important to open up people's opportunities.'

Soon after the NDP was launched, at the opening of parliament by then-President Zuma, flags were hoisted at parliament with the slogan 'SA Knowledge Economy'. While it was expected that the President would elaborate on government's understanding of the knowledge economy and what it would mean for education and science, he instead launched the biggest infrastructure project in the history of the country and declared that infrastructure would drive growth (SA Commercial Property News 2013). He did not announce improvements in the country's internet and ICT infrastructure, but instead concentrated on improvements to the rail and road networks to move minerals from the interior of the country to its ports. The following day, the flags were removed. When the Department of Higher Education and Training produced the Draft National Plan for Post-school Education and Training (2017), no reference was made to the NDP, although the substance of the plan signalled a shift to skills, but not to postgraduate study and knowledge production.

Inconsistency between national and institutional policy goals

Policy coordination is a vital factor in the research fortunes of a country. Consistency assumes that each country should have (1) a statutory framework for its higher education system, (2) a national statement of government's views of the purposes and goals of the national higher education system, and (3) a national strategic plan for higher education. It assumes also that each of the participating Herana universities has (1) an institutional statement of purposes and goals, which should be consistent with national purposes and goals for higher education, and (2) a strategic plan which should flow from each institution's statement of its purposes and goals, which should be consistent with the national strategic plan for higher education, and which should indicate what specific objectives and targets the institution has set for itself.

The search for information relied on web searches of national documents, including acts of parliament, government white papers, and reports of government departments and of statutory bodies such as higher education councils. The search for information on institutional statements of goals relied on searches of the websites of each of the eight Herana universities.

Table 3.1 offers a picture of the fit, or lack of a fit, between the national and institutional documents found and analysed.

Table 3.1 Assessment of national and institutional documentation

University	Research-activity classification	National level			Institutional level	
		Statutory framework for higher education	National purposes & goals for higher education	National strategic plan for higher education	Institution's purposes & goals	Institution's strategic plan
Cape Town	Research-led	A	A	A	C	C
Ghana	Emerging-research	B	A	A	D	D
Makerere	Emerging-research	B	B	A	D	D
Nairobi	Emerging-research	B	B	n/a	D	D
Dar es Salaam	Research-oriented	B	B	B	D	D
Mauritius	Research-oriented	B	B	n/a	D	D
Botswana	Research-aspirational	A	A	n/a	D	n/a
Eduardo Mondlane	Research-aspirational	B	B	n/a	D	n/a

Key:

- A clear and complete national information available
 B national documents do not give precise or comprehensive information
 n/a information could not be found after searches made of government and institutional websites
 C clear institutional information available; consistent with national documents
 D clear institutional information available, but not consistent with national documents

The overall picture presented by the table is that there are serious mismatches between national and institutional accounts of the goals and purposes of higher education, and between national planning objectives and the planning objectives of individual universities.

As can be seen, Cape Town, which is the only university classified as *research-led*, is also the only university which has all three of its cells in the national columns given 'A' codes, and both its cells in the institutional columns given 'C' codes. This reflects a judgement that both the South African national and the University of Cape Town institutional statements of the purposes and goals of higher education are consistent and clear. This would suggest that a minimum condition for being classified as *research-led* are consistent national and institutional goals and objectives.

In the cases of Ghana (classified as *emerging-research*) and Botswana (classified as *research-aspirational*), the national and institutional statements of goals and purposes are clear and comprehensive but are not consistent. The institutional statements either do not include goals expressly formulated in the national statements or include goals which fall outside the parameters of the national goals.

As far as the other five universities are concerned, the national statements of the goals expected of the higher education system are neither clear nor comprehensive. Furthermore, the available documentation suggests that these national goals and their related institutional goals are probably not consistent.

Conclusion

Not only is it important that institutional and national policies are consistent, it is also important that knowledge economy policies between different government departments be coordinated. While the relationship between higher education, science, innovation and development is complex and nonlinear, a crucial component for a productive relationship between them is connectivity and coordination between the policies that govern different government departments, agencies and the market. In his comprehensive review of policy coordination, Braun (2008) introduced the notion of a 'knowledge space' consisting of four core areas of innovation policy – higher education, professional education, basic research, and technological research – and used insights from administrative science and a number of science and policy studies to discuss the need for coordination in policy-making in knowledge and innovation systems.

The Herana Phase 1 project investigated this aspect (Cloete et al. 2011) and found that there was a range of coordination activities in most of the African countries. The most common structures for promoting coordination and consensus-building were forums. But interviewees said that these were largely talk shops; follow-up to agreements was weak, and there were few attempts to monitor progress and to implement decisions. There were also attempts at coordination through the creation of 'super-ministries' (Kenya, Mauritius, Mozambique). In a study of super-ministries in Europe, Braun (2008) found that these departments are often unstable and do not ensure policy coordination. A perpetual problem was the absence of cooperation between departments of education and science and technology. But merging them does not guarantee more effective coordination either.

In South Africa, with one of the most developed science systems in Africa, a review of the science system lamented the lack of policy coordination and the 'near universal opinion of the principal players within the science and technology system that the system had no clear or consistent goals or direction' (IDRC 1995). More than 15 years later, the number one recommendation from a report on capacity in the country's science system was for South Africa to enhance policy and process coordination as well as institutional cooperation to improve the development of human capacity (Stumpf 2011).

This raises several issues. First, none of the countries in which participating Herana universities are located have a knowledge economy; they are still resource-dependent as the much-proclaimed phenomenon of 'Africa Rising' (August 2013) was largely driven by a demand for, and a rise in, prices of commodities. Second, as knowledge institutions,

universities are integral to the country moving towards a knowledge economy. But universities can't steer in the direction of substantive knowledge production unless the national government has a development plan that supports the universities. And third, while a number of the countries (Mauritius, Kenya, South Africa) have knowledge economy policies, these are not part of a comprehensively agreed upon and implemented development plan. Above all, coordination between 'knowledge spaces' remains poor.

Chapter 4

Tensions between functions in the research university

Historically-determined functions of universities

According to Castells (2017), the ability of universities to manage contradictory functions, while also emphasising the university's role in generating knowledge and training self-programmable labour in the information age, will to a large extent determine the capacity of countries and regions to become part of the global economy. The four historically-determined functions of the university proposed by Castells are: producers of values and social legitimation, selection of the elite, training a professional labour force, and the production of scientific knowledge (Castells 2017).

Castells's position regarding the relationship between these four functions is one of unavoidable conflict (Muller 2017). The important consequence is that universities should expect conflict when attending to their functions. The functions are socially-determined forces that are in collision with one other, and this collision needs to be understood, mediated and managed:

[T]he critical element in the structure and dynamics of the university system is their ability to combine and make compatible seemingly contradictory functions which have all constituted the system historically and are all probably being required at any given moment by the social interests underlying higher education policies. It is probably the most complex analytical element to convey to policy-makers: namely, that because universities are social systems and historically produced institutions, all their functions take place simultaneously within the same structure, although with different emphases. (Castells 2017: 42)

Leading universities in Africa, as part of their ‘revitalisation’ in response to influential voices calling for a re-orientation, often using both an ‘instrumentalist’ and ‘engine of development’ discourse, have developed a new discourse of ‘development’ and knowledge production with research emerging as a central tenet (see Chapter 3). Castells had predicted that universities in developing countries may react to the ‘new’ emerging global informational economy by ‘rushing’ towards the new mode of production and development by making rhetorical commitments to it without fully appreciating what far-reaching changes this would imply for the economy and universities alike. The vision and mission statements of the eight universities are presented in Part 2 of this book and support the observation that there has been a move towards an economically instrumental and engine of development view of the university. But how has this resultant shift been handled in African universities?

Contemporary tensions between functions in universities

The Herana project focused mainly on the Castellan function of scientific knowledge production because it aligned conceptually with the positive relationship between knowledge and development, but also because the leading universities in Africa had self-articulated aspirations for their emergence as research universities participating in the global knowledge project. In keeping with Castells, the project team was cognizant of the tensions inherent in managing a shift towards research in universities historically orientated towards elite selection and training. The genesis and tradition of the colonial-era African university is rooted in a role to serve primarily an elite socialisation function, though this function was not pursued further in the empirical indicators of the Herana research. Nevertheless, the variable imprint of this legacy is clearly seen in the performance indicators of the African universities in the Herana sample.

Herana did, however, pursue its interest in the knowledge production function by paying attention to other historically determined university functions. For example, data and indicators on student enrolments, student-staff ratios and differences by broad field of study at the undergraduate level are an acknowledgement of the broader role universities play in society.

There was also an awareness of the university ‘being submitted to the pressures of society, beyond the explicit roles they have been asked to assume’ (Castells 2017: 41). In the first phase of the Herana project, attention was paid to the extent to which university research projects, often resourced by external funding, were connected to the needs and interests of stakeholders external to the university while simultaneously meeting the requirements of a research-led university, that is,

strengthening the academic core of the university (Cloete et al. 2011). This position is articulated in the original hypotheses put forward by Herana (see Chapter 1). In the second phase of the project, social connectedness was reconceptualised to capture the tension between the demands of society and the requirements of a university focused on research (Van Schalkwyk 2015). Universities must manage this tension in such a manner so as not to become too service-orientated and forego the production of new knowledge; nor should they become so disconnected from the needs of communities and only produce new knowledge that is of little relevance to them. The expectation is for universities to be productive forces in the knowledge economy; an expectation that is legitimised by invoking the fact that universities are publicly-funded institutions in the service of society.

Herana, then, paid attention to two of the four Castellan functions and to the additional pressures emanating from the social environment because of its developmental potential; attention that dovetails with the three functions of universities referred to consistently in the higher education studies literature, namely, to research, teaching and community development (or engagement as the 'third mission' of the university).

As shown in Chapter 3, one consequence of the dominant instrumental model steering the relationship between universities and development, is the relative neglect of universities' function as knowledge producer. As universities become more 'research-orientated', varying interpretations of what constitutes the production of scientific knowledge can be brought to bear in plotting the strategic direction to be followed by the university and, subsequently, in the implementation of that strategy. These interpretations are often shaped by discordant and even competing global, national and institutional expectations.

Different interpretations of what constitutes knowledge production are apparent as universities attempt to operationalise their new research focus. It is possible to detect these interpretations in the empirical data collected by the Herana project. In particular, trend data on numbers of students enrolled, enrolments by qualification type, and student-staff ratios are informative with regard to teaching, while trend data on scientific publications and postgraduate enrolments with an emphasis on doctoral enrolments inform inferences about research activity. Data from the Herana sub-project on community engagement and how it relates at the project level to the academic core at three of the eight participating universities is informative in terms of how community engagement is balanced with the requirements of the academic core.

These interpretations and their operationalisation find expression in the functions of teaching, research and community engagement resulting in tensions that lie on a continuum which at the one end interprets

knowledge production in a way that will not necessary produce the kind of knowledge required to drive development and at the other end interprets the production of knowledge in a manner that will allow it to participate in the global knowledge economy while remaining connected to national development needs.

In the case of its training function vis-à-vis the production of scientific knowledge, the university can choose either to concentrate on the certification of undergraduates with little regard for their postgraduate studies, or it can encourage the continuation of selected undergraduates to postgraduate studies. It is the cadre of postgraduates, particularly doctoral graduates, that will fill future academic posts and be the knowledge producers of the future. In terms of its postgraduate training, the university can produce graduates that are attuned to the requirements of the labour market in the information age (what Castells refers to as 'self-programmable labour'), or it can warehouse large numbers of students, with little consideration for their eventual contribution to the knowledge economy. Castells (2017) describes warehousing of university students as a response to the social pressures exerted on the university – as society observes the social and economic benefits accruing to those who attend university. According to Case (2018), Castells's stance on warehousing shifts over the course of the 20 years that follow his first description of the warehousing of students as higher education massifies. It is a shift that, according to Case, increasingly acknowledges the economic and societal value of warehoused students. But there is no indication that warehousing poses any less of a risk to the productive contribution of universities dependent on their production of new scientific knowledge; particularly in universities that lack the capacity and/or the autonomy to manage together mass teaching and knowledge production.

In the case of community development, the university faces several choices. From a knowledge production point of view, it can interpret the engagement activities of academics as being simultaneously responsive to the needs of communities and creating new scientific knowledge. This is the interconnected interpretation. It can also interpret engagement as the application of existing knowledge in the delivery of services to the community where community could equally be non-academic, on-campus communities (e.g. students); communities on or near the doorsteps of universities (e.g. neighbourhood communities); or private firms and industry. The university may also produce new knowledge in the service of industry, with little say over problem, process or the ethics of application. The knowledge-as-service interpretation throttles the production of new knowledge while the knowledge-in-service interpretation leaves no room for curiosity-driven scientific enquiry.

The production of knowledge in the service of external stakeholders is not only an interpretation on the part of the university on how to engage, it is also one interpretation of the kind of research to be promoted within the university. The motivations may not be the same. Engagement may be motivated by social pressures; applied research may be motivated by additional factors such as the creation of additional income streams for the university. Within research as a core university activity, the university may therefore be attracted to promoting the kind of knowledge production that is directly linked to the research agendas and needs of development aid agencies or industry (that is, consultancy research or applied research). At the other end of the interpretation continuum, the university may insist on protecting and supporting research whose sole criterion is the production of new knowledge that advances understanding (that is, 'basic' or 'blue sky' research).

Given these latitudes of interpretation, how has the articulation of a knowledge production orientation by universities affected their teaching, research and community engagement? Given their aspirations, are universities able to operationalise the three functions in relation to the production of scientific knowledge?

How universities are managing the tensions between functions

Cloete et al. (2015) provide an early example of the challenges faced by Herana universities as they attempt to convert their knowledge production aspirations into reality. Three participating universities were put under the microscope – University of Mauritius, University of Nairobi and Makerere University. All three committed themselves to strengthening their scientific knowledge production function. But Mauritius showed that while policies regarding the role of the university in the knowledge economy are in place, the contradictory functions of training for the labour market and producing scientific knowledge have not been managed in a way that has allowed the university to assume a role as a producer of new knowledge in the country's envisioned knowledge economy. As a result, the function of undergraduate training has remained dominant at the expense of the production of scientific knowledge. Similarly, despite strong institutional commitments to strengthening knowledge production at both Nairobi and Makerere universities, without national support to curtail the pressure for income-generation through increased undergraduate enrolments, the universities could not manage the contradictory demands of undergraduate training and knowledge production.

In the sections that follow, the University of Mauritius and Makerere University are again examined by applying the conceptual framework

presented above. The University of Ghana is analysed in place of the University of Nairobi because Nairobi discontinued its participation in the Herana project in 2014, and because the University of Ghana participated in the Herana sub-project on community engagement (along with the University of Mauritius and Makerere University).

The University of Mauritius

The data show that Mauritius has neither seen dramatic increases in its student enrolments, nor has it successfully transformed the teaching of students in a manner that integrates knowledge production at its core. In other words, growth in student numbers has been contained, but the number of postgraduate enrolments has not increased nor have student-staff ratios in science, engineering and technology (SET) improved.

Average year-on-year growth in student enrolments from 2001 to 2015 was a relatively modest 5.8%, almost half that of universities such as Eduardo Mondlane, Ghana and Nairobi. At the same time, there has been no change in the proportion of postgraduate students enrolled. In 2001, 2.2% of total head-count enrolments were doctoral students and by 2015 the proportion had decreased to 0.6%. In the case of masters students, enrolments increased marginally from 6.6% in 2001 to 9.0% in 2015. Enrolments in SET decreased from 50% in 2001 to 40% in 2015, while enrolments in business, economics, finance and related areas of study increased from 24% in 2001 to 33% in 2015. The ratios of students to staff in all three broad areas of study exceed the Herana targets but it is in SET where Mauritius misses the target by the greatest margin. In 2001, there were 25 students for every 1 full-time academic staff; in 2015, the number of students had decreased marginally to 24 students for every 1 full-time academic staff member, well above the target of 15.

Both the current (2015–2020) and previous (2006–2015) strategic plans of the University of Mauritius (2005, 2015) make reference to community engagement as being one of the six strategic directions of the university. The university embraces community engagement as being both central to the university's mission and as an opening to excellence in teaching, learning and research. Community engagement is seen as the mechanism through which university staff and students make contributions to local and global issues (e.g. problems of environmental sustainability, poverty and health) by either participating in or contributing to public discourse in relevant domains and by sharing their expertise with members of the broader community. The term 'community engagement' is used to designate all university activities (commissioned teaching and research, consultancy, advisory services, analytical work, community services, etc.) whereby the university

partners with government, industry, civil society and other stakeholders for a specific piece of work, and/or where the results of any university activity can be of direct benefit to stakeholders.

In addition, one of the five core values identified for the 'Strategic Plan 2015–2020' is social responsibility: 'The University believes that its sustainability cannot be ensured without accomplishing its social responsibilities. Its services are accessible to all citizens of Mauritius as its staff put their expertise at the service of society.'

A sub-committee, comprising representatives from university faculties and centres, was established to spearhead the activities under this strategic direction. The monitoring of the key actions and the key performance indicators (Table 4.1) is done annually by the Strategic Plan Monitoring Committee. The strategic plan was cascaded to each faculty and centre so that each could develop its own goals and indicators for each strategic direction including community engagement.

Table 4.1 shows that community engagement as conceptualised in the university's strategic plan is skewed towards the application and dissemination of completed research in the form of services and solutions delivered to local communities. Engagement is not seen as an activity that feeds into and strengthens the university's production of scientific knowledge. This approach is confirmed in the Herana data based on 62 engagement projects in five faculties and two centres at the University of Mauritius. With some notable exceptions, the Herana data show that with a mean score of 3.6 out of a possible 9.0, the majority of engagement projects are not effectively managing the tension between connecting to the needs of communities and to the research production function in the academic core of the university.

The underlying data reveal several noteworthy characteristics of engagement at the University of Mauritius vis-à-vis its aspirations to produce scientific knowledge. The data show that project funding is short-term, from single sources and predominantly from international agencies rather than from government: 17% received funding from the Mauritius Research Council and 9% received funding from government ministries. The university provided funding to 22% of the projects.

Most projects (47 out of 62) tended to score higher on the articulation indicators compared to the academic core indicators. The mean scores for all five of the academic core indicators were less than half of the maximum score attainable. Only 19 (30%) projects required original research to be undertaken as part of the project and of the academic core indicators; projects fared worst in terms of publishing findings, illustrating that most projects did not generate new knowledge, or at least disseminate it to peers.

Table 4.1 Objectives, key actions and key performance indicators for community engagement

Objectives	Key actions	Key performance indicators
To promote university-community partnership	Include the voice of the local communities in the university research agenda through meetings and workshops	Number of organisations contributing to applied research at community level
	Create broad public awareness of the university's mission and contributions	Number of outreach workshops/ extension activities/community engagement placement opportunities
To apply current knowledge to the country's evolving needs	Act as a 'think tank' for the country	Number of public lectures and talks on national issues organised
To adopt strategies that enhance proximity with our community and our alumni	Provide services to communities living around the campus	Number of activities carried out benefitting the local community
	Promote the 'alumni for life' concept	Number of projects in collaboration with alumni
	Determine avenues of collaboration with UoM alumni to expand the opportunities of students and to help the community at large	Number of alumni providing services, facilitating placements and mentoring UoM students on placements
To promote formal and informal education and to disseminate research findings through social networks and open educational methods	Develop an integrated and user-friendly web portal for the delivery of community engagement programmes and alumni activities	Dissemination of research findings to end-users in lay terms in the local media
	Make better use of UoM website and social media to foster greater public recognition and appreciation of the accomplishments of the UoM with regards to community engagement	Statistics related to Facebook, Twitter (e.g. followers, mentions, likes)
	Develop certificate (award or non-award) programmes targeting specific groups or fields	Number of non-formal or formal short courses for the community
To support the local community to develop sustainable solutions to immediate problems	Foster engagement with our communities of interest	Number of projects offering turn-key solutions for the communities

Projects located in two university centres – the Centre for Innovative and Lifelong Learning and the Centre for Biomedical and Biomaterials Research – perform better than those located in the faculties. In addition, projects in which academics at the University of Mauritius collaborated with international colleagues showed significantly higher scores than those projects where no collaboration was reported. A brief diversion back to Castells is illuminating. Describing new universities in developing countries and their place in the network society, Castells (2017) refers to specialised organisations that are part of the university system capable of organising external connections which, in conjunction with an emphasis on research, are needed to elevate a country's productive system. Castells is not specific on the role these specialised organisations

are to play in the research process, but he seems to suggest certain structural arrangements could be put in place to act as switches between faculties and external communities. It is possible that it is exactly this role that is being played by the two centres at the University of Mauritius. Castells also argues that the notion of universities as stand-alone, major research institutions is no longer applicable in the information age. Universities as producers of scientific knowledge must participate in the global networks of knowledge production. If the university manages its function of community development in such a way that its engagement projects link successfully to global networks by means of collaboration, then the university is likely to be in a better position to produce scientific knowledge.

This brief overview of the findings of the Herana engagement sub-project reveals that the University of Mauritius tends towards service rather than a form of engagement with communities that both meets the needs of those communities while simultaneously contributing to its knowledge project. As the university itself concludes in an assessment of its engagement projects: 'Despite the fact that the university aspires to be one of the leading international tertiary education providers and a research-led university, the high number of projects that claimed to be of service or outreach type was found not to strengthen the academic core' (University of Mauritius 2016).

In terms of the production of new knowledge as indicative of its interpretation of knowledge production, the Herana data show an average annual increase of 7% between 2001 and 2015 for published scientific articles indexed in the Clarivate Web of Science. This equates to every academic at the university publishing a scientific article once every five years, from a low base of once every ten years. The Herana target is for every academic to publish at least one article per annum. Doctoral graduates as contributors to scientific knowledge production are a further indicator of the university's interpretation of knowledge production. The university's average annual increase in doctoral graduates for the period 2001 to 2015 was 1.5%, the lowest of all the participating Herana universities. Equally notable is an average annual increase of 8.1% in masters enrolments for the period 2001 to 2015 and a decline of -3.2% in doctoral enrolments for the same periods.

Based on the data presented, the University of Mauritius is still predominantly an undergraduate teaching university that seems to provide an active service to its external stakeholders. However, data also show that the services provided by the university are not of the kind that produce new knowledge. The university does, however, produce professionals for its increasingly service-oriented labour market (Oolun et al. 2012; Stiglitz 2011), particularly financial services, as the country

establishes itself as a gateway between Asia and Africa (Jonker & Robinson 2018). This could well be a national interpretation of what constitutes the knowledge economy, and one that differs from that adopted by the Herana project via Castells. It is nevertheless an interpretation that has served the country well in its transition to an increasingly service-based economy.

Makerere University

The Herana data show that Makerere University has managed enrolments by limiting growth at the undergraduate level while encouraging growth at the postgraduate level. Average year-on-year growth in student enrolments from 2001 to 2015 was 4.2%, one of the lowest in the group of eight Herana universities. The data also show a decrease in student enrolments from 2013 to 2015. At the same time, there has been some positive change in the proportion of postgraduate students enrolled at the doctoral level. In 2001, 0.1% of total head-count enrolments were doctoral students and by 2015 the proportion had increased to 1.8%. In the case of masters students, enrolments increased marginally from 4.9% in 2001 to 5.2% in 2015. Masters and doctoral enrolments at this level in 2015 both still fall short of the Herana target of 15% and 5% respectively, but the increase from 23 doctoral enrolments in 2001 to 680 in 2015 along with managed undergraduate enrolments could be read as a positive sign of the university's attempt to shift towards knowledge-centric training.

Total student enrolments in SET are equally positive, with an improvement from 17% in 2001 to 33% in 2015, while enrolments in education, humanities and social sciences were reduced from 68% in 2001 to 46% in 2015. The 2015 ratios of students to staff in SET were fractionally above the Herana target of 15 students for every 1 full-time academic. In 2001, there were 6 students for every 1 full-time academic staff member; in 2015, the number of students had increased to 16 for every 1 full-time academic staff having peaked at 18 students per academic staff member in 2011.

In terms of community development, Makerere University's mission is 'to provide World Class innovative teaching, learning, research and services responsive to national and global needs'. The current 'University Strategic Plan 2007/8 to 2017/2018' includes knowledge transfer partnerships to improve community access to knowledge and skills, advice, technology and innovation at Makerere University. This approach is in line with the university's shift from an outreach paradigm which presented a posture of patronage and an ivory tower to a knowledge transfer and partnership approach that recognises the availability of

knowledge in the environs of the university to enrich its research and teaching.

The university is in the process of establishing grants offices in each of its ten colleges; and three such grants offices have already been set up in the Colleges of Agriculture and Environmental Sciences, the College of Humanities and Social Sciences, and the College of Health Sciences. These offices will coordinate the engagement activities in the colleges. The grants offices fall under the centralised Directorate of Research and Graduate Training. Key performance indicators have been developed for community engagement and include:

- number of joint projects established with the community;
- number of operational business and technology innovation incubation centres;
- number of staff scholarships by the private sector and non-government organisations; and
- level of participation of the community in University policy and curricula development.

A total of 100 questionnaires were distributed to the ten colleges of the university targeting individuals based on information provided by the Finance Department in the university. A total of 15 questionnaires were completed by the respondents. With such a small return rate it is difficult to comment on how the university is managing its community development function. A previous study on university–community engagement that relied on a similar methodology and conducted as part of Herana Phase 2, managed to collect a total of 22 completed questionnaires. It is clear that while there is intent to move from community development as outreach to community development as mutually beneficial engagement, this function of the university remains ad hoc and poorly managed. The indicators in the Phase 2 study showed that engagement between university academics and those external to the university is active but that the nature of this engagement varies considerably, and the degree to which such engagement activities can be said to be strengthening the university as a key knowledge–producing institution is uneven and too frequently marginal.

In terms of the production of new knowledge as indicative of the kind of research typical of a research–led university, the Herana data show an average annual increase of 14.5% between 2001 and 2015 in scientific articles indexed in the Clarivate Web of Science. This was the largest increase across all eight universities. The improvement equates to every academic at the university publishing one scientific article once every two and half years from a low base of one article every ten years. The

Herana target is for every academic to publish one article per annum. However, the 613 scientific articles published by Makerere University academics in 2015 should be seen in context: while indicative of a marked improvement, its efforts are still well short of the 2 582 articles published by academics at the University of Cape Town in the same year.

The average annual increase in doctoral graduates at Makerere University for the period 2001 to 2015 was 14%. The number of doctoral graduates increased from a low base of 10 doctoral graduates in 2001 to 64 in 2015. This suggests that while Makerere has managed improvements in both of the two key knowledge outputs over the 15-year period, it has been more successful at doing so in terms of publications.

Based on the data presented, Makerere University appears to have had the most success of the three universities in shifting towards knowledge-centrism in its teaching, research and engagement. The shift is slight and is more evident in the university's research function than it is in its training and engagement functions. This interpretation of how Makerere University is operationalising knowledge production is consistent with its classification in Chapter 2 as an emerging research university. However, there is limited evidence to suggest that its knowledge production is interconnected with its engagement in any significant way.

The University of Ghana

The Herana data show that in terms of managing the tension within its training function, the University of Ghana has veered towards the warehousing of students, particularly at the undergraduate level. The university has also been unsuccessful in transforming the teaching of its students in a manner that integrates knowledge production at its core. In other words, there has been a rapid growth in student numbers, but the number of postgraduate enrolments has not kept pace. Moreover, while the university is successful at ensuring that masters students graduate, it has less success in encouraging masters graduates to take up doctoral studies.

Average year-on-year growth in student enrolments from 2001 to 2015 was 9.4%, one of the highest in the group of eight Herana universities. At the same time, there has been no significant change in the proportion of postgraduate students enrolled. In 2001, 0.6% of total head-count enrolments were doctoral students and by 2015 the proportion had increased to 1.7%. In the case of masters students, enrolments increased marginally from 10.5% in 2001 to 12.5% in 2015. Masters and doctors enrolments at this level in 2015 both fall short of the Herana target of 15% and 5% respectively. Enrolments in SET improved from 22% in 2001 to 28% in 2015, while enrolments in education, humanities

and social sciences were at 63% in 2015. The ratios of students to staff in SET were below the Herana target of 15 students for every 1 full-time academic. However, the trend data show that the ratio is increasing – in 2001, there were 6 students for every 1 full-time academic; in 2015, the number of students had increased to 12 for every 1 full-time academic.

The data show that the University of Ghana has improved its efficiency in terms of masters graduates. In 2001, masters graduates made up 17% of masters enrolments and by 2015, this proportion had increased to 30%. This is above the Herana target of 25%. However, Herana shows that if the University of Ghana is to be categorised as research-led, the university should, based on 2015 enrolment data, have enrolled 2 000 doctoral students and graduated 400 doctoral students. Data for 2015 show that the University of Ghana enrolled 671 doctoral students and graduated only 25.

Community development is articulated in the University of Ghana's mission statement: 'to create an enabling environment that makes University of Ghana increasingly relevant to national and global development through cutting-edge research as well as high quality teaching and learning'. The university has also identified nine strategic priorities in its current 'Strategic Plan 2014–2020'. Research is listed as its first strategic priority and it states that through research, the university intends to 'create a vibrant intellectual climate that stimulates relevant cutting-edge research and community engagement'.

The Office of Research, Innovation and Development has developed a draft action plan for the uptake and utilisation of research evidence. The action plan proposed a database for capturing all research uptake activities that takes place at the university as a means to help measure the level of impact that the University of Ghana makes in improving the lives of the people and also contributing to national development.

In total, 209 faculty staff were approached to submit information on their engagement projects; only 19 projects were ultimately captured in the database. With such a small number of projects it is difficult to comment on how the university is managing its community development function. It is clear, however, that its projects are not connected directly to community needs, nor are they producing new knowledge characteristic of a research-led university.

In terms of the production of new knowledge, the Herana data show an average annual increase of 9% between 2001 and 2015 in articles indexed in the Clarivate Web of Science. This equates to an improvement for every academic at the university publishing a scientific article once every five years from a low base of one article every ten years. The Herana target is for every academic to publish one article per annum. The average annual increase in doctoral graduates at the University of Ghana for the

period 2001 to 2015 was 20%. While this was the highest average annual increase for all eight Herana universities, it should be noted that Ghana only graduated two doctoral candidates in 2001 and any increase is therefore measured from a low base. Ghana graduated 25 doctoral graduates in 2015, equivalent to the number of doctoral graduates at the Universities of Botswana and Mauritius, universities that are a third of the size of the University of Ghana.

Based on the data presented, the University of Ghana is predominantly an undergraduate teaching university. Trend data show an improvement in the total number of publications per annum for the period 2001 to 2015 but the improvement in publications per academic over the same period, is marginal. There is little evidence to suggest that its engagement activities contribute to the production of new knowledge. Overall, the university's interpretation of research within the frame of social connectedness is one which does not support its aspirations to make the university 'increasingly relevant to national and global development through cutting-edge research'.

Conclusion

The picture that emerges from the empirical data collected by Herana shows a mix of interpretations and uneven operationalisation as universities attempt to shift towards becoming recognised global producers of scientific knowledge while still labouring to come out from under the shadow of their colonial parent institutions and responding to social, political and other pressures emanating from their contemporary environments.

The global science network makes plain that there is a rift emerging in academia, also in African universities. If they are to thrive, the universities will have to ensure that they have a significant number of their scholars operating successfully in the global science network. But not every scholar can, or wants to be, a global star. Some will value local, grounded commitments above global eminence, and these will contribute to the local knowledge priorities that are particular to the local context. Mamdani (2018: 32) puts it well:

The local conversation gives rise to the committed intellectual, embroiled in public discourse, highly sensitive to political boundaries in the society at large; the global conversation calls for a scholar who takes no account of boundaries.

Both conversations are important, and African institutions need both kinds of scholar. The future of the African academy may well depend on

astute management of this new intellectual division of labour in the global world of knowledge.

The tensions and contradictions that each institution faces also show that it is important to avoid a single narrative and instead assess soberly and critically the complex and contradictory changes that continue to shape the continent's higher education landscape.

Notwithstanding these challenges, these three universities have expressed a shared aspiration to become producers of knowledge, breaking away from the notion that the main function of universities in Africa is the certification of graduates to populate the post-liberation professional class. However, these three African universities still have a long road ahead if they are to turn aspiration into reality. Not least will be the challenge of managing their dual aspirations of engaging with those external to the university while producing the kind of knowledge that will stimulate national development and open the doors to the global scientific community. They will also need to confront the daunting challenge of shifting from being predominantly undergraduate training institutions to being research-led institutions with more prominent postgraduate profiles.

Chapter 5

Incentivising research performance at African universities

Incentives can hinder or enhance the productivity of universities in achieving their knowledge-production goals. There are many different strategies for improving research performance, including differentiating the missions and functions of universities, providing research support, doctoral training, and the introduction of faculty rewards and incentives (Balán 2007). One of the interests of the Herana project was on whether and how research is being incentivised at universities in Africa, and what the effects of incentives have been on the research productivity of universities. This chapter therefore focuses on research incentives as an important change lever in aspirant research universities.

Research incentives may be introduced by universities, they may originate from donor agencies, or they may come from governments wishing to incentivise research across the system or at specific universities in a system. Each of these sources of research incentives is discussed in turn in the sections that follow.

University incentives for research

During the second phase of the Herana project, research was undertaken at Makerere University, Eduardo Mondlane University and the University of Nairobi on how financial incentives offered by universities can shape academic productivity, as measured by publications and effective supervision of postgraduate students. This is an under-researched area in higher education globally, but particularly in Africa.

At Makerere University, Musiige and Maassen (2015) found that more could be done to stimulate the development of a stronger research culture in the institution. The university's human resource policy focuses on

encouraging academic staff with PhD degrees to engage in teaching. The income from tuition fees garnered from privately sponsored students is used to pay lecturers who have additional teaching loads. Tenured academic staff members are not held to account for their research outputs. Musiige and Maassen suggest that incentives could be used to enhance output production and strengthen an institutional research culture.

Many of the academics themselves ranked individual factors above organisational factors and the impact of funding and research culture on fostering successful researchers. However, in their specific institutional context, funding played a greater role than was acknowledged in shaping the career paths of individual researchers. In addition, the lack of funding from the university for research made it an individualised activity, impeding institutional research ambitions and strategies and disincentivising academic staff from engaging in research.

A different approach was used to study the impact of incentives at the University of Nairobi and Eduardo Mondlane University. The research approach adopted for these two institutions considered whether principal agents delegate tasks to others with specialised skills and knowledge to achieve certain goals (Eisenhardt 1989; Laffont & Martimort 2002). In theory, (monetary) incentives work by increasing effort which, in turn, leads to improved performance. According to Stiglitz (1987), the main challenge in this regard is devising incentive schemes that will trigger maximum effort by the agent.

Since academics tend to have multiple principals, who incentivise different outputs, such as research, consultancy and teaching, the model sought to understand how research-related incentives shaped research behaviour, and how the existence of competing incentives, which often require mutually exclusive responses, have affected the establishment of a robust research culture.

In a higher education context, the use of financial incentives to boost research is regarded by some as anathema. For example, the pursuit of science driven by external, especially monetary, rewards, may be viewed as going against the traditional values of science (Macfarlane & Cheng 2008; Merton 1973). Notwithstanding such objections, monetary inducements can shape the pursuit of core academic activities, such as teaching, the supervision of postgraduate students and research.

There is a common perception that African academics are relatively poorly paid. However, in Mozambique, academic salaries were shown to be generally on a par with, and in some cases better than, those of senior civil servants. At the same time, no direct incentives were offered to encourage research, even though existing policies provided for such incentives (Wangenge-Ouma et al. 2015).

In addition, the often-conflicting interests of multiple principals tended to further undermine the research capacity of already weak higher education institutions. For example, instead of pursuing research within the university and seeking to socialise junior academics and postgraduate students into research, many senior academics seemed to prefer establishing entities outside their institutions, and using these newly created bodies as vehicles to attract funding for research and consultancies. This has contributed to a deinstitutionalisation of science at Eduardo Mondlane University. In this case, incentives for research from international agencies seem to be applied in ways that impede the university's institutional advancement (Wangenge-Ouma et al. 2015).

At the University of Nairobi, competing incentives provided by different principals – the university itself, the national research council, and NGOs and other entities offering consultancy opportunities – rewarded the production of different outputs, such as teaching programmes; the publication of papers in international peer-reviewed journals; the effective supervision of postgraduate students; and the writing of consultancy reports. While the university placed a premium on research and postgraduate supervision through its promotions criteria, its system of incentives broadly encouraged teaching at the expense of research. In this regard, the academics were confronted with the challenge of understanding and reconciling contradictory duties stemming from conflicting instructions and incentives offered by multiple principals (Shapiro 2005: 267).

The university's leaders seemed to have failed to establish an incentives regime that both encouraged teaching and supported realisation of the university's research goals. The incentives, especially those for research, were seen by academics at the university as inadequate and unsystematically applied. The prioritisation of teaching over research at the university stems from the institution's efforts to raise money as state funding has declined. Fee-paying, evening-school students generate crucial income to sustain the institution, which has led to enrolment beyond the university's capacity (Wangenge-Ouma 2008, 2012). In order to meet the additional burden – and provide the resources needed to maintain an institution that can, among other objectives, pursue research – academics are incentivised to teach.

The case studies at Eduardo Mondlane University and at the University of Nairobi indicate that, in combination with other material conditions, the incentives for research, which are weak and crowded out by incentives for other activities such as teaching, have failed to encourage a research culture at these institutions. While incentives can be used to leverage research productivity, their effectiveness seems to depend on the presence of an institutional culture that promotes research – be it through the

consistent application of promotions criteria, the mentorship of young academics to become established researchers, research capacity building, or the provision of research funding through the university itself.

Funding and development aid for research

Donors have played an important role in funding of African higher education in the post-independence era. Many individual academic staff members have profited from donor funding, which has allowed them to supplement their relatively low salaries. However, and notwithstanding the considerable funds invested by donors in university projects under the heading of 'research' (Maassen et al. 2007), such financial support has generally failed to promote the development of research-intensive universities in Africa.

The low salaries, absence of proper incentives, poor infrastructure, and lack of a professional research management system endured by senior academic staff at many African universities, are often blamed on a lack of consistent, adequate research funding. However, this is not only the result of a lack of research funding per se, but rather the kind and source of the income. Musiige and Maassen (2015) interviewed academic staff at Makerere University about the impact of individual and institutional factors, and funding and research culture on research productivity. They found that funding had a major impact on the nature and sustainability of research capacity at the university and productivity in this area. With 80% of the university's research income coming from donor agencies, mainly on a project-by-project basis, the institution's leaders lack the funds to build the academic and infrastructural foundations required to help it to become a research-intensive university.

Much of the Herana universities' research funding comes from donor agencies, implying that the leaders of these institutions have limited or no direct influence over how this money is invested in their universities' research activities. With the exception of the University of Cape Town, this indicates a broader disconnect between institutional research strategies and the research activities of individual academics. For universities outside of South Africa, this includes a lack of incentives for the supervision of research masters and doctoral students.

Notwithstanding the obstacles posed by the diverse sources of income, the universities themselves can promote the development of a stronger organisational research culture. University personnel policies could stimulate greater involvement of tenured academic staff with a doctoral degree in academic research. For example, each institution could introduce incentive schemes and promotion procedures to reward academic staff for producing research. These could be based on research

productivity data, such as number and quality of academic publications; number and nature of externally funded research projects; and involvement in supervision of doctoral and master students.

The data produced by the Herana project offer an important insight into the nature of research income at the eight flagship universities (Cloete et al. 2011). For example, there is a significant gap between the total amount of research income at the universities and their research productivity. Makerere University has more or less the same level of non-government research income as the University of Cape Town, although its research productivity is much lower than the University of Cape Town's. In this regard, different sources of, and conditions for, research funding can promote or limit productivity. More than 75% of the research income of the non-South African universities in the Herana project came from foreign (either national or supranational) donors. By contrast, a considerable part of the University of Cape Town's research income – in line with the model for such funding at the world's top research universities – is generated by academic staff competing successfully for external research council funding.

As discussed in Chapter 1, the investments of donor agencies in research projects at sub-Saharan African universities have a number of characteristics that contribute to the low research productivity of these universities (Maassen 2012). It was found that there is hardly any coordination among donor agencies in relation to investments in research projects in sub-Saharan African universities. The donor funding tends to be funnelled through individual academics and targeted projects rather than institutions or networks, despite the rhetorical emphasis on capacity building among the donor community. In addition, such funding is not distributed through open, competitive, peer-reviewed processes, nor are the academics who are funded necessarily required to publish. As a result, most donor-funded projects resemble consultancy activities rather than academic research projects. The focus on funding individual academics or projects and the parochial nature of the funding – with up to 80% of such income being donated on the basis of the donor's own programmes and ideologies rather than the research priorities of receiving institutions and countries – makes it difficult for African universities to realise their institutional research strategies.

Government incentives for research

A dominant 'globalisation' and 'knowledge economy' discourse has been accompanied by increasingly important roles assigned for research and innovation in development. The knowledge economy takes as a starting point that the leading edge of the economy in developed countries has

become driven by technologies based on knowledge production and dissemination. In general, the key characteristic of a knowledge economy is 'a greater reliance on intellectual capabilities than on physical inputs or natural resources' (Powell & Snellman 2004: 199).

In the development of new national 'knowledge policies' as well as supranational policies such as the EU Horizon 2020 funding framework, three different science policy approaches are visible. The first is an approach focused on curiosity-driven or basic research, the second is an approach focused on research that leads to practical innovation that will foster economic growth, and the third focuses on the contributions of research to solving the grand, global challenges faced by society. While many governments include all approaches in their science policies, there is also an element of competition between them.

The last two decades have seen concerted efforts in advanced economies to harness innovation toward economic growth and the promotion of societal wellbeing. In turn, the promotion of the various dimensions of innovation has been guided by the innovation systems approach with its emphasis on the importance of linkages among the actors and institutions comprising the innovation system. With innovation understood to arise from systemic interactions, governments seek to monitor and enable the inputs to and processes in the innovation system, with the goal of attaining desired outputs.

In South Africa, the policy frameworks of the 2012 National Development Plan and a 2013 White Paper on Post-school Education describe the purposes of university education: providing people with high-level skills for the labour market, producing new knowledge, finding new applications for existing knowledge and providing opportunities for social mobility. As shown in Chapter 10, the vision, mission and strategic goals of the University of Cape Town are consistent with the national policies on the purposes of higher education.

South Africa was among the first emerging economies to adopt an innovation systems approach and it introduced a range of policy instruments including direct and indirect incentives. In 2003, the Research Funding Framework for universities was revised by government. The funding framework recognises six categories of knowledge production, including articles in journals, books, book chapters, papers published in peer-reviewed conference proceedings, research masters students graduated, and PhD students graduated. Each output attracts a weighted financial subsidy from government, provided that each output meets the required quality criteria set out in the framework. Each output unit attracts the equivalent of approximately USD10 000. To illustrate: a journal article published by a single academic in a journal accredited by the Department of Higher Education and Training would equal 1 unit and attract USD10 000 in subsidy; if the article was co-authored by two

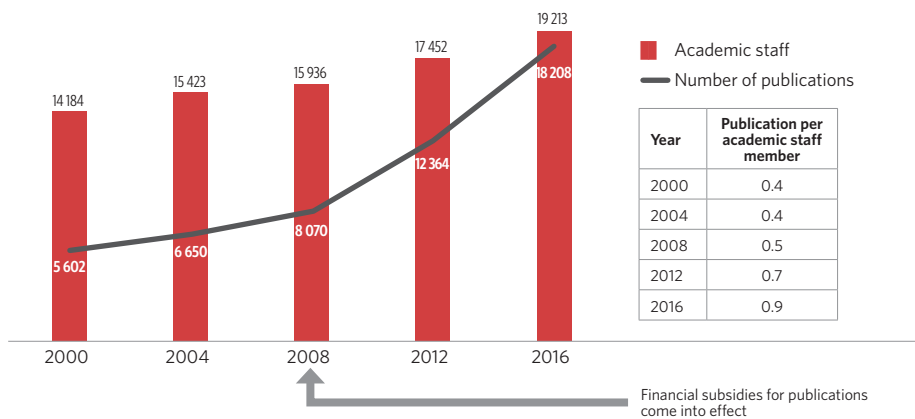
academics from different South African universities, the subsidy would be shared between the two universities. For a PhD graduate, a university receives a subsidy equivalent to 2 units, that is, USD20 000.

The knowledge output subsidy is awarded to the university. How each university chooses to reward the academic(s) responsible for the production of the output is at the discretion of the university. At some South African universities, academics receive a percentage of the subsidy as a cash reward while at others they receive it as funds to be used for research purposes only. At the University of Cape Town, the university that has historically attracted the highest subsidy, a percentage of the subsidy is not allocated to individual academics but instead deposited into a central research fund. Academics apply to this central fund for financial support for their research-related activities with those who have contributed to the fund via their research output subsidies receiving preference when they apply for funding from the central fund.

Figure 5.1 shows the effects of the subsidy on research publications in the South African public university system. While the Research Funding Framework was released by government in 2003, it only came into effect when the incentivisation of knowledge production through financial subsidies were eventually implemented in 2008. Following the introduction of the subsidy, there has been a clear increase in the number of research publications while the number of academic staff employed in the university sector has not increased to the same degree in relative terms.

While Figure 5.1 illustrates considerable increases in both outputs and efficiency, financial incentives are seldom without unanticipated or perverse consequences. Research has shown that there is a concerning

Figure 5.1 Research publications and academic staff at South African universities: 2000–2016



Source: Department of Higher Education and Training (2018), compiled by Charles Sheppard

increase in predatory publications, although the increase is not evenly distributed (Mouton & Valentine 2017). At the traditional research universities (including the University of Cape Town, University of Pretoria, University of the Witwatersrand, University of KwaZulu–Natal, Stellenbosch University and Rhodes University), the proportion of predatory publications to total publication is less than 1%, while at some of the aspirant research universities it is more than 20%. Notable is that the traditional research universities offer more modest, indirect incentives tied to research compared to the direct financial incentives offered to researchers at the aspirant universities.

Research incentives and a differentiated higher education system

Incentivising research activities such as the supervision of doctoral students and producing publications is one way of improving knowledge production. But when applied at the system-level, there is the danger that the incentives on offer will entice all universities in the system towards the same goal. Van Vught (2007: 6) has pointed out that tertiary systems around the world have tended to become less diverse and differentiated. He attributes this to a combination of one-size-fits-all government policies which lead to homogenisation, and the ability of powerful academic communities to defend their norms and aspirations. Differentiated systems have several positive effects for higher education, including allowing different universities to fulfil their equally important, often contradictory functions (Castells 2017). The upshot of a differentiated system is that not all universities can and should be research-led universities. At the same time, as the example of South Africa illustrate, incentives should promote a differentiated system.

As pointed out in Chapter 1, Altbach (2013) stated that developing countries need to differentiate the missions of their post-secondary institutions for research universities to flourish, but that few developing countries have managed to do this. Ng’ethe et al. (2008) observed that the expansion of higher education in Africa had not been accompanied by differentiation; instead, they found evidence of institutional isomorphism whereby newly established institutions tended to replicate the dominant ‘flagship’ university. In other words, the impulse was for universities to become increasingly alike, rather than to develop diverse and distinctive missions. This is illustrated, for example, in statements such as the one made by the University of Dar es Salaam in its ‘Five-Year Rolling Strategic Plan: 2008/2009–2012/2013’ which reads that it aspires, ‘to assume a leading role in providing university education and professional or vocational training in centres of learning, *and* in promoting research’ (University of Dar es Salaam 2009: 6, emphasis added). This process is

further entrenched by government funding frameworks that do not differentiate between undergraduate and postgraduate students and that do not incentivise research.

Government policies aimed at increasing the capacity of the higher education system by establishing new universities have in general adopted one basic university model as the template, with the result that the new universities try to become clones of existing institutions in the sector. In addition, public and private institutions that enjoy levels of institutional autonomy that allow them to develop unique profiles have, in general, adopted similar, budget-maximising approaches (for example, in the form of recruiting large numbers of fee-paying, private students) (Ng’ethe et al. 2008).

Unlike in South Africa where the predominant incentive on offer to a university academic is linked to supervision and publishing, in the other seven countries that are home to participating Herana universities, the predominant incentive on offer is linked to teaching. In none of the systems is there evidence of incentive regimes that encourage different academic activities at different universities. Africa may learn some useful lessons about developing a differentiated higher education from China (see Box 1).

BOX 1: CHINA: MASSIFICATION AND DIFFERENTIATION

After 4 June 1989, when the Chinese government sent in troops to end the occupation of Tian’anmen Square by student protesters in the heart of the capital, Beijing moved to quell discontent through increased repression of political activism and further liberalisation of the economy. Policy-makers prioritised the development of higher education, in part to address the problem of protesting youth but also as part of the broader economic development project. The number of students enrolled for undergraduate courses doubled during the 1990s, growing from 2.1 million to 4.1 million, before tripling to a remarkable 22 million during the first decade of the new millennium. In line with this huge growth, the percentage of China’s 18- to 24-year-old population enrolled in tertiary education rose from 3% in 1991 to 24% in 2009 and to 33% by 2016. By 2016 a record-breaking 7 million students graduated from Chinese universities – more than double the number of the graduates in the US that year and ten times as many as had graduated in China ten years earlier (Stapleton 2017). These numbers represent the fastest expansion of any higher education system in history.

At the same time as overseeing this unprecedented massification (in other words, ‘warehousing’ [Castells 2017]), Chinese policy-makers successfully introduced significant differentiation within the system. The increase in the number of postgraduates was greater than the rise in the number of undergraduates.

Graduate enrolments grew from 128 000 in 2000 to over 538 000 ten years later. In addition, China produced 49 000 PhD graduates in 2010, 40% of whom took their doctorates in science, technology, engineering and mathematics (STEM) disciplines. This was more than any other country and represented a tenfold increase over the number of PhDs produced in 1999. Over roughly the same period, from 2000 to 2015, the number of Chinese universities in the top 500 in the Shanghai Jiao Tong rankings rose from 9 to 44.

How did China, a developing country, manage to achieve so much so quickly? In particular, how did it fund the massification and differentiation of its higher education system? The answer is, in part, through an increase in the national higher education budget from 1994, which rose from less than 1% of gross domestic product (GDP) to almost 3%, and, in part, through the introduction of a system of universal tuition fees, tapping into the savings of the rapidly expanding middle class, which was supported by a large-scale, regionally-based regime for issuing loans to assist poor students. The system was implemented through regional credit cooperatives, which were underwritten by the China Development Bank, and offered investment opportunities for the middle class, while issuing student loans which could be paid back over a 10- to 15-year period.

Dong et al. (2018) describe six phases of government driven reform which started during the 1950s with so-called 'Key Universities Construction' policy. The process was accelerated in 1994 when the targets and intentions of the 211 Project were specified. The main policy was to develop 100 world-class universities for the 21st century. Then president Jiang Zemin stated that to achieve modernisation, China must have world-class universities (Dong et al. 2018). In many cases, such as in Shanghai, these universities were jointly developed by the central government with local cities and regions. A total of 99 universities were selected from 1 683 public colleges for the project, 34 of which were identified as research-oriented universities. In 1998, during phase four, the 211 Project was supplemented by the 985 Project, which made substantial additional resources available to Tsinghua University and Peking University (Nian Cai Liu in Altbach & Balán 2007). These two institutions were ranked among the top 100 universities in the world in 2016, making them the only universities in the developing world to achieve this status.

The Chinese government's focus on differentiating its higher education is further demonstrated in the classification system which it developed for the sector in the early 2000s. Combining the Carnegie and the Japanese systems with 'Chinese reality', the Chinese higher education system has 39 'Project 985' universities that are designated level 1 universities that receive more funding, and 112 'Project 211' or level 2 universities. To be classified as a research university an institution had to be able to achieve a ratio of at least 0.7 articles in World of Science publications per academic per year (Nian Cai Liu in Altbach & Balán 2007).

However, the most influential classification system that has emerged in China has been that of Shanghai Jiao Tong. This was not originally established as an international ranking system - although this is how it is now widely used - but

rather to assess the progress being made by Chinese universities on their way to becoming world-class. The ethos informing the establishment of this classification system was revealed at the 2013 International Higher Education Research and Policy Roundtable in Shanghai (Siwinska 2013) when, in response to the question why they included Nobel Prize winners in the ranking system when China did not have Nobel Prize laureates, the response given was that to be world-class, you must have a Nobel Prize laureate.

In the Herana Phase 1 study on three systems that successfully linked higher education to development (Pillay 2010), differentiation was achieved through a pact, and we argued that African countries should strive to achieve a social agreement between universities, society and government if they want to enhance the role of universities as ‘engines of development’ (Cloete et al. 2011).

However, what we did not comment on was the unique political systems of these countries. Finland and North Carolina both have strong liberal democracies, while South Korea is a very strong developmental state. In China, the differentiation of higher education (simultaneous with massification and the introduction of fees) was achieved in a very different kind of state, one with a strong central party and a citizenry steeped in a culture that has valued education and meritocracy since the establishment of the oldest education system in the world. The political and cultural configuration of a ‘pact’ provided fertile ground for the centralist government to exploit, by introducing a range of funding and other incentives in support of a meritocratic system. The public has supported the system of a fees-based funding model, with regions and provinces setting the actual fees and loan support through regional credit cooperatives.¹⁵ In turn, the universities accepted performance monitoring based on objective, evidence-driven assessment criteria.

Conclusion

Despite national policy documents promoting the importance of new knowledge to advance development, the absence of the state as a primary agent supporting research in Africa has allowed others offering incentives for research to exert greater influence on a range of activities and inadvertently weakening the research enterprise in universities. In at least one university in the Herana group, the application of inadequate and fragmented incentives for research from multiple sources has weakened the research enterprise of the university.

¹⁵ Thanks to Ou Yufang for expert inputs.

In South Africa, where supportive policies and incentives for research are in place, and where there has been an observable increase in research productivity, there are also unanticipated (perverse) factors that have become evident.

A serious challenge for governments in Africa is to create higher education systems in which universities will be strong and dynamic enough to withstand the tensions inherent in their multiple, contradictory functions, while at the same time being able to respond to what they see as their specific mission at any given moment in the history of the system. The fulfilment of different functions, including that of research, cannot be resolved within individual universities alone. Ideally, the functions need to be distributed with particular institutional types undertaking different combinations of functions in response to the suite of incentives on offer. For the eight universities that participated in the Herana project, a differentiated incentive scheme that comprehensively serves all the important functions of the university, is still to be developed.

Chapter 6

Evidence-based planning and governance

‘Governing without data is like driving without a dashboard,’ said former UN secretary-general Kofi Annan in his keynote speech at the Dakar Higher Education Summit in 2015. Central to the Herana project was the acknowledgement that the systematic collection and analysis of performance data made possible by digital information systems are the basis for evidence-based strategic governance. The task of collecting and cleaning data, developing data standards and implementing systems for storing, retrieving and sharing data may be unglamorous, but it is essential.

The methods adopted by the Herana team to embed the collection and use of organisational performance data in support of their transition to research universities were both opportune and collaborative. It capitalised on each participating university’s self-articulated strategic plan to become research-led by introducing agreed-upon procedures for data collection, standards and indicators to provide an empirical foundation for assessing organisational performance and change at each university. Data were collected, organised and verified as part of a collaborative effort between the Herana team and the university representatives. Data were interpreted, presented and discussed at regular Herana seminars and at forums hosted by the participating universities.

The project’s focus on data was opportune for two reasons. First, the establishment of Herana took place at a time when Africa’s flagship universities were expressing aspirations to become research-led universities but lacked systematic processes for collecting and interpreting data, particularly in relation to research performance. Second, the Herana project coincided with an increased emphasis globally on university ranking systems from which African universities were, and still are, largely excluded.

The first section of this chapter elaborates both the challenges faced by the universities in collecting performance data as well as on their achievements. However, it became apparent that university-level data collection, analysis and planning capacity are inexorably linked to national data systems, national planning capacity and funding. The second section of this chapter reflects on these aspects.

Planning, the importance of evidence and the role of Herana

From the Herana project it has become apparent that the management of information is an indicator of the degree of organisational coherence or fragmentation. While in some cases fragmentation is the result of a shortage of trained staff or inappropriate technology, in others, a major problem appeared to be the lack of systemic procedures related to the collection, storage and retrieval of data. Because institutionalisation is the basis for evidence-based policy and management, it becomes problematic when 'one-off' datasets are used to influence decision-making. Limited capacity for analysing data and translating it into policy information also has various consequences. These factors often lead to a mismatch between aspiration and reality, where institutional leaders and websites declare their universities to be 'world-class' while in some of these universities, academics publish on average one article every five or ten years as the previous chapter has shown.

Bunting (2014) described in detail the limited institutional data capacity encountered during the 2009 data collection exercise conducted as part of Herana Phase 1. He found that some universities could not extract the required data because they lacked appropriate, functional and comprehensive electronic student and staff databases. In some cases, the classifications for the data were inaccurate; in others, the data sets were incomplete. Some institutions lacked a central management information office for storing complete data sets. The translation of the data into indicators posed another major challenge as did the absence of comparable performance data among peer institutions. By the time of the launch of Herana Phase 3 in November 2014, the capacity of the participating universities had improved markedly and, as was illustrated in Chapter 2, there are now comparable performance data for the eight flagship universities in the study. However, in order to become research-led universities, most of the participating universities need to strengthen further their planning and research management offices.

If the future development of research universities in Africa is to be more evidence-driven, then the Herana project has made a contribution to this process by developing an agreed, common, data collection and analysis framework among eight universities and by creating some

capacity in data collection at each of the participating universities. However, during the consultative forums convened by Herana, it became clear that while there has been an improvement in the data-collection capacity at all the universities, as well as an increase in the use of data, the institutionalisation of information gathering, and especially the centralisation and analysis of data, still posed considerable challenges. In this regard, improving capacity at the Herana universities has not necessarily led to institutionalising data collection and its use in evidence-based planning as optimally as Herana might have wished.

This is well illustrated in Makerere University's '2017 Strategic Plan Review' which asserts that the university continues to have fragmented and inconsistent information provision because of the lack of a one-stop information centre and that much still needs to be done about strengthening the institutionalisation of data. It goes on to say that 'there is no rationalised research performance monitoring and evaluation either by colleges or individual academic staff. As such, the systemic status of research facilities review, prioritisation and resource-allocation remains fragmented and a preserve of the respective colleges' (Makerere University 2017: xii).

Such self-assessment in a public document is noteworthy among universities in Africa (and elsewhere) and shows a strong awareness of, and commitment to, open, transparent evaluation. The comment is indicative of the increasing importance of data for planning and for the governance of research at all the participating institutions.

Beyond awareness is the use of data for planning and governance purposes, and a required investment in digital infrastructure and the creation of organisational structures to support the collection and use of performance data for such purposes. Two examples from Makerere University and the University of Ghana support the claim that participating universities are becoming more data oriented. In the case of Makerere University, the example illustrates the use of data while the example of the University of Ghana illustrates organisational investments and adaptations for incorporating data into their plans and performance reviews.

The 'Makerere University 2001-2005 Strategic Plan' was published just before the Herana project commenced. The plan states that research was one of the core activities of the university and that the university would take 'forward the development of a critical mass of science and technology and research'. It also states that there was a need to strengthen the coordination of research activities, to enhance research skills among staff, and to put in place mechanisms for the dissemination and utilisation of research results. However, the only data in the report were a set of financial tables projecting institutional costs for the period 2001 to 2005.

In stark contrast, the university's '2017 Strategic Plan Review' published at the end of Herana 3 explicitly articulated the direction of the university as: 'a research-driven university in which research and teaching/learning are mutually reinforcing' (Makerere University 2017: ix). Accordingly, it prioritised the establishment of research and technology innovation incubation centres, knowledge transfer partnerships and a networking partnership. In addition, the knowledge-production goals are clearly underpinned by evidence-based planning in the 2017 document. The review contains a detailed section on Makerere University's research achievements which are supported by data. To illustrate: 'Increased research output in form of publications especially in journal articles which has more than doubled, policy briefs and paper presentations at national and international conferences. This has propelled the university (to rank) among the top 10 over the period under review. The university has been able to train more staff to PhD levels from 420 to 732. Staff at senior levels, namely professors, associate professors and senior lecturers, has improved not only the quality of teaching but also research and innovations and knowledge transfer and networking' (Makerere University 2017: x).

Increasing research outputs, doctoral graduates and senior staff are three key Herana performance indicators. In an even more radical departure from the 2001–2005 plan, the 2017 review contains 16 data tables and 29 graphs providing performance data which presents an assessment of its achievements from 2008 to 2015, which dovetails with the Herana data (Makerere University 2017). Many of the data tables and graphs are the same as those prepared for the Herana project and – in the case of research outputs – go beyond the Herana data. Using the SCOPUS bibliometric index, Makerere University planners not only calculated percentage increases in publications but also disaggregated the data by type of research output (see Figure 6.1).

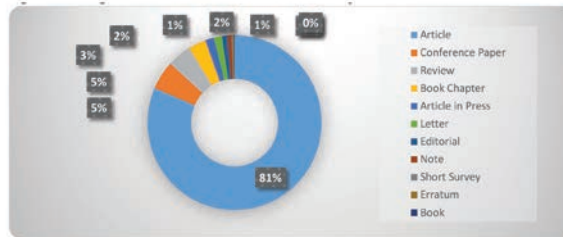
The data and indicators were used by Makerere University's management to assess performance over the 2008 to 2015 period and as a basis to inform the planning and governance functions of the university. It is a radical departure from the aspiration-driven approach that had characterised the pre-2008 period at Makerere University. Responding to a question about whether the institution had produced its own indicator document with evidence-based policy proposals for strengthening knowledge production, the university noted: 'The university annually produces two indicator documents. The annual Fact Book gives a snapshot on the indicators of the university. The self-assessment report, discussed by university management and other academic leaders in the university, makes comparison to especially some of the eight universities under Herana. The university planning and reporting process is captured by the practice of evidence-based policies. This presentation captures the key

Figure 6.1 Figures extracted from the Makerere University 2017 review

Figure 11: Trend of Research Publications in the Scopus database for Mak



Figure 12: Categories of Research Publications in the Scopus database



Source: Makerere University (2017: 22)

gaps in the performance of the university. This is further strengthened by the league tables and other initiatives that require the university to demonstrate outputs and relevance' (CHET 2017).

At the University of Ghana, the university registrar, Mercy Kuukuwa Agyaakowa, reported that the institution was committed to becoming research-intensive. In its 'Strategic Plan 2014-2024', research is cited as being central to the university's transformation process (University of Ghana 2014). The plan states that the university's priority is to create a climate that will stimulate research and community engagement. To that effect, it has:

- adopted an integrated enterprise-level software system;
- established an institutional research and planning office; and
- created a research-management structure headed by a pro-vice-chancellor with responsibility for research, innovation and development, with a director of research assisted by research development officers to identify research opportunities, create awareness of these opportunities, help with applications and conduct research administration.

In November 2013, all participating Herana universities were asked to write a short report on the use of the data with specific reference to the use of data

for managing the research performance of their university. The following are some of the important points that emerged from their reports:

- Data are used internally for monitoring and evaluating the institutional strategy.
- Research performance indicators are crucial for establishing the interface between research impact and appropriate research policy.
- Calibrating research performance by academic rank is currently a vital research management information activity.
- The Herana indicators have been a crucial source of cross-national and cross-institutional comparative data and have enabled the university to assess its performance and develop a set of new goals for the future.
- Indicator reports have been used as a platform to get feedback from both internal and external stakeholders about university core activities.
- The indicators have, in some countries, started to inform national discussions on the performance of public universities.
- The university has used the data to initiate action to engage government more actively to determine and execute relevant research aimed at economic development.
- The comparative indicator data has been important for beginning to inculcate evidence-based decision-making within the institution. (CHET 2017)

As part of the Herana project, a series of forums were held with university managers concerning the collection of data and their use in academic planning, for example, in enrolment management and the utilisation of staff resources. Significant changes in the collection and use of data were revealed among the participating universities. Feedback from participants also indicated that continued training of staff responsible for managing data and greater investment in new technology in support of their efforts are required to institutionalise the collection and analysis of information in support of evidence-based institutional strategic planning and implementation.

Notwithstanding the ongoing challenges in institutionalising data collection and use, the strategic plans adopted by the universities in the Herana network, which emphasised the importance of becoming research-led universities, were clearly shaped by the use of the Herana indicators on knowledge production concerning, for example, the ratio of undergraduate-to-postgraduate enrolments, the proportion of senior staff with doctorates, doctoral enrolments, and graduation and research outputs. In this regard,

one of the most important achievements of the Herana project has been the heightened awareness of the importance of valid data for producing evidence-based planning and policies (CHET 2017).

At most of the participating Herana universities, their respective governments require mainly undergraduate enrolment and graduation data, and, in some instances, performance in comparison to the previous reporting period. What is not required are national and international comparative performance data, and a focus on data related to a particular reform or institutional-strengthening strategy. A second, critical, achievement of the Herana project was to produce an agreed-upon, common data framework among the eight universities each located in a different African country. This framework includes standardised definitions of key terms in higher education data (e.g. full-time equivalent, weighted publications, etc.), a classification schedule of programmes and qualifications, and templates for inputting raw data (Bunting 2014). Equally important from the perspective of the overarching interest in research universities, Herana has provided indicators specific to the assessment of research performance at universities in Africa. These indicators provide guidance to strategic initiatives such as ARUA as they negotiate membership criteria, standards, policies and indicators for the assessment of the research performance of member universities.

Government capacity, systems and data quality

A lack of capacity is often used to account for failures in African higher education, and capacity development remains a challenge at both the institutional and national levels even though the staff capacity of central administrative units in the eight Herana universities has overall been expanded (Maassen & Jungblut 2017). Visits to the offices of government departments responsible for higher education in the eight Herana countries were often disconcerting: piles of administrative folders surrounded the officials, among whom there were PhD-educated bureaucrats with some university teaching experience. By contrast, at least some of the national higher education commissions and councils seemed better resourced with more professional, business-like offices. The research group also observed that the government bureaucrats they met seldom interacted with officials in similar positions in other countries, and that they were generally absent from the capacity-building higher-education conference circuit.

In terms of strengthening higher education divisions in education ministries, a debate continues about whether higher education systems should have a dedicated ministry of their own, rather than being embedded within broader education ministries, or whether higher

education should be combined with other key knowledge areas (such as science and technology) in a so-called 'super ministry'. Although there may be no ideal model in this regard, this is a public governance issue that should be kept on the table.

The creation of quasi-independent government agencies in the field of higher education opens up space for developing and concentrating specialised capacity and expertise at the level of national governance. Higher education councils/commissions in the Herana study have developed expertise around key functions – both internally and within other institutions and the sector at large – relating to quality assurance, planning, research, policy advice and stakeholder engagement (Bailey 2015). Arguably, this brought capacity into the system that had not been available in the parent ministries or their departments. However, the most commonly cited obstacle to implementation in all eight councils/commissions was a lack of capacity. This was manifested as shortages of staff within these organisations because vacancies had not been filled and also a lack of expertise in specialised areas such as quality assurance, research and data analysis.

Capacity issues also emerged in a study on science-granting councils in sub-Saharan Africa. Mouton et al. (2015) advised that opportunities should be created for these councils to share information and learning on a regular basis, and that the capacity of their programme officers and staff should be systematically strengthened. The authors also supported the establishment of accredited training courses and workshops for continuous professional development in areas such as peer review and evaluation procedures; grant-making; management of international science and technology agreements; policy analysis and research; priority-setting for science, technology and innovation; and the basics of research and development management and bibliometrics.

Comprehensive, up-to-date data on higher education institutions and sectors is crucial to the effective implementation of a range of governance functions including decision-making in relation to the accreditation of institutions or the allocation of funds; policy advice to government; and strategic planning for institutions and the sector. Four of the eight Herana countries had a tertiary or higher education management information system in place, but only those in Mauritius and South Africa could be considered comprehensive. In South Africa, the information system was housed in the national Department of Higher Education and Training, while in Mauritius it was located in the Tertiary Education Commission. The locations of such information systems, which are decided by the government, can affect their impact.

What remains missing in the higher education information systems of many African countries is an incentive for universities to provide

performance data to a central administrator, either in the form of a government department, the national statistics agency, or a body responsible for the oversight of higher education. In South Africa this problem has been addressed: Universities do not receive their annual government funding if they have not supplied the required data to the department responsible for higher education. In addition, South African universities and academics do not receive subsidies linked to research outputs if they have not supplied the required research output data.

Also absent in most African systems is an incentive for the central data administrator in the system to report to government and/or to the higher education councils. In countries where legal provisions require the collection and distribution of university performance data, data are still predominantly compiled and submitted in paper format. For example, data are collected by means of a paper-based census of universities, converted from paper to digital format by a central agency, collated and prepared as a report to be published in a non-editable format such as PDF, printed and tabled in parliament. In rare cases, the PDF version of the report will be available from the responsible agency's website and the raw data may be made available upon submission of a formal request. This places serious constraints on both the accessibility and reuse of data (Van Schalkwyk et al. 2013). Limited access and reuse, in turn, stifles improvements in data quality. The more eyes there are examining the data, the more likely it is that discrepancies and inaccuracies in the data will be brought to light. Exposing data problems is not only important in terms of making corrections to published data, but can play an important role in adjusting data processes and standards in order to reduce the risk of recurring data errors.

Herana experienced at first-hand the value of publishing its data openly. On several occasions, this resulted in data being challenged by administrators and university leadership. For example, disagreements would ensue over the number of doctoral graduates for a given year in the Herana data and a vice-chancellor's recollection of how many doctoral graduates he capped at the graduation ceremony of the same year. Or the number of publications recorded in the Herana data would be challenged. In each case, the processes and standards followed by the Herana team were tested, and more accurate and authoritative data on a university's performance could be produced and recorded.

Data for planning and governance

The Herana forums were hosted by most of the participating universities and attended by, amongst others, members of council, with the latter expressing an interest in the available data and suggesting improvements

in university systems to afford them greater access to the university's performance data. Nonetheless, the forums also confirmed a breakdown in the flow of performance data from planning and other administrative offices in the university to the university council, as well as to university executives, ministries and other national government agencies.

Research on the use of data in South African universities (Van Schalkwyk et al. 2013) showed, for example, that at the seven public universities studied, requests for data were seldom made by university councils. At one of the seven universities in the study, where performance data were presented to that university's council on the back of the initiative taken by the planning office, data were often met with suspicion. The council of that university would insist that the data provided by the planning office be verified by a third party before it was satisfied that the data reflected an accurate state of affairs. The university was the only one in the study facing a crisis in its governance (Van Schalkwyk et al. 2013).

This implies that producing more and better data and elaborate charts and infographics does not necessarily equate to their use by university council or university executives in strategic decision-making, nor does it mean that more and better data on university performance will be used for national governance purposes. In other words, while data collection and analysis for planning purposes may be improving (in step with the increased professionalisation of university administrators), it does not necessarily follow that there will be an improvement in the governance of African universities. At the very least, it cannot be assumed that university leaders responsible for governing transformation will be interested in the information and data provided by planning offices to take decisions that will result in improvements in their research performance. A pilot survey undertaken at two of the Herana universities (Maassen & Jungblut 2017) suggests that part of the challenge is that university leaders on the one hand stimulate an enhancement of the capacity of their central administrative units, in the sense of increasing the number of staff positions in these units and recruiting better educated and more experienced staff for these positions. But on the other hand, the mandates of the units are in a number of ways restricted by the institutional principals which creates various barriers for these units to use their enhanced capacity for producing the data they as professional experts perceive to be of relevance for evidence-based governance.

In addition, while Herana data show that as the eight participating universities moved to becoming more research-led, the problematic governance relationship between university and national government actors and agencies is regarded by the institutional representatives as hampering the further strengthening of their university's research productivity. Therefore, it is of importance to differentiate between

planning and governance, and to get a better understanding of differences in how data is accessed, interpreted and used in the execution of each of these functions. The effective use and value of data for the transformation of universities will depend on the links between evidence-based planning and evidence-based governance. While Herana did not explore these differences, future research in this area will need to be mindful of the distinction. This is embedded in the overall importance of investigating the basic features of the public governance of higher education in Africa, including recent changes in public governance arrangements and the relationships between higher education governance and institutional as well as system-level performance. This will also allow for producing knowledge on the governance-related factors that are responsible for cross-country differences in the performance of individual universities and national higher education systems in Africa.

Conclusion

One of the strategic objectives of the Herana project was the institutionalisation of eight years of capacity-building in performance data collection within the eight participating universities and the promotion of institution-specific policies to contribute to the universities' knowledge-producing capabilities.

In relation to these goals, the project's main achievements were in developing a common data framework among the eight universities; improving their data collection capacity; advancing and promoting the importance of data-based decision-making within the universities; indicating the kinds of strategic directions that leading universities in Africa may take in engaging internal and external stakeholders to strengthen their knowledge production, and linking this more closely to national economic development; and promoting the importance of research-led universities on the continent.

However, much still needs to be done to institutionalise data collection and use across the participating Herana universities, in ARUA, and, more broadly, in the higher education systems of African countries. Universities in the network will also need to go beyond data collection and management. They will need to incorporate the systematic analysis and interpretation of data in a more structured and expertise-driven way into their decision-making processes as they govern the university's transition to becoming research-led.

Chapter 7

Knowledge and networks

In this chapter, we shed light on some formal features of Herana and of the evolution of the global science system in order to deepen our grasp of the possibility and limits of networks like Herana and of the dynamics of the global science system more generally. We will do that through the lens of the theoretical concept of a 'network'.

The first section of the chapter considers some general characteristics of networks; the second considers Herana itself as a network; and the third section considers the global science system as a network in order to see how that might impact both on emerging scholars from the developing world, and on the operation and possibilities for development of the national science system and the economy. The chapter concludes with a few brief comments on the implications of understanding development projects in network terms, particularly those projects with ambitions of establishing productive links with the global network of science while remaining relevant to local development priorities.

If our singular focus on networks seems forced, it is because we wish to foreground a particular understanding of an increasingly salient organisational form. We are certainly not suggesting that it is only networks that matter. Rather, we wish to suggest that networks as a form of social arrangement is often overlooked or goes unrecognised in favour of other arrangements (such as institutions) that may be less suited for the ambitions of knowledge-for-development projects.

Why networks matter

The network as a particular type of social arrangement does not necessarily capture all the social dynamics that account for the success (and limitations) of Herana. The dynamics of social institutions may also provide insight and, as Owen-Smith and Powell (2008: 11, 24) argue, networks and institutions should be regarded as 'co-constitutive'. We

do, however, believe that our use of the concept of the network departs from more conventional notions of networks as merely comprising of contact lists or links between institutionally-bound actors. Instead, at the risk of oversimplification, we see networks as flows of information dislocated from place, infinitely scalable and occurring on a global scale in real-time, resulting in a new way of conceptualising how social arrangements are formed (Stalder 2006). We also see networks as an increasingly central form of social organisation in the global world characterised by the emergence of the knowledge economy and the age of information.

Like institutions, networks are durable sets of social arrangements directed to coordinate a set of common purposes. Networks have been a form of organisation that can be found in all forms of life. They have become far more salient since the 1950s as an organisational form particularly appropriate to organising social life by means of the new technologies of communication, allowing for both space (or distance) and time to be compressed, allowing in turn simultaneous communication of multiple participants in real time over great distances, where only common purpose governs the terms of interaction. In other words, today's networks are profoundly different from traditional social networks. As Castells (in Stalder 2006: 181) explains:

to be sure, networks have always existed in human organization. But only now have they become the most powerful form for organizing instrumentality, rather than expressiveness. The reason is fundamentally technological. The strength of networks is their flexibility, their decentralizing capacity, their variable geometry ... Their fundamental weakness, throughout history, has been the difficulty of coordination toward a common objective, toward a focused purpose, that requires concentration of resources in space and time within large organizations [...]. With new information and communication technology, the network is, at the same time, centralized and decentralized. It can be coordinated without a centre.

Actors wishing to join a network, and thereby to become a 'node', will be vetted by a more or less stringent gatekeeping process. Some networks are 'closed'; the criteria for entry are highly specified, and only those who meet the criteria for entry are granted access. Others are less stringent; and some are 'open', which is to say, anyone can in principle join. In many cases, this 'openness' is more apparent than real, because the principal rationale of every network is to pursue a specific purpose or set of purposes. This means that the principal criterion for would-be

members of the network is that they are able to ‘add value to the network’ (Castells 2011: 774), that is, to the central purposes of the network.

As we see further below, the global science system is apparently open, but those that do not add much value simply get ignored: they will not gain citations, get invited to collaborate, or otherwise gain peer recognition. The other side of this coin is that entrants must themselves feel that it is in their interests to belong to the network. When they no longer perceive the benefits deriving from membership, they will leave the network. Members must add value; networks provide benefits. This is what sustains the network.

The principal form of social organisation and integration up to the advent of the new communication technologies was hierarchical, a principle of organisation that is an expression of the power and interests of an elite. This was and is the case whether we consider the state form itself, the military, organised religion, or the bureaucracies of the civil service. It was a command-and-control structure that proved its superior organising ability for centuries before the advent of electronic communications technology. The principal of organisation and integration of networks is horizontal, or ‘flat’. There is no central organising power vested in a person. What controls the network is a set of rules and codes which organise network interaction. Castells calls this set of rules and codes the network ‘programme’ (Castells 2009: 20), and the person, or usually a set of people, who set the programme in the first place have what he calls ‘network power’. These are the ‘programmers’ (Castells 2009: 42–47). However, once the programme has been set and accepted as the network programme, it develops something of a life of its own. In Castells’s terms, the programme becomes ‘self-configurable’. This contributes to one of three features of networks that make them distinct from hierarchical organisational structures. These are: speed and flexibility (adaptability and self-configurability); scalability (the ability to add or lose nodes); and survivability (there being no centre that can be ‘captured’ as in hierarchical organisations, although re-programmers and switchers can certainly disrupt or change the programme).

This latter point raises a critical feature of networks that bears both on Herana as a network and on networks of scholars and researchers that organise the focus of global scholarship. This is that networks do not respond well to regulatory forms that originate in hierarchical forms of social organisation. Of course, all academics ply their trade at a university, which is one of the oldest and most enduring hierarchical forms of organisation. But increasingly most academics also practice their scholarly activities in scholarly networks or in international and global forms of collaboration that are not easily steered by plans and

priorities set by the university or the national polity, even though they are incentivised and remunerated by their universities. We will examine some of the risks and opportunities this potential disconnect poses to the continuing vitality of Herana, or to scholarship in other networks.

Herana as a network

Before Herana, the eight universities were doing little to organise and coordinate their research activities and to record their outputs apart from setting out aspirations and ideals about research in their annual plans (see Chapters 2 and 6 above), including their aspiration to join the global network of science comprised of ‘excellent’ and ‘world-class’ research universities.

Most importantly, most of the universities had yet to develop a *systematic* data capture system that could provide them with robust and stable evidence on which they could make assessments of their academic core track record, and which was essential for strategic planning and decision-making. The first opportunity Herana thus offered the would-be Herana institutions was that they would receive expert collaboration to develop the instruments that would make this possible. This was the core resource that Herana offered. The price of entry was that they would commit to the collective process of indicator, instrument and target development.

Herana therefore had criteria for entry into the network, which were that members had to undertake to develop a data collection and processing system, and maintain it for the duration of the project. These criteria were subscribed to for the duration of the project with only the University of Cape Town providing some resistance because its extant data collection and processing systems did not mesh effortlessly with the standards (indicators) accepted by the network.

An aspiration to be a research university and the apex contributor to the national science system were more implicit requirements. Again, these criteria were tested in the Herana network. The Nelson Mandela University was originally the university from South Africa invited to the network. While it easily met and committed to collecting and processing the data required by Herana, it was excluded from the network after Phase 1 of the project by the other university nodes because it did not meet the criteria of being an apex institution in the South African science system. It was replaced by the University of Cape Town. It is important to note that by that stage it was not CHET or the Herana project team that brought the University of Cape Town into the network, although they might have been the ones actively negotiating their participation. A space was created for a new node in the network because the other nodes

in the network authorised its inclusion based on the criteria established by the network.

As indicated above, when nodes in a network no longer perceive the benefits deriving from being part of the network, they leave. This was also observed in Herana when the University of Nairobi ceased to participate in the Herana network. Rather than providing benefits to the University of Nairobi, the network exposed the relatively poor performance of the university in relation to other important nodes in the network, principally Makerere University.

Chapter 2 details the development of the founding ‘principles’ of Herana into a set of six propositions, which were then operationalised and successively refined into a set of indicators and their criteria for collecting robust, comparable evidence on the operation of the academic core over time. Both input and output data were collected, and notional targets set for each of the core data indicators. The combination of input and output indicators as defining characteristics of the research university in Africa differentiated Herana from other assessments of research performance. However, as shown in Chapter 2, the indicators that came to be most critical for the universities’ aspiration to be ‘research-led’ were the high-level outputs of doctoral graduates and research publications.

This would seem to suggest that Herana was at root a developmental exercise, and indeed, a good deal of development went into the fashioning of the final product. But as the chapters in this book also make clear, Herana was both a research project mapping academic core trends and comparing them between the eight institutions over time; and a development project, helping the institutions to map their own data, and to use it for strategic purposes. In this sense, Herana was a developmental capacity-building network. From this development perspective, what Herana set out to develop was the joint construction of a data tracking system that none of the universities possessed at the start of the process.

This meant that, insofar as the universities even wanted to track their knowledge production activities, they couldn’t, because they did not have systematic methods nor instruments to do it with. What is more, many of the institutions did not even realise what they didn’t have, so the first task was to persuade them of its long-term value for their strategic planning and policy development. Herana’s first task then was to generate institutional buy-in. This had to happen at the top, at the level of the planning departments, but also at the level of the faculties who had to assemble and supply the raw data to the planners. They had to buy in, and they had to stay in. And by and large they did.

Herana had then to generate a rolling consensus over the evolving categories of capture, taking into account the local realities of either poor

record keeping and data gaps or legacy data systems that could not readily provide the necessary data. Through this sometimes-thorny process, Herana had to keep everyone in the project so that when it was done, the final instrument was perceived by all as thoroughly legitimate. And with this instrument, all the partner institutions had a mechanism for longer-term institutional planning and steering, and the wherewithal to compare themselves to their peer partners on the same indices.

If we consider Herana as a network, we can see that Herana actually comprised the more visible, external network of the eight institutions – the network proper – as well as inner subnetworks that legitimised and guided the process of network formation and nourishment.

It would be natural to say that there was a single subnetwork and that the subnetwork of Herana was CHET. But it would be more accurate to say that there were two Herana subnetworks or expert clusters connected to the institutional network. The first subnetwork was an expert group recruited by CHET for their expertise in, and deep experience of, data management. The second was also an expert group but their expertise lay in higher education studies, particularly related to matters of governance and institutional change.

This expert data-subnetwork knew their way around data, how to clean it, how to configure it, how to use it. To put that another way: The network's prime mover, the CHET Board, compiled an expert team who proved equal to the developmental job, and who also stayed in until the end of the process. Together, this team, in Castells's terms, was the network programmer which became the custodian of the network standard and its guarantor of probity and efficacy. What can also be observed is that once the programme had been set, it became very difficult to change by any one actor; equally the successive refinements of the programme show the ease with which re-configuration could happen with a coordinating programme structure regulating the process and to whom the process was accountable.

This data expert subnetwork assumed the role of the network programmer in a singular way. It was not itself an interested party in what the standard should look like. Its interest was from the start on design coherence and operational implementability. It set itself up, not as a contending player, but solely as the custodian of the standard and its development. Each institution became committed to participation and the task of setting up institutional systems; in return, the institutions could, in a grounded way, benchmark themselves for the first time against both their immediate peers and against the apex peer in the network, the University of Cape Town. And because CHET published the Herana data under an open license on its website and in online data repositories, other universities, researchers, policy-makers and donor

agencies are able to access the rich comparative data for further analysis. By doing so, the programmatic standards set by Herana may propagate to other emergent networks in the global system of science.

While this subnetwork did not deliberately devise a programme to contend with the existing programme of the global institutional network – one founded on institutional reputation, increasingly defined by the standards of the global rankings agencies – it did provide an alternative set of criteria and standards that the eight African universities could buy into.

The second subnetwork of higher education studies experts was simultaneously connected to the data subnetwork and to a network of international higher education experts. The connection between the two subnetworks was important because while the data subgroup may have taken a technical and pragmatic approach to creating the standards of the network, the higher education expert subnetwork conferred legitimacy on the concepts in the Herana toolbox. In particular, the concept of the academic core and the indicators for measuring the academic core of a university were developed through ongoing interaction between nodes in the subnetwork, as well between the expert data-subnetwork and the network of universities.

The higher education subnetwork in Herana played an important role in legitimising the network and its programme in relation to other network-like organisations in the global network. The success of the subnetwork's work of legitimising the Herana network is apparent in the formal interest shown by, amongst others, the Guild of European Research-Intensive Universities, the International Panel on Social Progress, the Global Higher Education Salon of the International Institute of Education, the Commonwealth Tertiary Education Facility, the International Higher Education Research and Policy Roundtable hosted by Shanghai Jiao Tong University, and the Consortium of Higher Education Researchers (CHER).

The subnetworks in Herana illustrate some of the advantageous features of networks over hierarchical organisational structures. The network was both scalable and flexible, and did not depend on any single central organising node for its survival. Some may argue that CHET was such a node, but CHET itself operates as a network organisation. The composition of the higher education subnetwork changed regularly during the three phases of the Herana project. Experts entered and exited the network as the value proposition of the network changed or as the network no longer valued the contribution of the expert. The subnetwork of data experts was always going to become redundant once the network had been programmed. And the institutional nodes which are strictly speaking not nodes, but clusters of nodes made up of institutionally-

sanctioned representatives, saw their composition change as those representatives either left the institution, or were promoted to new positions. But neither the entry and exit of experts and institutional representatives nor the diminishing value of a subnetwork jeopardised the survival of the network.

Herana research showed that most of the Herana institutions were far closer to each other at the start of the process than at its end. At the start of Herana, the institutions were mostly clustered together towards the bottom end of the scales. With the network standards and targets clarified, stabilised and agreed upon, some institutions responded with greater alacrity than others to the challenge of expanding their research activities and outputs. The network standard then was a means for differentiating the institutions on a continuum from research-aspirant to research-led. This picture will change and develop as the institutions move forward, resources and conditions permitting.

Differentiation in network terms is not insignificant as it provides the network with one of its key distinguishing characteristics from more communal social morphologies: the heterogeneity of its nodes. As Stalder (2006: 179) explains, a network is 'not based on the idea of sameness, but on the idea of difference among its constituent parts. As much as nodes are defined by a network, they still retain a crucial degree of autonomy that prevents the network from collapsing into one big mega-node'.

At the outset, the centrifugal forces were very similar in Herana institutions and again, as we saw, it was the very poor physical resources which inhibited an optimal use of space and time for serious research, together with the ongoing political instability on the campuses, that created the conditions to force promising and productive researchers away to institutional environments and subnetworks more propitious for research, invariably overseas. For example, Coussens et al. (2018) report that nearly 7 000 African scientists leave Africa every year, citing as principal reasons the lack of mentoring, resources and funding. These conditions will have to change for the Herana institutions to realise their research aspirations.

Be that as it may, Herana has left the institutions with an endogenous instrument to help steer the institution by taking rational strategic choices based on hard information. The institutions can now choose to maximise or minimise their vulnerability to centrifugal or centripetal forces, admittedly by taking what will amount to being tough choices. The network standard is thus a tool for rational strategic decision-making and comparison, whether it gets used in that way or not. But more, the network of the eight universities continues to exist as a collegial resource even if the funding cycle that powered the original

process has ended. For example, the ‘emerging research’ institutions can provide valuable lessons for the research aspirant institutions, since their material and social conditions are still not that far apart. The network ‘glue’ will continue to be the Herana programme, and possibilities for productive collaborative work amongst the institutions will depend on the institutions continuing to maintain their data capture systems based on the original Herana programme. Once the institutions let the network programme lapse, the network will begin to wind down, unless a successor network is established.

BOX 2: ARUA: A FOLLOW-ON NETWORK OF RESEARCH UNIVERSITIES?

The African Research Universities Alliance, or ARUA, was inaugurated in Dakar in March 2015 to create a network of 16 leading universities in Africa. The network’s purpose is to enhance the quality of research done in Africa by African researchers. Its approach is to bring together a number of peer African institutions willing to work together by pooling their own limited resources with a view to generating a critical mass that could more effectively support research. Underlying this is the conviction that ARUA universities could leverage this critical mass for additional resources from outside.

There is some hope that the newly established ARUA network will take over the momentum that Herana created. The fact that the vice-chancellor of one of the emerging research universities was appointed as the first chair of the ARUA board, and that its secretary-general was the vice-chancellor of one of the emerging research universities in the Herana group, bolsters hopes of continuity. As does the fact that five of the eight Herana universities are participating in ARUA.

Much, though, will depend on the network dynamics set up by this fledgling network. Has it, for example, assembled as Herana did an expert network to help inaugurate the network programme and its standard? Has it a clear set of criteria for entry? And are those criteria informed by imperatives related to research? The exclusion of universities found by Herana to be research-oriented or research-aspirational, and the inclusion of those found to be research-led or emerging research universities (see Chapter 2), suggests that ARUA may well be applying research-related criteria. However, there is also some deviation. The inclusion of the research-oriented University of Dar es Salaam suggests that there may be political as well as research criteria in play.

Other important questions for ARUA are: What value do the members add? What benefits do the network provide? Without clear answers to these questions, the new network will not thrive.

Above all, the success of ARUA as a network will depend upon whether the universities see value in the network, and whether they are successfully bound together to a common set of purposes in the form of a network programme. If not, we can expect the universities to gradually drift away.

ARUA member universities: University of Lagos, Nigeria; University of Ibadan, Nigeria; Obafemi Awolowo University Ile-Ife, Nigeria; University of Ghana; University of Dar es Salaam, Tanzania; University of Nairobi, Kenya; University of Cape Town, South Africa; University of the Witwatersrand, South Africa; University of Rwanda; University Cheikh Anta Diop, Senegal; Makerere University, Uganda; University of Stellenbosch, South Africa; University of Pretoria, South Africa; Rhodes University, South Africa; University of KwaZulu-Natal, South Africa; Addis Ababa University, Ethiopia.

Global research networks

In considering the future prospects for the Herana programme, and indeed for the eight Herana institutions, it will be fruitful to consider the larger science field globally, and some of the dynamics that are taking it in specific directions. Science is growing in a distinctively new way and can be considered ‘a new organisation on the world stage’ (Wagner et al. 2015: 1). It is increasingly collaborative, for example, and the percentage of international co-authorships has more than doubled in 20 years (Wagner et al. 2015). Global science can be considered as a global network, though, in reality, it is made up of a myriad of subnetworks or ‘invisible colleges’ (Wagner 2008), each driven by the epistemic interests of its participants, and of widely varying lifespans. Wagner and her collaborators argue that overall the science network is robust, and is not affected by the appearance or disappearance of nodes, neither is it affected by the activities of individual agents. This is because science self-sets the scientific agenda at the cutting edge of the disciplines and depends neither on individual participants nor on and regulative structures external to global science.

There are three noteworthy properties of the global science network. The first is that it is open, in the sense that participants join and leave in a dynamic fashion. But its openness doesn’t mean that everybody communicates or collaborates with everyone else. It is an association of ‘weak ties’. Though there may not strictly be a price of entry, there is a price of recognition, which is reputation and resources. The ‘value’ determining attention in global science is thus either what track record the entrant brings or what resources of value to other members is brought

in. For would-be entrants from developing countries, resources may be an under-appreciated good; science is always seeking to expand its fields of testing and application and developing countries can bring opportunities – like access to rare diseases – that the higher profile members of the network might be eager to gain access to.

The second property is that it is what is called a ‘scale-free network’ (Wagner 2008: 39). That means that very few participants or nodes link to a great many nodes, but most nodes (or participants) are linked to far fewer nodes. The mutual contact rate drops off sharply. This can be seen in the citation and collaboration rates in various fields, where a few ‘network stars’ (Wagner 2008: 41) are ‘high-cites’, the rest tailing off sharply until there is the bulk that have modest citation and collaboration records at best. This feature of being scale-free, says Wagner, is typical of a complex adaptive system.

The third property is that the science network is one that is potentially very rich in resources. It attracts the most productive and innovative researchers, who bring with them in turn access to lucrative research grants, connections to many other nodes with resources. This means that the best researchers in a field are invariably linked to the network. It also means that researchers join and collaborate in the network ‘not because they are told to but because they want to’ (Wagner et al. 2015: 2). They gain direct and indirect benefits from access to expertise, infrastructure, funding and exposure to an ideas hub that is simply not available ‘back home’. Since these scientific incentives drive the activities in the science network, it means in turn that the science system is essentially self-directive and increasingly de-coupled from institutional goals and from national science policies. This has a number of major entailments we will explore below.

The global science network is growing fast, and there are now very many more countries than there were 20 years ago in the dense centre of the network, including more and more developing countries which now compare favourably with more low- and medium-income countries in terms of scientific output.¹⁶ For example, by 2010, the BRIC countries – Brazil, Russia, India and China – had ‘about the same percentage of high-quality science (publications, as measured by the Science Citation Index) from these four countries as for North America and Europe’ (Wagner & Wong 2012: 1001). At the same time, however, there are a great number of indigenous publications that are invisible and therefore remain ‘unseen’ by the global science network, resulting in lower rates of citation.

16 For example, in 2016, South Africa produced more published papers than did Norway, Egypt, Romania, Singapore, Finland and Greece, virtually the same as Israel, and just less than Portugal and the Czech Republic (Marginson 2018: 61).

As the overall network grows, so the interrelationships become denser, which means in turn that there are fewer highly central nodes, and it becomes less important to have direct contact with the ‘star’ nodes. The global science network no longer displays a core/periphery grouping (Leydesdorff et al. 2013: 92). ‘New entrants are able to find collaborators without having to pass through a core of highly powerful (or central) nodes’ (Marginson 2018: 8). This means in turn that fewer nodes dominate the network and contributes to the increasingly ‘democratic’ quality of the global science network (Wagner et al. 2015: 6).

The innovation space in all countries is now directed and regulated by two different logics, one directed by national innovation plans and investments, the other driven by the logic of the science network which operates at a tangent to these national plans. ‘This dynamic system, operating orthogonally to national systems, is increasingly difficult to influence, and even less amenable to governance as it grows’ (Wagner et al. 2015: 12). Wagner (2008: 105) says forthrightly: ‘the (related) concept of a “national innovation system”, while relevant in the twentieth century, (is) waning in relevance and will do little to help build scientific capacity in the developing world’.

This creates difficulties not only for central ministries in developing countries still trying to direct development through command-and-control structures that seek to dovetail national and institutional development plans. It also raises questions for national funding regimes. As Marginson (2018) says, nation-states are still the principal investors in large scale national research efforts, and they do this to secure competitive advantage over other nation-states in the global polity; at the same time, the global science network is globally cooperative and obeys its own dictates. The question might then arise as to the benefits that accrue to nation-states in return for their investments. For Castells, Wagner and Marginson, this question is misconceived and is brought about by clinging to what Beck (2005: 50) has called ‘methodological nationalism’ and Wagner (2008: 105) ‘scientific nationalism’. This describes an attitude where countries regard their economic and scientific standing solely from a national point of view, and compete with other countries for economic standing and dominance.

The account developed here suggests that the terrain has changed. Benefits will still accrue to nations and national systems, but more through spill overs, less by edict, and what now becomes critical is the number of scientists a country has that are a productive part of the global science network, not whether or not the scientists and universities of a country are or are not pursuing science according to a national innovation or development plan. A key way to do this is to send budding researchers to prestigious universities active in the global science network. China is

one country which seems already to be reaping the benefits of this lesson (Marginson 2018).

There are a number of implications for developing countries worth teasing out briefly. At the national or state level, the new dynamics of global science pose distinct challenges, as well as benefits, for a nation-state wishing to advance development. While it is true that large, centrally organised and state-underwritten scientific projects still exist and thrive, it is also true that these projects are not only in the minority, but that most new innovations are not of this nature, being laterally organised by the scientists themselves, and it is these laterally distributed projects that are growing at a far faster rate than the centrally organised ones (Wagner 2008: 29).

What should a central ministry do? As we said above, science policy authors writing about this are unequivocal that states must change their 'nation-first' vision, they must drop their 'scientific nationalism'. It should be said that not all scientific fields are equally globally driven, and Wagner (2008) distinguishes between those fields where science is principally domestically driven because of their local contextual relevance – she mentions soil science, agriculture, aquaculture, biology and hydrology (Wagner 2008: 79) – and those 'hot' fields like astronomy which are firmly collaboration-driven and global. Given this, the first developmental priority for a state is to decide which locally relevant fields are required for national development, and which global fields would also benefit national development. On this basis, the national planners could develop a dual strategy which Wagner calls 'sinking' and 'linking': sinking investments into fields of local relevance; and linking promising emerging scientists to the best global networks: 'In science and technology, then, the question facing a developing country is not how to keep smart people home. It is not even how to get them to return home. The real challenge is how to get a country's researchers into the new invisible college ... and then attract other researchers to work on local problems' (Wagner 2008: 67).

It is all too clear that all the countries in the Herana project are still immersed in scientific nationalism. National plans are framed at a distance from, and quite unconnected to, the potential innovative researchers in the universities. As Chapter 5 shows, the incentive systems for the Herana institutions are not targeted and far from adequate. Above all, there is little recognition in the ministries that the generative hubs of science have moved to a global level, and that this is potentially of great benefit to developing countries; as Marginson (2018: 70) says, 'collaborative global science advances modernisation in emerging countries. It helps to build stable states and functional economies, diffuses technologies, enhances economic and cultural exchange, and

“thickens” global civil society’. But ‘policy-makers are not only slow, but reluctant, to grasp the importance of the new networks’ (Wagner 2008: 4).

The Herana institutions and countries have yet to embrace the potentials of global science in a focused way and are as yet not privy to the benefits and riches that will accrue when they do: ‘they must still ‘learn to manage and benefit from a (global scientific) network’ (Wagner et al. 2015: 8). We would suggest that of particular relevance to Africa is that donor funders also have not yet realised the potentials of networks for development. This is apparent in their preference for funding individual researchers or institutions and in their reluctance to fund networks.

A similar switch of perspective is required at the institutional level. The national rankings have sharpened inter-institutional competition, and institutional leaders have developed a kind of zero-sum mentality which does not encourage collaboration, especially not with what are perceived as near-rivals in the rankings. Yet co-publications with global peers raises visibility and increases citations, lifting the quality of science produced as a consequence. Institutional policy should not only encourage collaborations, but also send emerging young scholars to prestigious overseas institutions for doctoral and post-doctoral work and for research attachments with prestigious research groups. The benefits will be large. Yet, as with scientific nationalism at the national level, institutions all too often see their mission as being to ‘keep smart people at home’ (Wagner 2008: 67).

At the level of the individual researcher, the benefits are perhaps more obvious. There are direct benefits to be leveraged, including access to unusual resources, to funding and to leading interconnected peers. There are also indirect benefits, like access to evolving specialised knowledge and ideas, recognition by peers and specialist membership. Exposure to eminent scholars in a budding researcher’s career gives them early advantages which they cannot get ‘at home’. The generative effects of belonging to a productive network cannot be overestimated, and such early interaction with eminent global peers has been shown to have a significant influence on whether an emerging researcher later becomes eminent or not (Reyes-Gonzalez 2018). Not having such exposure will in future be a significant brake on a young researcher’s future career prospects and standing if it is not so already.

The account presented above may create the impression that switching to a ‘sinking and linking’ approach to planning and funding the science system is straightforward. It is not. The distinctive logics or programmes of the networks of science and politics will clash, and nationalism may continue to trump cross-border collaboration and the formation of

productive global networks of scientists. Scientific networks will falter when their programmes are superimposed by agents who do not share the norms and values of scientists. Universities and researchers wishing to participate in the global network of science will need to attract the attention of star nodes in the network, and they may resort to questionable tactics to do so; tactics that may not be in the best interest of science. And even when universities and researchers successfully attract the attention of stars in the network, it cannot be taken as given that standards subscribed to by the network will result in the meaningful participation of new entrants.

Possible implications of network thinking

This chapter is a product of a realisation by the Herana team that it had in its previous reflections on the contribution of the project overlooked the importance of networks, both in how the project organised itself and in how the global research landscape is arranged. But what is the value of this realisation? We suggest that its value lies in bringing to the fore a different way of conceptualising and designing knowledge for development projects, and that such a different approach is more likely to yield the expected benefits. This requires, first and foremost, to augment our thinking with a network perspective. Several possible implications then become apparent.

First, a 2007 review of development aid (Maassen & Cloete 2009) concluded that while many development aid agencies adhered to an instrumental notion of development, their own countries had shifted to an engine of development model. In 2018, it appears that many aid agencies are still predominantly funding individual projects in particular institutions and countries. In 2017, CHET developed a proposal for an international network in higher education studies and it was dismissed by Carnegie on the grounds that it cannot fund researchers from the US and Europe as part of an Africa grant. Such funding models run counter to a globally networked understanding of knowledge production and exchange. Put differently, a change to network thinking makes the case for supranational funding structures that value borderless collaboration over national interests.

Second, no longer should projects be thought of exclusively in national terms. Designing and investing in projects in terms of local relevance without consideration of how they link to global knowledge networks will increasingly deliver less by way of social returns on the investments made.

Third, a change to network thinking also requires those investing in development and research to accept that the returns on their investments

are more likely to accrue indirectly. In instances where research funding is directed at linking rather than sinking, it is not that investments will be without social or economic impact, but that impact will follow only after the effects of new knowledge produced within the scientific network agnostic to national boundaries travels circuitously through global communication networks to produce often unexpected innovation.

And, finally, for universities and researchers in Africa, a network approach offers hope in the sense that it provides an alternative to the approach that depends on a pact between society, the state and the university that have yielded development benefits for other nations, but may well be out of reach for African countries in the foreseeable future.

PART THREE

**ACADEMIC CORE PROFILES
OF EIGHT AFRICAN
UNIVERSITIES**

Chapter 8

Introduction to institutional profiles

Purpose of profiles

A theme which runs through the institutional policies of the Herana universities is that higher education systems in Africa serve three main functions:

- instruction of students at levels above secondary schooling, in order to produce graduates for the country's labour market;
- research designed to produce high-level knowledge outputs of benefit to the social and economic development of the country; and
- community service in which the university makes its knowledge and skills available to its local and regional communities.

The Herana project has placed most emphasis on the first two of these functions; that is, on the role which universities must play through their production of graduates and their research activities in national social and economic development. The view of the project has been (a) that it is their knowledge activities which enable universities to make sustainable contributions to both social and economic development; (b) that these knowledge activities involve both the production of skilled graduates at all levels and of new knowledge and new applications of existing knowledge; and (c) that the nature and strength of these knowledge activities are to be found in the academic core of a university.

The academic core of a university is taken by the Herana project to consist of a limited set of quantitative inputs and outputs. The inputs for teaching are the qualifications and fields of study which the university offers, its student enrolments and its academic staffing. The outputs for

teaching are the university's graduates at all qualification levels. Its research inputs include the university's doctoral enrolments and those of its academic staff who are qualified to supervise research programmes. Its research outputs are its doctoral graduates and its published research articles.

Studies of national and institutional policy documents, including strategic plans, indicate that, even though both are central aspects of the academic core of a university, there are tensions between the instruction and research functions in the national policy environments of the Herana universities. The institutions are committed to both functions, but some seem to prioritise the research function in their vision and mission statements. The arguments that institutions have given for this emphasis were (a) that any country needs a limited number of research-led universities; and (b) that they either already have this status in their country or would receive such recognition if the government were to agree to the establishment of a category of research-led universities.

The tensions between the teaching and research functions have been expressed in the following ways:

- the government either does not formally recognise the research-led nature of its Herana university;
- the government emphasises equity of access and improving national participation rates rather than high-level knowledge production and so expects all universities (including those classified as research-led) to prioritise increasing their undergraduate student enrolments;
- the government fails to provide adequate financial support for the increased demands placed on academic staff and teaching infrastructure by growth in undergraduate student enrolments; and
- the government funds its Herana university as though it were a teaching-only institution and expects its research to be funded by external, mainly international organisations.

In exploring these issues and tensions each chapter in Part 3 of this book begins with an account of the national context of one of the Herana universities, and the role which the university plays in this context, particularly in relation to its knowledge-production inputs and outputs. Each institutional profile then focuses on the application of the Herana academic core criteria and assesses the performance of the university relative to the academic core targets.

Academic core targets and criteria

Table 8.1, which is an extract from Table 2.15 in Chapter 2, summarises the broad requirements built into the Herana account of the academic core.

Table 8.1 *Academic core framework*

Inputs	High proportions of student enrolments in (a) science and technology programmes, and (b) in masters and doctoral programmes
	Upper limit on proportions of undergraduate enrolments
	High proportions of (a) academic staff in senior ranks, and (b) senior and junior academic staff holding doctorates
	Favourable full-time equivalent student to academic staff ratios
Outputs	High ratios of total graduates to total enrolments
	High ratios of masters graduates to total masters enrolments
	High ratios of doctoral graduates to academics with doctorates
	High ratios of research articles to academics with doctorates

Discussions during 2014 to 2016 with the participating Herana universities led to specific input and output quantitative targets being linked to the academic core framework.

Academic core input targets

- A university's enrolment should be predominantly in undergraduate programmes, but with an upper limit of 75% on the number of undergraduate students enrolled as a percentage of the total.
- At least 25% of students should be postgraduates, with a minimum of 15% enrolled in masters programmes and 5% in doctoral programmes. The balance may be studying for postgraduate qualifications below masters level.
- A university's fields of study must fall into the categories of:
 - science and technology (SET), which includes life and physical sciences, engineering, building sciences, computing and information sciences and agricultural sciences;
 - health and clinical sciences, which includes medicine, surgery, dentistry, pharmacy, public health and veterinary sciences;

- business, economics and management (BUS), which includes financial accounting, auditing, finance, economic sciences and management studies;
 - education, humanities and social sciences (EHSS), which includes curriculum and policy studies and teacher training, language and literature, fine and performing arts, communication, law, psychology, social services, sociology, political studies, history and development studies.
- A university must have a fields-of-study shape in which at least 40% of its undergraduate and postgraduate enrolments are in science and technology and the health and clinical sciences, with no more than 30% of its total enrolments in business, economics and management, and with no more than 30% in the humanities, social sciences and education.
 - A university's academic staff must include a large proportion of well-qualified, permanent, senior members. To enable the university to conduct research, including through the supervision of doctoral students, at least 60% of its academic staff must hold doctoral degrees, and at least 60% must be professors, associate professors or senior lecturers.
 - The academic staff who teach must be distributed in balanced ways across all the disciplines. Acceptable average teacher-to-student ratios for science and technology and for health and clinical sciences would be no more than 15:1. Ratios across the other disciplines should be no more than 25:1.

Academic core output targets

- At least 25% of all students must, even during periods of rapid growth, complete their qualifications and graduate at the end of each academic year.
- The performance measures for doctoral graduate outputs must be based on doctoral graduates per academic with a doctoral degree. Due to differences in supervisory practices, higher ratios must be set for science and technology and health and clinical science disciplines compared with the humanities, social sciences and education. For science and technology and health and clinical sciences, a ratio of at least 0.38 doctoral graduates a year per academic with a doctorate must be set. For the education, humanities and social sciences fields, as well as business, economics, and management disciplines, the ratio must be at least 0.23.

- A university must expect each science and technology and health and clinical sciences academic with a doctorate to produce alone or with others at least two research publications per year. Each humanities, social sciences, education, business, economics and management academic with a doctorate must produce at least one a year.

Research-activity categories

Chapter 2 concluded with analyses of the research-activity categories into which the eight universities could be placed. The definitions of these categories took account of the levels of consistency between national and institutional commitments to research activities, empirical evidence of the performance of each university relative to the Herana academic core targets in Tables 2.15 and 2.16 in Chapter 2, and empirical evidence of changes in research performance over time. The over-arching data element requirements in the research-activity categories are summarised in Table 8.2 which is extracted from the relevant table in Chapter 2.

Table 8.2: Data elements in the research activity categories

Research activity category	Key data elements of category
Research-led university	In terms of the quantitative elements, a research-led university can provide compelling empirical evidence of being able to sustain research activities at the target levels set by the Herana project.
Emerging-research university	In terms of the quantitative elements, an emerging-research university can meet some of the targets set by the Herana project and has research inputs and outputs which reflect some improvements over time.
Research-oriented university	In terms of the quantitative elements, a research-oriented university can meet few of the targets set by the Herana project and can provide little evidence of improvements in research performance
Research-aspirational university	In terms of the quantitative elements, a research-aspiration university is one which fails to meet or come close to the targets set by the Herana project and which provides no evidence of movement towards satisfying any of the Herana research output targets.

These data elements show that most, but not all, of the academic core targets set out in the academic core framework in Table 8.1 above can be applied in a determination of what the appropriate research-activity is for each Herana university. The relevant data elements in the academic core framework are these:

- high proportions of student enrolments in doctoral programmes;
- high proportions of (a) academic staff in senior ranks, and (b) academic staff holding doctorates;
- high ratios of doctoral graduates to academics with doctorates; and
- high ratios of research articles to academics with doctorates.

The institutional profiles which follow will deal with all the targets contained in the Table 8.1 academic core framework but will focus on the above four points which deal with the production by the universities of high-level knowledge.

Data sources

The data and policies presented and analysed in the institutional profiles have been extracted from the following main sources:

- Academic core quantitative data collected in Herana Phase 1 from 2001 to 2009; in Herana Phase 2 from 2009 to 2011; and in Herana Phase 3 from 2012 to 2015. The 2017 publication *An Empirical Overview of Emerging Research Universities in Africa: 2001-2015* analyses and summarises these academic core data.
- Institutional policies and plans taken from the universities' publicly accessible websites and from transcripts of the institutional presentations at Herana meetings.
- Quantitative data on national contexts extracted from a range of publicly accessible websites, including those hosted by government education departments, statistical services, and advisory and buffer bodies, as well as those belonging to international agencies and statistical reporting bodies.
- National policies and plans extracted from publicly accessible websites, including those hosted by government education departments and higher education commissions, as well as national parliaments.

The data accessed from institutional and national data sources was uneven in its extent and quality. In general, and due to the priority placed on data collection during the Herana project, the institutional-level academic core data that were collected were consistent and comparable across countries. In addition, all eight Herana universities published vision and mission statements on their websites, although not all

published clear strategic plans, covering the final academic years (2010–2015) of the project.

However, extracting data on the eight universities' national contexts was more problematic. Quantitative data on population, particularly on the numbers of people in the 20–24 age group, were not readily available, and calculations and estimates based on data provided by international agencies had to be used. Official views on the purposes of higher education and of its past and future developments were often unavailable on government websites. In one case, the best document available was a parliamentary act. However, in two cases a full array of national education department strategic plans, government White Papers and parliamentary acts were available on websites.

Structure of the institutional profiles

The profiles have been written around a common framework featuring the following elements:

- An overview of national contexts which presents:
 - population totals and gross participation rates in higher education;
 - data on student enrolments in the national higher education system; and
 - national higher education policies and strategic plans.
- A focus on individual Herana universities which presents:
 - the vision and mission of the university including the objectives of strategic plans;
 - data on student enrolments by qualification type and field of study;
 - data on research publications in the context of national research–system outputs;
 - actual 2015 academic core inputs and outputs of the university assessed according to the Herana criteria for a research–led university; and
 - radar graphs assessing whether the university meets all the academic core criteria and then whether the research–activity category assigned to it in Chapter 2 is an appropriate one.

The contents of the profiles can be considered comparable because the research–led criteria have been accepted by all eight Herana universities

following meetings held in Cape Town in 2014 and 2016. However, problems with the availability of national data and policy documents implies that the analyses of the national context of the profiles may not be fully comparable.

Interactions with Herana universities

The Herana project's interactions with the eight universities began well before the Cape Town meetings of 2014 and 2016. Requests for data were sent to the universities after a seminar held in Cape Town in 2009 and the returns were checked by the Herana team and, as necessary, referred back for clarification and often correction. One outcome of these interactions was the publication of a data manual (Bunting 2014), which was designed to ensure consistency and comparability in the production of Herana academic core data. This manual was used in the production of Herana data after 2010, and in later discussions with institutional data offices.

In January and February 2018, emails were sent to all eight universities informing them (a) that this book would be the final output of the Herana project; (b) that the profiles of the eight Herana universities would constitute a major part of the volume; and (c) that the institutional profiles would consider their research focus and plans and their production of high-level knowledge in the form of doctoral graduates and research articles. A copy of a draft of their profile was attached to these emails. Reminders were sent in March 2018 to institutions who had not responded. This section accordingly takes account of all responses and comments received from institutions by 7 April 2018.

Chapter 9

University of Botswana

National context

Population data

Botswana's population for the period 2005 to 2015, including totals in two age bands, 18–24 and 20–24, are summarised in Table 9.1. The data for the numbers of 20–24 year-olds is based on information provided by *Statistics Botswana 2016*, which estimates that, in 2011, 10% of the total population fell into this age band. This 10% estimate has been applied to the 2005 and 2015 population totals, generating the final row in the table. The estimated numbers of 18–24 year-olds is derived from the *Education Statistics Report 2012* (Statistics Botswana 2015a), and from *Botswana Population Projections 2011–2016* (Statistics Botswana 2015b).

Table 9.1 Botswana population: 2005, 2010 & 2015 ('000)

	2005	2010	2015	Average annual increase
Total population	1856	2015	2209	1.2%
Estimated number of 18-24-year-olds	262	280	310	1.1%
Estimated number of 20-24-year-olds	186	202	220	1.1%

Sources: *Worldometers.info* 2018; *Statistics Botswana 2016, 2015a, 2015b*; *Human Resources Development Council 2015*

The data estimates for the age groups, when taken together with enrolment data, should permit calculation of the country's gross participation rates in tertiary education. These gross participation rates are defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20–24, but that employed by Botswana is 18–24. This makes comparisons of Botswana's participation rate with

those of other Herana countries problematic. Take, for example, the calculations that would have to be made for 2015 on the adjusted figure for tertiary students for that year, which is 56 800.

- Participation rate on 18–24 age band = $56\,800 / 310\,000 = 18.3\%$
- Participation rate on 20–24 age band = $56\,800 / 220\,000 = 25.8\%$

It may well be that neither of these calculations is correct, primarily because even the adjusted total of 56 800, who are described as ‘tertiary education’ students, seems to include all post-school students. Botswana appears not to distinguish, within its broad set of tertiary students, a subset of ‘higher education’ or ‘university level’ students. For the purposes of comparison across the Herana universities, 25.8% will be taken as Botswana’s gross participation rate for 2015.

Tertiary education at the national level

Botswana’s Tertiary Education Act of 1999 gives a statutory body called the Tertiary Education Council responsibility for promoting and coordinating tertiary education. The Act empowers the council to (Tertiary Education Act 1999: clause 5, with selected sub-clauses):

- formulate policy on tertiary education and advise the government accordingly;
- co-ordinate the long-term planning and overall development of tertiary education;
- plan for the funding of tertiary education and research, including the recurrent and development needs of public tertiary institutions;
- receive and review budgets for public tertiary institutions and make recommendations to the government;
- review and approve programmes of study in respect of private tertiary institutions;
- ensure that quality assurance procedures are in place in all tertiary institutions;
- ensure the audit of physical facilities and the assessment of their adequacy in tertiary institutions; and
- advise on any other matter related to tertiary education.

The policy framework under which the Tertiary Education Council operates is a white paper ‘Towards a Knowledge Society’ which was approved in 2008 by Botswana’s National Assembly. The main points in the white

paper, outlined in a summary prepared by the Tertiary Education Council (2008), include:

- Botswana's tertiary education sector has to undergo major changes because it is key to the country's transition from a resource-dependent to a diversified economy. This diversified economy should be characterised by an innovative knowledge-intensive service sector, with highly skilled, high-level knowledge workers employed in well-paid, high-value jobs.
- Human resource development is the white paper's first strategic goal for the tertiary education sector. This goal involves increasing access to higher education and producing highly skilled, knowledgeable and competent graduates in order to promote their personal wellbeing and progress and provide them with the capabilities and competencies required to advance the country's economic and social development.
- Research and innovation is the white paper's second strategic goal for the tertiary education sector. This goal involves strengthening research, innovation and, knowledge-creation within the sector in order to drive the country's uptake and application of new ideas and its socio-economic development.
- System level capability is the white paper's third strategic goal for the sector. This involves strengthening the capacity and quality of the sector and its public and private institutions to foster the sector's contribution to the country's long-term prosperity.

The kinds of institutions in the country's tertiary education sector are shown in Table 9.2. Details of the programmes offered by these public and private institutions indicate that many, including the two public universities and some of the public and private colleges, could be described as higher education institutions. Others, however, offer mainly training and service programmes which appear to be at levels below those of a higher education institution. Table 9.3 summarises the numbers of student enrolled in the different categories of higher education institutions.

In relation to Table 9.3, it is important to note that the overall tertiary total for 2015 is based on an assumption that the University of Botswana enrolments for 2015 would be 18 176, which was the total in 2014. The university's actual total for 2015 was 14 338, or 3 800 lower, which implies that the overall tertiary education total for 2015 should be adjusted downwards from the official estimate of 60 583, which is in the table, to 56 800. Participation rate calculations should as a consequence

be adjusted downwards (Botswana Human Resource Development Council 2015: 78; CHET 2017c).

Table 9.2 Tertiary education institutions in Botswana: 2015

	PUBLIC INSTITUTIONS (23)	PRIVATE INSTITUTIONS (15)
Public universities (2)	<ul style="list-style-type: none"> Botswana International University of Science and Technology University of Botswana 	<ul style="list-style-type: none"> ABM University College Assembly Bible College Ba Isago University College Boitekanelo Training Institute Bosa Bosele Training Institute Botho University Fly Mission School New Era College of Arts & Technology Gaborone Academy of Education Gaborone Institute of Professional Studies Gaborone Universal College of Law and Professional Studies Imperial School of Business Kgolagano College of Theological Education Limkokwing University College of Creative Technology Management College of Southern Africa
Colleges of education (5)	<ul style="list-style-type: none"> Francistown College of Education Molepolole College of Education Serowe College of Education Tlokweg College of Education Tonota College of Education 	
Technical colleges (3)	<ul style="list-style-type: none"> Botswana College of Engineering and Technology Francistown College of Technical and Vocational Education Gaborone Technical College 	
Institutes of health (7)	<ul style="list-style-type: none"> Bamalete Lutheran School of Nursing Francistown Institute of Health Science Gaborone Institute of Health Sciences Kanye Seventh Day Adventist School of Nursing Lobatse Institute of Health Sciences Molepolole Institute of Health Sciences Serowe Institute of Health Sciences 	
Other colleges (6)	<ul style="list-style-type: none"> Botswana Accountancy College Botswana College of Agriculture Botswana College of Distance and Open Learning Botswana Wildlife Training Institute Defence Command Staff College Institute Development Management 	

Source: Human Resource Development Council 2015

Table 9.3 Students enrolled in tertiary education institutions in Botswana by category: 2010–2015

	Number of institutions in 2015	2010	2011	2012	2013	2014	2015	Average annual increase: 2010-2015
Public universities	2	14 305	14 941	17 678	17 966	18 573	19 375	6.3%
Colleges of education	5	2 469	2 277	1 967	2 542	2 859	2 417	-0.4%
Technical colleges	3	1 483	581	1 074	1 849	2 544	2 719	12.9%
Institutes of health sciences	7	1 706	1 625	1 530	1 639	1 567	1 435	-3.4%
Other colleges	6	5 031	4 826	11 736	10 816	8 576	8 812	11.9%
Private institutions	15	17 372	13 607	12 628	22 635	26 320	25 825	8.3%
Total	38	42 366	37 857	46 613	57 447	60 439	60 583	7.4%

Source: Botswana Human Resource Development Council 2015

Issues arising from the Botswanan national context

One of the main aspects of the Botswanan national context which makes cross-Herana comparisons problematic, is the question of whether a distinction should be drawn in the tertiary education category between higher education institutions and post-school institutions at a lower level. Details of the programmes offered by some of Botswana's tertiary institutions suggest that these may actually be lower-level, post-school institutions. A related concern is that the strategic goals set for tertiary education institutions in Botswana are more appropriate for universities, rather than for the full set of 34 bodies which existed in 2015. Botswana had only two universities with a combined enrolment of 15 500 that year.

Focus on the University of Botswana

Vision and mission

The University of Botswana's vision as published on its website (2018) is: 'To be a leading centre of academic excellence in Africa and the world.' The institution's mission is: 'To improve economic and social conditions for the nation while advancing itself as a distinctively African university with a regional and international outlook. Specifically, the university will:

- Provide excellence in the delivery of learning to ensure society is provided with talented, creative and confident graduates;
- Advance knowledge and understanding through excellence in research and its application; and
- Improve economic and social development by high impact engagement with business, the professions, government and civil society.'

University's response to draft institutional profile

In April 2018, the University of Botswana submitted comments on the draft profile prepared as part of the Herana project, and asked that note be taken of the following points in judging its institutional performance:

- Subsection 2.1 of the draft profile gives an adequate account of the national environment of tertiary education in Botswana. Points which should however be stressed are (a) that the university has been largely dependent on the government for resources; (b) that the government had influenced its undergraduate enrolment

- planning up until 2016; and (c) that the government had not tried to influence planning for postgraduate student growth.
- No sponsorship had been provided by the government for post-graduate students. In addition, due to a lack of private or industry-related funding for research and scholarship, the university had been obliged to enrol mainly self-sponsored and part-time postgraduate students. Consequently, and as a result of having to juggle challenges that include financial constraints, job demands and part-time learning, many postgraduate students had never completed their studies.
 - The choice of only one database of high-quality journals to assess the institution's knowledge production gave a misleading impression of low outputs. Account needed to be taken of research outputs in individual journals and databases other than those listed and used by the Web of Science; and of books and chapters published by academic staff in the arts and humanities.

Basic data

Table 9.4 and Figure 9.1 summarise the numbers of students enrolled by field of study from 2009 to 2015, based on the data submitted by the university in the form of Excel sheets to CHET as part of the Herana project.

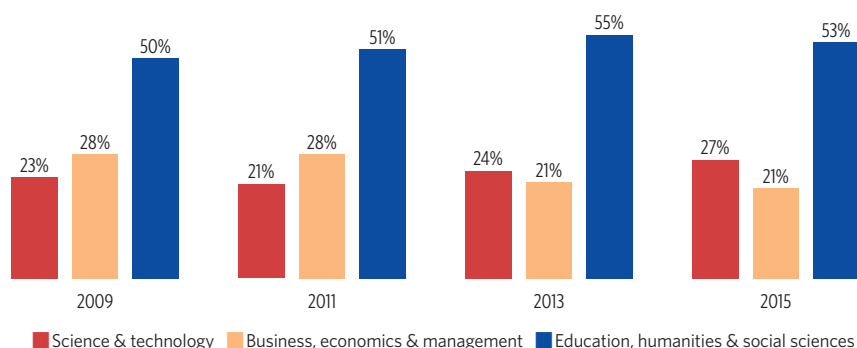
Table 9.4 Students enrolled at the University of Botswana by field of study: 2009–2015

	2009	2011	2013	2015	Average annual increase: 2009-2015
Science & technology	3 276	3 284	4 515	3 846	2.7%
Business, economics & management	4 004	4 335	3 990	2 946	-5.0%
Education	2 257	2 387	4 371	3 303	6.6%
Humanities & social sciences	4 916	5 664	5 841	4 243	-2.4%
Total university enrolment	14 453	15 670	18 717	14 338	-0.1%

Source: CHET 2017b & 2017c

Points to note about Table 9.4 and Figure 9.1 include the fact that the number of enrolled students fell by 23% in 2015 compared with the peak of 2013. Enrolments in the humanities and social sciences fell by 27% between 2013 and 2015, compared with falls of 26% in business, economics and management and 24% in education. The drop in science and technology enrolments was the smallest at 15%. As a result, the shape of enrolments changed, with the share of students enrolling in science and technology disciplines dipping from 23% in 2009 to 21% in 2013 before rising to 27% in 2015.

Figure 9.1 University of Botswana enrolments by fields of study: 2009–2015



Source: Calculations based on Table 9.4

Table 9.5 and Figure 9.2 summarise the numbers of students enrolled by type of qualification from 2009 to 2015, drawing on data submitted to CHET as a part of the Herana project. Points to note about the Table 9.5 and Figure 9.2 include the fact that the university experienced a sharp decline of 4 420 (26%) in the number of students enrolling for undergraduate courses in 2015 compared with 2013. Postgraduate enrolments at all levels increased by 41 (2%) over the same period. As a result, the proportion of undergraduate enrolments dropped from 91% of the total from 2009 to 2013 to 88% in 2015. However, the university remained an undergraduate-dominated institution.

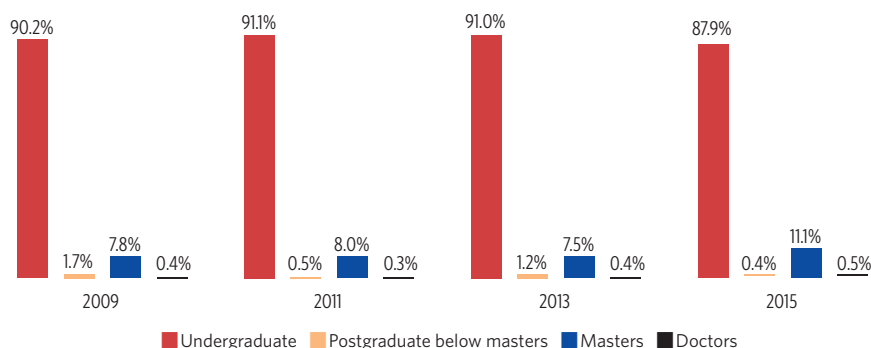
The university's proportion of masters students increased from 7.8% in 2009 to 11.1% in 2015, but the numbers and proportions of enrolments in doctoral degrees (84 and 0.6% respectively) were relatively low that year. A university which has research aspirations and which enrolls around 14 000 students annually should be enrolling at least 700 students a year for doctorates according to the Herana target.

Table 9.5 Students enrolled in the University of Botswana by qualification type: 2009–2015

	2009	2011	2013	2015	Average annual increase: 2009–2015
Undergraduate	13 008	14 260	17 017	12 605	-0.4%
Postgraduate below masters	268	102	214	57	-22.8%
Masters	1 123	1 254	1 403	1 587	5.9%
Doctors	54	54	69	84	7.6%
Total	14 453	15 670	18 700	14 400	-0.1%

Source: CHET 2017b & 2017c

Figure 9.2 University of Botswana enrolments by qualification type: 2009–2015



Source: Calculations based on Table 9.5

The Herana project has recognised that while enrolments in doctoral degree programmes are important indicators of a university's research engagement, its share of the national output of research publications, drawn from a bibliometric study undertaken by Stellenbosch University (CHET 2017d), also indicates the nature and extent of its role in its country's knowledge production.

The study by Stellenbosch University extracted from the Web of Science all the research articles produced by public and private universities and research bodies in Botswana. The study attributed a score of one to each institution for every article authored or co-authored by at least one of its researchers.

The data in Table 9.6 indicates a relatively low national output of only 275 research articles a year from 2010 to 2016. The table shows that the University of Botswana produced 58% of the total, but at an annual average of only 159 articles, well below that required for classification as a research-led university under Herana criteria.

Table 9.6 Research articles allocated to Botswanan institutions: 2010–2016

	Total for period	% of total
University of Botswana	1 113	57.9%
Botswana International University of Science and Technology	81	4.2%
Botswana College of Agriculture	90	4.7%
Botswana Ministry of Health	67	3.5%
South African universities	152	7.9%
Other international universities	419	21.8%
Total	1 922	100.0%

Source: CHET 2017d

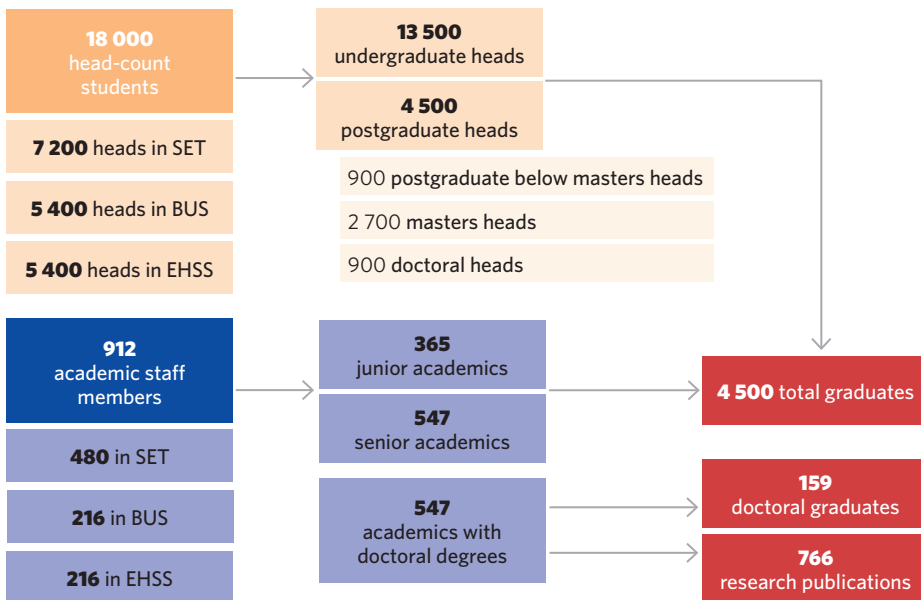
Assessing the University of Botswana according to the academic core criteria

Figure 9.3 offers a sketch of what the University of Botswana would have looked like in 2015 if it had enrolled 18 000 students and had satisfied the Herana academic core criteria in terms of the mix of these students – the ratio of undergraduates to postgraduates and the subjects being studied – the number of graduates, the appropriate accompanying academic staff requirements and the research outputs in terms of publications and doctorates (see above). The university actually enrolled 14 388 students in 2015 but the figure of 18 000 is used because (a) this was the university’s original estimate of its 2015 enrolment, (b) it is consistent with the previous enrolment totals of 18 700 in 2013 and 18 200 in 2014, and (c) the actual 2015 total of 14 388 represents an unexplained drop of nearly 4 000 (22%) below that of 2014.

The ratios employed in Figure 9.3, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;
- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;

Figure 9.3 Model of the University of Botswana meeting Herana academic core criteria



- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;
- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate;
- Doctoral graduates = 0.29 per academic with doctorate

Table 9.8 compares some of the main data elements in Figure 9.3 with the university's actual enrolment, staffing and output data for 2015. The differences between the university's actual outputs of graduates and research articles and those reflected in the model are assessed and discussed in further detail below.

Table 9.8 University of Botswana: Actual data compared with academic core data: 2015

	Actual data for 2015	Data generated by academic core ratios	Difference between actual data and data in model
Total head-count enrolment	14 388	18 000	-3 612
Enrolment by qualification:			
undergraduate	12 672	13 500	-828
postgraduate below masters	57	900	-843
masters	1 587	2 700	-1 113
doctoral	86	900	-818
Enrolment by field of study:			
science & technology (including health)	3 846	7 200	-3 354
business, economics & management	2 946	5 400	-2 454
education, humanities & social sciences	7 546	5 400	+2 146
Permanent academic staff:			
professors, associate professors and senior lecturers	410	547	-137
lecturers and below	408	363	+45
total academic staff	818	912	-94
academic staff with doctorates	474	547	-73
Knowledge outputs:			
total graduates	3 512	4 500	-710
doctoral graduates	15	159	-144
research publications	192	766	-574

Sources: CHET 2017; Figure 9.3 for academic core ratio data

Further assessment of the University of Botswana as a research-led university

In assessing the overall academic performance of the Herana universities, the Herana team has deployed quantitative data based on the averages

from a three-year period, linking these to targets for the academic core of each institution. Accordingly, the first two columns of Table 9.9 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 of Chapter 2. The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios. The numerical values in the fourth column can be understood in these broad ways:

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

Table 9.9 University of Botswana: Data for assessing academic core performance

	Target	Three-year average 2013-2015	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	25%	2.5
Limit on % undergraduate enrolments	75%	90%	3.3
% masters enrolments	15%	8.9%	2.4
% doctoral enrolments	5%	0.5%	0.4
% senior academics	60%	51%	3.4
% SET academics with doctorates	60%	62%	4.0
% BUS academics with doctorates	60%	35%	2.3
% EHSS academics with doctorates	60%	63%	4.0
Favourable student-to-academic ratios in SET	15	11	4.0
Favourable student-to-academic ratios in BUS	25	40	2.5
Favourable student-to-academic ratios in EHSS	25	23	4.0
Output targets			
Ratio of total graduates to total enrolments	0.25	0.20	3.2
Ratio of masters graduates to masters enrolments	0.25	0.13	2.1
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.06	0.4
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.00	0.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.03	0.5
Ratio of SET research articles to academics with doctorates	2.00	0.65	1.3
Ratio of BUS research articles to academics with doctorates	1.00	0.10	0.4
Ratio of EHSS research articles to academics with doctorates	1.00	0.26	1.0

Sources: Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The targets and 4-point scale scores can be used to depict the university’s performance in two radar graphs: one for its inputs and the other for its outputs. The shapes of these two radar graphs flag the extent to which the university has succeeded in meeting the Herana academic core targets.

Figure 9.4 indicates a mixed performance against the Herana academic core criteria for inputs. Four scores of 4.0 indicate that the university met four input targets, but only two related directly to the criteria for being-research-led. These concerned the proportions of academics who have doctoral degrees in the fields of science and technology and education, humanities and social sciences. The major input weaknesses reflected in Figure 9.4 was the proportion of doctoral enrolments at the university.

Figure 9.5 indicates a poor performance on the output side against Herana criteria, with no scores of 4.0. The university performed reasonably well only in its output rate of total graduates (with a score of between 3.0 and 3.9). All six of the indicators dealing with doctoral graduate and research publication outputs were poor; with the highest of these being 1.3.

Figure 9.4 University of Botswana: Inputs based on the averages for 2013 to 2015

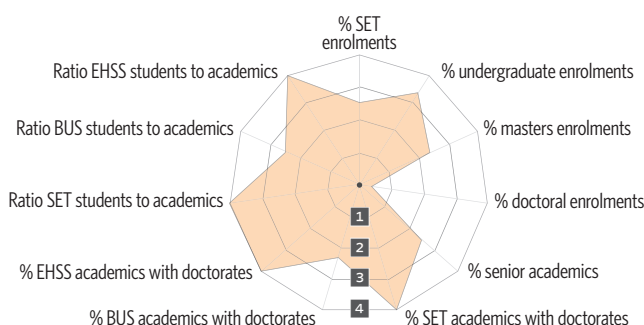
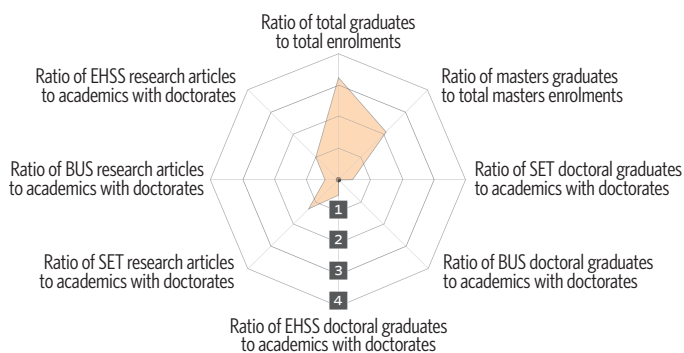


Figure 9.5 University of Botswana: Outputs based on the averages for 2013 to 2015



Summary

Botswana is a small country with a total population of 2.2 million in 2015. It is classified by the World Bank as an upper middle-income country. Botswana's gross participation rate in tertiary education was about 27% in 2015.

In 2015, 35 public and private bodies described as 'tertiary education' institutions enrolled 56 800 students. Two of these bodies with a combined enrolment of 15 500 – only 27% of the total that year – were classified as universities. Although enrolments at these two bodies accounted for a relatively small fraction of the total in the tertiary sector, Botswana's Tertiary Education Council set research and innovation goals that were more appropriate for a university-dominated system rather than the country's actual one.

The University of Botswana indicated its acceptance of the council's strategic goals by describing its vision as that of being a leading centre of academic excellence in Africa and the world, and its mission as that of delivering learning which would advance knowledge and understanding through excellence in research and its application. The university, like the other seven Herana institutions, thus demonstrated its strong research aspirations.

The numbers of students enrolling at the university rose and fell steeply from a total of 14 453 in 2009 to a peak of 18 717 in 2013 and a total of 14 338 in 2015. Undergraduate enrolments fell by 4 345 (26%) in 2015 compared with 2013, while postgraduate enrolments at all levels increased by 2% over the same period. Notwithstanding the drop in undergraduate enrolments, the university remained an undergraduate-dominated institution.

From 2009 to 2016, only 275 articles a year were produced on average under the national research system in Botswana. The University of Botswana produced 58% of these but at a low institutional average of only 159 articles a year.

The University of Botswana's performance fell far short of the performance targets in the Herana academic core, and in particular those linked to research outputs. The academic core data show that the Chapter 2 classification of the University of Botswana as a research-aspirational university is correct. It has strong research aspirations but has provided relatively little evidence of involvement in research activities.

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Chapter 10

University of Cape Town

National context

Population data

South Africa's population estimates for the period 2005 to 2015, including totals for the 20–24 age band, are summarised in Table 10.1.

Table 10.1 South Africa population: 2005, 2010 & 2015 ('000)

	2005	2010	2015	Average annual increase
Total population	46 889	49 992	54 957	1.6%
Population in 20-24 age group	4 622	5 019	5 302	1.4%

Sources: Statistics South Africa 2005, 2010, 2015

Higher education in South Africa is part of a post-school system, which includes public and private vocational training and continuing education institutions. The numbers of institutions and their student enrolments for 2010 and 2015 are set out in Table 10.2.

Table 10.2 Post-school education in South Africa: 2010 & 2015

	Higher education institutions				Below higher education level: vocational training institutions and continuing education institutions			
	Number of institutions		Student enrolments ('000)		Number of institutions		Student enrolments ('000)	
	2010	2015	2010	2015	2010	2015	2010	2015
Public	23	26	893	985	50	59	358	1 022
Private	109	124	91	147	344	252	47	88
Total	132	150	984	1 132	394	311	405	1 110

Sources: Department of Higher Education and Training 2013b and 2017a

Extrapolating from this data, South Africa's gross participation rates in higher education were 21% in both 2010 and 2015.¹

Table 10.2 shows that the public university system is the main component in South Africa's higher education system. Totals of 91% and 87% of higher education students were enrolled in public institutions in 2010 and 2015 respectively. The government collects data using the race group categories established under apartheid in order to measure demographic changes in participation in the country's socio-economic structures. Accordingly, Table 10.3 analyses participation rates in the public university system by race.

Table 10.3 Age group and public university data: 2015 ('000)

	Population in 20-24 age group	Public university enrolments	Gross participation rate: public universities only
African	4 462	708	16%
Coloured	426	62	15%
Indian	108	53	49%
White	306	162	53%
Total	5 302	985	19%

Sources: Statistics South Africa 2015; Department of Higher Education and Training 2017a

The South African government recognises that the overall 2015 participation rate of 19% in public universities is low and needs to be increased to foster socio-economic development, provided that this is accomplished in conjunction with increases in other parts of the post-school system. The substantial differences between the African and Coloured participation rates and those of Indians and Whites have remained major drivers for higher education policy in South Africa.

Public universities in South Africa

The university system's governance structure is determined by South Africa's Higher Education Act, which was amended nine times between 1998 and 2013. Section 3 of the Act makes the minister of higher education and training responsible for governance of the public and private higher education systems at the national level. The Act states that the minister must determine higher education policy after consulting the Council on Higher Education, which is an advisory body (Higher Education Act 1997).

1 The gross participation rate is defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20-24.

The preamble to the Higher Education Act sets the framework within which the minister acts. It requires the minister to determine policies related to:

- establishing a single co-ordinated higher education system;
- restructuring programmes and institutions in response to South Africa's human resource, economic and development needs;
- redressing past discrimination and ensuring representivity and equal access;
- contributing to the advancement of all forms of knowledge and scholarship, in keeping with international standards of academic quality; and
- ensuring that higher education institutions enjoy freedom and autonomy in their relationships with the state, within the context of public accountability and the national need for advanced skills and scientific knowledge.

The public higher education system has experienced radical changes over the past 20 years. In 1995, it was divided into two distinct categories of institutions: (1) universities which were permitted to offer degree programmes from undergraduate to masters and doctoral levels; and (2) technikons which were not permitted to offer degrees and which had to focus on technical and vocational training through diploma and certificate programmes. The technikon category was dropped after 2005 when the total number of public higher education institutions was reduced through institutional mergers from 36 to 23. The binary divide of university/technikon was replaced by a single category of university, which was divided into three subcategories:

- traditional universities, which focus on degree training up to doctoral level and enrol small numbers of diploma and certificate students;
- universities of technology, which focus on vocational training through diplomas and certificates and which offer a limited number of degree programmes; and
- comprehensive universities, which offer a mix of traditional university and university of technology programmes at degree and diploma levels.

The publication and launch in 2012 of a 'National Development Plan 2030', and in 2013 of a 'White Paper for Post-school Education and Training', provide the context in which these three subcategories of

university became embedded in the country's higher education policy framework.

The National Development Plan provided a description of the role of universities (National Planning Commission 2012):

Universities are key to developing a nation. They play three main functions in society: Firstly, they educate and train people with high level skills for the employment needs of the public and private sectors. Secondly, universities are the dominant producers of new knowledge, and they critique information and find new local and global applications for existing knowledge. South Africa needs knowledge that equips people for a changing society and economy. Thirdly, given the country's apartheid history, higher education provides opportunities for social mobility. It can strengthen equity, social justice and democracy. In today's knowledge society, higher education is increasingly important for opening up people's opportunities.

The 2013 White Paper accepted this account of the functions of universities, which it paraphrased as (Department of Higher Education and Training 2013a):

- Universities educate and provide people with high-level skills for the labour market.
- Universities are the dominant producers of new knowledge, they assess and find new applications for existing knowledge, and they validate knowledge and values through their curricula.
- Universities provide opportunities for social mobility and strengthen social justice and democracy, thus helping to overcome the inequities inherited from the apartheid past.

According to the white paper, South Africa must have a differentiated university system in order to fulfil these functions. Differentiation, it noted, would ensure increased equitable access to higher education for all South Africans; would improve participation and success rates; and would enable all universities to identify and pursue specific ways of responding to national development needs.

The white paper sets out principles to guide the focused differentiation of universities and the formulation of their individual institutional missions. These principles included that (Department of Higher Education and Training 2013a):

- A continuum of institutions is needed to ensure that national developmental needs are met. In the university sector this continuum will range from largely undergraduate institutions to specialised, research-intensive universities which offer teaching programmes from undergraduate to doctoral level.
- The three subcategories of universities summarised above (traditional, comprehensive and universities of technology) will, however, be kept in place, and further categorisation of institutions will not be permitted. Each university will, within these subcategories, have a clearly defined mandate.
- All universities in South Africa must offer high-quality undergraduate education. Each university will engage in some level and type of research, though the extent of this will be determined in relation to its overall mandate.

The number of public universities in South Africa was increased after 2009 from 23 to 26 through the establishment of two new comprehensive universities and the unbundling of a merged institution into one traditional and one comprehensive university. In 2015, the public system comprised 11 traditional universities, 9 comprehensive ones and 6 universities of technology (seen Table 10.4).

Table 10.4 Public universities in South Africa by subcategory: 2015

Traditional universities	Comprehensive universities	Universities of technology
University of Cape Town	University of Johannesburg	Cape Peninsula University of Technology
University of Fort Hare	Nelson Mandela Metropolitan University	Central University of Technology
University of the Free State	University of Mpumalanga	Durban University of Technology
University of KwaZulu-Natal	Sefako Makgatho Health Science University	Mangosuthu University of Technology
University of Limpopo	Sol Plaatje University	Tshwane University of Technology
North West University	University of South Africa	Vaal University of Technology
University of Pretoria	University of Venda	
Rhodes University	Walter Sisulu University	
Stellenbosch University	University of Zululand	
University of the Western Cape		
University of the Witwatersrand		

Tables 10.5 summarises the number of students in the public university system in 2015. The table contains the category of ‘occasional students’, which refers to those who are not registered for a degree or diploma or

certificate, but who are following courses of study (for example, Mathematics 1 or Sociology 2) that form part of the curriculum of a qualification.

Table 10.5 Students enrolled in South African public universities by qualification type: 2015 ('000)

	Traditional universities	Comprehensive universities	Universities of technology	Total
Occasional students	6	15	1	22
Undergraduate diplomas and certificates	27	128	117	272
Undergraduate degrees	219	260	11	490
Postgraduate below masters level	43	57	27	127
Masters	39	12	4	56
Doctors	14	4	1	20
Total	348	477	160	985

Source: Department of Higher Education and Training 2015

The total for comprehensive universities is high because a large number of students – more than 70% of the total for this subcategory – were enrolled in the dedicated distance-education institution, the University of South Africa (Unisa), that year. In 2015, Unisa's enrolments were:

Undergraduate	287 000
Postgraduate below masters	43 000
Masters	6 000
Doctorate	2 000
Total	338 000

Source: Department of Higher Education and Training 2015

Table 10.6 summarises the 2015 enrolments by the broad fields of study employed in the Herana project.

Table 10.6 Students enrolled in South African public universities by field of study: 2015 ('000)

	Traditional universities	Comprehensive universities	Universities of technology	Total
Science & technology	38%	18%	47%	30%
Business, economics & management	19%	33%	32%	28%
Education	17%	21%	6%	17%
Humanities & social sciences	27%	27%	14%	25%
Total	348	477	160	985

Source: Department of Higher Education and Training 2015

Focus on the University of Cape Town

Basic data

The University of Cape Town falls in the official category of a traditional university. A medium-sized institution, it enrolled 8% of the students at traditional universities in 2015, and 3% of the total for all public universities.

Table 10.7 Number of students enrolled in traditional universities: 2015

North West University	64 070
University of Pretoria	55 984
University of KwaZulu-Natal	45 506
University of the Witwatersrand	33 777
University of the Free State	30 418
Stellenbosch University	29 613
University of Cape Town	28 000
University of the Western Cape	20 382
University of Limpopo	18 907
University of Fort Hare	13 458
Rhodes University	8 007
Total for traditional universities	347 931

Source: Department of Education and Training 2017c: HEMIS information table 2.12

Table 10.8 summarises the number of students enrolled at the University of Cape Town from 2005 to 2015. The table shows that overall growth rates have been moderate at an annual average of 3.2%. Undergraduate enrolments grew by 2.5% a year on average from 14 337 in 2005 to 18 267 in 2015. Postgraduate enrolments grew from 6 106 in 2005 to 8 904 in 2015, at an average annual rate of 3.7%. Occasional (or non-degree) students have not been included in these totals.

Table 10.8 Students enrolled at the University of Cape Town by qualification type and field of study: 2005, 2010 & 2015

	2005	2010	2015	Average annual increases
Undergraduate	14 337	15 731	18 267	2.5%
Postgraduate below masters	2 037	2 506	3 246	4.8%
Masters	3 171	3 306	4 741	4.1%
Doctoral	898	1 110	1 746	6.9%
Total	20 413	22 653	28 000	3.2%
Science & technology	8 418	10 254	11 829	3.5%
Business & economics	5 225	5 924	7 236	3.3%
Education, humanities & social sciences	6 800	6 475	8 935	2.8%

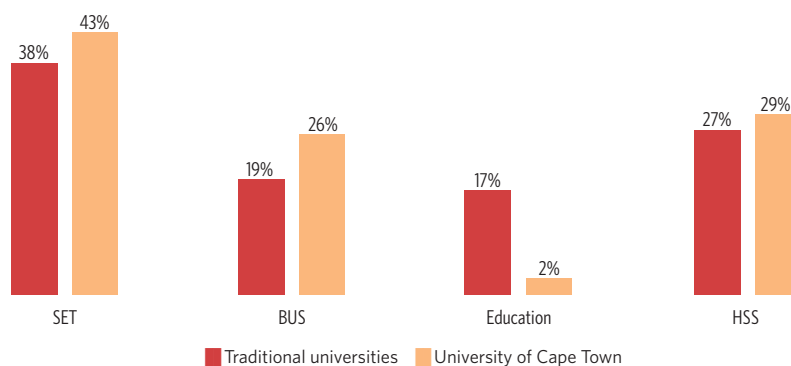
Source: Department of Education and Training 2017c: HEMIS information tables 2.12 for 2005, 2010, 2015

Figures 10.1 and 10.2 compare the proportions of enrolments by field of study and qualification type at the University of Cape Town with those for all 11 traditional universities in 2015.

Figure 10.1 shows that the University of Cape Town’s enrolment shape by field of study differed from the average in 2015. Enrolments in science and technology were 43% of the total compared with an average of 38%. They were 26% of the total for business and management compared with an average of 19%; and 2% for education compared with an average of 17%.

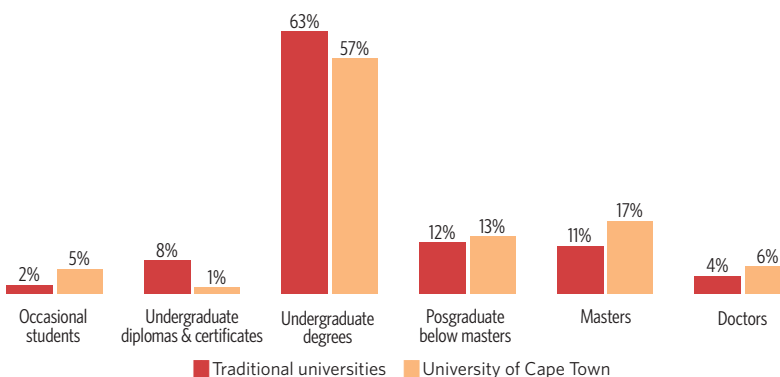
Figure 10.2 shows that 5% of the University of Cape Town’s student cohort were ‘occasional’ compared with an average of 2% for all the traditional universities. Meanwhile, the University of Cape Town’s proportion of masters enrolments was well above the average and its proportion of doctoral enrolments at 6% was well above the average of 4%.

Figure 10.1 Enrolments by fields of study for the University of Cape Town and traditional universities in South Africa, 2015



Source: Department of Education and Training 2017c: HEMIS information tables 2.12 for 2015

Figure 10.2 Enrolments by qualification type for University of Cape Town and traditional universities in South Africa, 2015



Source: Department of Education and Training 2017c: HEMIS information tables 2.12 for 2015

The relatively high proportion of doctoral enrolments and healthy growth in these at the University of Cape Town, as reported in Table 10.8, indicate the university's strength within South Africa's national research environment. In order to measure this more fully, account must also be taken of University of Cape Town's share of the national output of research publications, which was measured in a bibliometric study undertaken by Stellenbosch University. Table 10.9 summarises the production of research articles by institution from 2010 to 2016.

Table 10.9 Total research articles allocated to South African institutions: 2010–2016

University of Cape Town	14 037	16.9%
University of the Witwatersrand	11 649	14.0%
University of KwaZulu-Natal	10 691	12.9%
University of Pretoria	10 126	12.2%
Stellenbosch University	10 007	12.0%
University of Johannesburg	5 315	6.4%
North West University	4 840	5.8%
University of the Free State	3 535	4.3%
University of the Western Cape	3 078	3.7%
All other: remaining public universities plus research organisations	9 834	11.8%
Total	83 112	100.0%

Source: CHET 2017d

The publication data in Table 10.9 indicate, in the Herana context, a high national output of research articles. A total of 73 278 research articles were produced from 2010 to 2016 by eight of the country's traditional universities and one comprehensive institution, the University of Johannesburg. The balance of 9 834 articles was produced by the other three traditional universities and the other five comprehensive universities, as well as by research organisations such as the National Research Foundation.

The data show that the University of Cape Town produced an annual average of 2 005 research articles over this period, compared with an annual average of 1 100 for the other seven traditional universities in South Africa. The outputs indicate that the University of Cape Town is a major player in South Africa's research system.

The University of Cape Town's strategic planning

The University of Cape Town's vision and mission statements are set out in Table 10.10.

Table 10.10 University of Cape Town (UCT) vision and mission: 2016

Vision statement	UCT is an inclusive and engaged research-intensive African university that inspires creativity through outstanding achievements in learning, discovery and citizenship; enhancing the lives of its students and staff, advancing a more equitable and sustainable social order and influencing the global higher education landscape.
Mission statement	<p>UCT is committed to engaging with the key issues of our natural and social worlds through outstanding teaching, research and scholarship. It seeks to advance the status and distinctiveness of scholarship in Africa through building strategic partnerships across the continent, the Global South and the rest of the world.</p> <p>UCT provides a vibrant and supportive intellectual environment that attracts and connects people from all over the world.</p> <p>It aims to produce graduates and future leaders who are influential locally and globally. Its qualifications are locally applicable and internationally acclaimed, underpinned by values of engaged citizenship and social justice. UCT's scholarship and research have a positive impact on society and the environment.</p> <p>It will actively advance the pace of transformation within the university and beyond, nurturing an inclusive institutional culture which embraces diversity.</p>

Source: University of Cape Town 2018a

The University of Cape Town published a 'Strategic Planning Framework 2016–2020' on its website which lists five goals (UCT 2018b):

- to forge a new inclusive identity that reflects a more representative profile of students and staff, and the cultures, values, heritage and epistemologies of the diversity of staff and students;
- to promote the university as a vibrant, supportive intellectual environment that attracts and connects people from all over the world and advances the status and distinctiveness of scholarship in Africa;
- to advance the University of Cape Town as a research-intensive university that makes a distinctive contribution to knowledge, locally and globally;
- to renew and innovate in teaching and learning, improving student success rates, broadening academic perspectives, stimulating social consciousness and cultivating critical citizens; and
- to enhance the scope, quality and impact of engaged scholarship with an emphasis on addressing development and social justice.

The framework lists 19 high-level objectives which are related to the goal of advancing of the University of Cape Town as a research-led university. These objectives include (UCT 2018c):

- recruiting and retaining scholars who are leaders in their fields and who will contribute positively to the research strategy of the university;
- providing seed funding for strategically selected new collaborations that include a Global South partner, and three- or four-way international partnerships, to advance the quality, impact and profile of the university's research, and to access global research resources;
- challenging academics to develop new thinking about the problems that should most urgently be addressed by the University of Cape Town as an African university, and feeding this thinking not only into published research and innovative products and solutions, but also into the curriculum;
- building the capacity for staff across all disciplines to conduct research requiring analysis of high volumes of complex data;
- enhancing the environment for soft-funded research units;
- providing researchers with tailored 21st-century, technologically-enabled research support;
- accelerating the pipeline of future academics at the University of Cape Town and on the continent through holistic professional development opportunities for the postgraduate cohort as well as young appointees with a particular focus on emerging black and women scholars;
- improving the completion rate and reducing the average time to completion of PhD students; and
- providing more opportunities for undergraduate students to undertake research during their degrees.

Implementing the objectives of the strategic plan

At Herana project meetings held in South Africa in November 2014 and November 2016, representatives of the University of Cape Town discussed the implementation of the university's research-led goals and high-level objectives (CHET 2017a, CHET 2015). At the November 2014 meeting, university representatives listed some of the key recommendations that had emerged in 2014 during the development of the university's strategic planning framework:

- There should be a focus on research strengths that draw on the University of Cape Town's geographical context – for example, biodiversity and the confluence of two oceans in the area – and its situational advantages – for example, in addressing poverty, infectious diseases, safety and security. The goal should be to

bring an African lens to bear on international debates and global challenges.

- The research strategy should seek to provide an enabling environment which rewards, supports and motivates academic staff and students to engage in innovation and research activities.
- Principal investigators need to receive support and training to develop the research leadership required to manage large, mostly international collaborative projects.
- Research should be resourced adequately in an environment in which research funding from government, including the National Research Foundation, has dwindled. A research fundraising plan designed to raise more private money for research would have to be implemented.

At the November 2016 project meeting, the University of Cape Town's representatives outlined steps that were being taken to implement the objectives of its strategic planning framework:

- Efforts to improve research outputs at the University of Cape Town had led to the establishment of a board for graduate studies and the creation of a postgraduate directorate, which offered funding on a competitive proposal-driven basis for students seeking to attend conferences abroad. It also assisted the university in attracting international, particularly African, students with ring-fenced research funding and discounted fees.
- The University of Cape Town had sought to expand its supervisory capacity by training existing academics, as well as post-doctoral students. It had created a new system consisting of groups that included a supervisor, a mentor, a post-doctorate and three doctoral students who worked together on a common theme. The mentor in the group could be a retired academic retained by the University of Cape Town, who would advise the group on networking with other scholars in the field. It was hoped that the new system would allow more doctoral students to graduate more quickly.
- The University of Cape Town had invested resources in an improved research administration system. This system included a research office, a postgraduate funding office, contracts and copyright services, an international academic exchanges office, and comprehensive library services. The main goal of this investment had been to enable the university researchers to be competitive.

The services offered included: (a) advice on big data and costings; (b) action to increase visibility on international platforms; (c) identifying potential international partnerships that might complement the individual researcher's own ad hoc network; and (d) providing traditional support, such as advice on national and international grants, awards and other funding opportunities.

- A new electronic data management system had been set up which enabled the University of Cape Town's partnership activities to be tracked more comprehensively. The system was able to harvest publications from existing indices without relying on individual academics to provide that information. It was also used to produce research reports for the University of Cape Town's Senate and Council and for distribution to the wider university community.

The following points about research incentives were emphasised at both the 2014 and 2016 project meetings:

- Although the University of Cape Town did not offer direct incentives in the form of remuneration for research publications, the government subsidies earned for these research outputs were used to enhance research by funding attendance at international conferences, topping up bursaries and financing running costs such as field trips.
- In addition, enabling grants were offered to researchers whose proposed projects included at least one other African partner and a partner in the Global North.

The University of Cape Town accepted the Herana project's performance measurement processes as fair and applicable to its situation and context. The university's internal data management system had however enabled it to use indicators which were more detailed and sharper than those adopted by the Herana project.

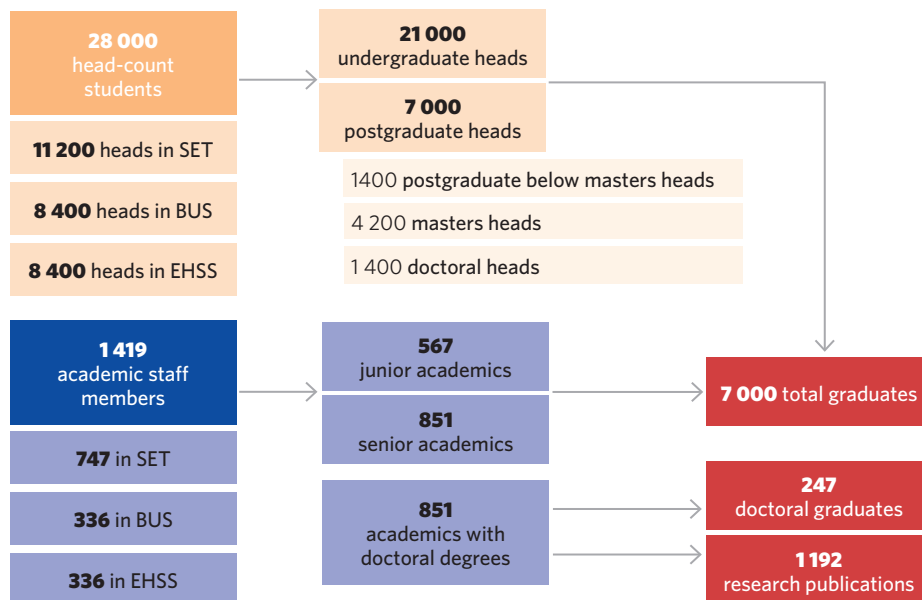
Assessing the University of Cape Town according to academic core criteria

Figure 10.3 offers a sketch of what UCT would have looked like in 2015 if it had satisfied the Herana academic core criteria.

The ratios employed in Figure 10.3, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;

Figure 10.3 Model of the University of Cape Town as a university meeting Herana academic core criteria: 2015



- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;
- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;
- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate;
- Doctoral graduates = 0.29 per academic with doctorate.

The differences between the actual data and the data for the model can be explained in a number of ways. The smaller percentage of undergraduates as a share of the total cohort, compared with the model, indicates the university's policy to increase its proportion of postgraduate students. It would have had to take in 2 733 extra undergraduates to meet the maximum target of 75% set by the model, compared with the actual 63% recorded in 2015. Enrolments in the broad field of business, economics and management constituted only 26% of the total, below the target of 30%.

The shortfalls in staff numbers against the model's target stemmed from the relatively large number of part-time and temporary teaching staff employed by the university. The part-time staff would normally be postgraduate students who are conducting undergraduate tutorials and teaching in laboratories. The University of Cape Town's permanent academic staff total in all fields in 2015 was 1 179, and its full-time equivalent academic staff total, which included all permanent and other academic staff, was 1 783.

The shortfall in the number of doctoral graduates against the model's target was the result of doctoral students taking longer than they should to complete their qualifications.

Table 10.11 University of Cape Town actual 2015 data compared to academic core data

	Actual 2015 data	Data generated by academic core ratios	Difference between actual data and data in model
Total head-count enrolment	28 000	28 000	0
Enrolment by qualification:			
undergraduate	18 267	21 000	-2 733
postgraduate below masters	3 246	1 400	+1 846
masters	4 741	4 200	+535
doctoral	1 746	1 400	+341
Enrolment by field of study:			
science & technology (including health)	11 829	11 200	+629
business, economics & management	7 236	8 400	-1 164
education, humanities & social sciences	8 935	8 400	+535
Permanent academic staff:			
professors, associate professors and senior lecturer	815	851	-36
lecturers and below	364	567	-203
total academic staff	1 179	1 419	-240
Knowledge outputs:			
total graduates	7 242	7 000	+242
doctoral graduates	223	247	-24
research publications	2 582	1 192	+1 390

Source: CHET 2017c; Figure 10.3 for academic core ratio data

Further assessment of the University of Cape Town on academic core criteria

In assessing the performance of the Herana universities, the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators and targets. Accordingly, the first two columns of Table 10.12 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2. The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares

the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios.

The numerical values in the fourth column can be understood in these broad ways:

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

Table 10.12 University of Cape Town: Data for assessing academic core performance

	Target	Three-year average 2013-2015	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	45%	4.0
Limit on % undergraduate enrolments	75%	65%	4.0
% masters enrolments	15%	16.8%	4.0
% doctoral enrolments	5%	6.2%	4.0
% senior academics	60%	71%	4.0
% SET academics with doctorates	60%	69%	4.0
% BUS academics with doctorates	60%	44%	2.9
% EHSS academics with doctorates	60%	63%	4.0
Favourable student-to-academic ratios in SET	15	10	4.0
Favourable student-to-academic ratios in BUS	25	24	4.0
Favourable student-to-academic ratios in EHSS	25	11	4.0
Output targets			
Ratio of total graduates to total enrolments	0.25	0.27	4.0
Ratio of masters graduates to masters enrolments	0.25	0.27	4.0
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.43	4.0
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.41	4.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.28	4.0
Ratio of SET research articles to academics with doctorates	2.00	4.79	4.0
Ratio of BUS articles to academics with doctorates	1.00	1.24	4.0
Ratio of EHSS research articles to academics with doctorates	1.00	2.6	4.0

Source: Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The targets and 4-point scale scores can be used to depict the university's academic performance as a research-led institution in two radar graphs: one for its inputs and the other for its outputs. The shapes of these two radar graphs flag the extent to which the University of Cape Town has succeeded in meeting the Herana targets.

Figure 10.4 indicates that the University of Cape Town met 10 of the 11 input academic core targets set by Herana. The exception was the proportion of academic staff with doctorates in the field of business, economics and management. From 2013 to 2015, the proportion of permanent academics with doctorates in this field was 44% compared with the Herana target of 60%. Figure 10.5 shows that the University of Cape Town met all of the eight Herana targets on the output side.

Figure 10.4 University of Cape Town: Inputs based on the averages for 2013 to 2015

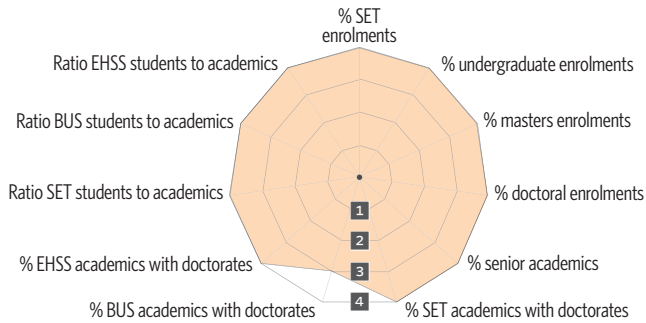
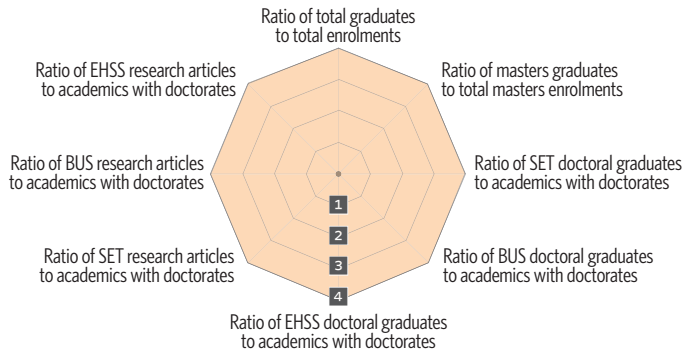


Figure 10.5 University of Cape Town: Outputs based on the averages for 2013 to 2015



Summary

South Africa is one of the larger Herana countries with a total population of 55 million in 2015. It is classified by the World Bank as an upper middle-income country. South Africa’s gross participation rate in higher education was 21% in 2015.

In 2015, 1.13 million students were enrolled in South African higher education institutions, 87% of whom were studying at public universities and 13% of whom were at public higher education colleges. A total of 348 000 students were enrolled at the country’s nine traditional

universities; 160 000 were at the six universities of technology; and 477 000 were at the country's six comprehensive universities.

South Africa's policy framework for public universities was set by a 2012 'National Development Plan' and a 2013 'White Paper for Post-school Education'. The purposes of education at the country's universities may be summarised as (a) providing people with high-level skills for the labour market; (b) producing new knowledge; (c) finding new applications for existing knowledge; and (d) providing opportunities for social mobility. The vision, mission and strategic goals of the University of Cape Town are consistent with the national policies on these purposes.

The University of Cape Town is a middle-sized traditional university with 28 000 students in 2015. It grew by 3.2% between 2005 and 2015, with undergraduate enrolments rising by 2.5% a year on average and postgraduate enrolments increasing by 3.8% a year. Growth in doctoral enrolments at the university has been strong, nearly doubling from 898 in 2005 to 1 746 in 2015. At the same time, the University of Cape Town produced many research articles: 14 037 at an average of 2 005 a year from 2010 to 2016. Over this period, the University of Cape Town produced 17% of research articles in South Africa, indicating the presence of other major players in the national research system. In recognition of the room for growth in its knowledge production capacity, the university implemented a number of new strategic priorities.

The University of Cape Town postgraduate directorate used ring-fenced research funding to attract international, particularly African, students to register for doctoral programmes at the university. Doctoral supervisory capacity was enhanced by training of existing academics and post-doctoral students. Research groups including a supervisor, a mentor, a post-doctorate and three doctoral students were established to collaborate on common research themes. The mentor in each group, who was often a senior retired academic retained by the University of Cape Town, provided advice on networking with other scholars in the field.

An improved research administration system was introduced. This included a research office, a postgraduate funding office, contracts and copyright services, an international academic exchanges office, and comprehensive library services. The main goal of this investment was to enable university researchers to be competitive.

The University of Cape Town met 10 of the 11 input targets set by the Herana project for defining a university as research-led. The exception was the proportion of academic staff with doctorates in the field of business, economics and management. From 2013 to 2015, the proportion of permanent academics with doctorates in this field was 44% compared with the Herana target of 60%. The University of Cape Town met the eight Herana targets on the output side.

The data suggests that the University of Cape Town's classification in Chapter 2 as a research-led university is correct. The university is strongly committed to research and has provided compelling evidence of its engagement in this area.

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Chapter 11

University of Dar es Salaam

National context

Population data

Tanzania's population estimates for the period 2010 to 2014, including totals for the 20–24 age band, are summarised in Table 11.1 below.

Table 11.1 Tanzania population data: 2010 & 2014 ('000 000)

	2010	2014	Average annual increase
Total population	44.9	52.4	3.9%
Population in 20-24 age group	4.1	4.7	3.5%

Source: Tanzania Population 2018

Student enrolments by type of institution for 2010 and 2014 are set out in Table 11.2. Extrapolating from this data, Tanzania's gross participation rates in higher education were 3% in 2010 and 4.7% in 2014.¹

Table 11.2 Tanzanian student enrolments and participation rates: 2010 & 2014

	2010	2014
Enrolments in public universities	89 400	144 200
Enrolments in private universities	34 000	74 800
Total university enrolments	123 400	219 000
Gross participation rate in university education	3%	4.7%

Source: Tanzanian Universities Commission 2016b

1 The gross participation rate is defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20–24.

Tanzania's gross participation rates increased from 2010 to 2014 but could be regarded as too low for a country which has stated its commitment to improving equity of access to higher education.

University education at the national level

The Universities Act of 2005 established the Tanzania Commission for Universities (TCU) and sets out in detail its functions and powers, indicating that the commission plays a major role in the country's university system (Universities Act 2005 Part II, clauses 5–18).

The TCU, which produces five-year plans to manage the national higher education system, has described its role as regulatory, supportive and advisory (The TCU Rolling Strategic Plan: 2015/16–2019/20, executive summary):

- *Regulatory*: Conducting periodic evaluation of universities, their systems and programmes so as to oversee quality assurance systems at the universities and in the process leading to new institutions to be registered to operate in Tanzania, and existing institutions to be accredited.
- *Supportive*: Ensuring the orderly performance of the universities and the maintenance of the set quality standards, by providing support to universities in terms of coordinating the admission of students, offering training and other sensitisation interventions in key areas like quality assurance, university leadership and management, fundraising and resources mobilisation, gender aspects in university management and gender mainstreaming, etc.
- *Advisory*: Advising government and the general public on matters related to the higher education system in Tanzania, including on programme and policy formulation on higher education, and on the international issues pertaining to higher education.

In the five-year plan from 2015/2016, the commission discusses implementation of the previous plan, which had nine strategic objectives and 38 targets. The TCU claimed most of the targets had been achieved. In line with these goals, it noted that from 2009 to 2014 (The TCU Rolling Strategic Plan: 2015/16–2019/20, executive summary):

- 26 new university institutions were registered;
- quality assurance units were established in 21 universities;
- 272 curricula were approved;
- 3 656 foreign awards were evaluated and recognised;

- admission audits and assessments of admission capacity were conducted annually;
- the gross enrolment rate in universities increased by 1.7% (from 3% to 4.7%);
- the number of female enrolments in universities increased from 38 566 in 2008/2009 to 78 800; and
- information and communication technology facilities and equipment were installed in universities to facilitate processing, storage and easy retrieval of information from universities and university colleges.

The definition of ‘university institution’ employed by the commission is broad and extends beyond individual universities. The Tanzania’s Universities Act of 2005 established two categories for such institutions: universities; and university-based campus colleges, constituent colleges, connected colleges and institutes, centres or directorates (Universities Act 2005, Part III, clause 19). The ‘university institutions’ recognised by the commission are listed in Table 11.3.

Table 11.3 Categories of university institutions: 2015

Categories	Total
1 Fully-fledged universities	33
1a Public universities	12
1b Private universities	21
2 University colleges	16
2a Public university colleges	2
2b Private university colleges	14
3 Campuses, centres and institutes	22
3a Linked to public universities	5
3b Linked to private universities	17

Source: Tanzanian Universities Commission 2016a

Table 11.4 summarises the number of students enrolled at Tanzania’s university institutions by field of study. The data indicate rapid average annual growth of more than 15% in enrolments in all fields from 2010 to 2014. Enrolment totals in the fields of engineering science and medical science doubled over the five years, an exceptional rate of growth in fields of study that require access to laboratories and, in the case of medicine, to patient-care facilities.

Table 11.4 Students enrolled in public plus private universities in Tanzania by field of study: 2010, 2012 & 2014

	2010	2012	2014	Average annual increase
Agriculture	2 026	2 200	2 867	9.1%
Engineering	2 737	9 667	12 600	46.5%
Medical science	5 242	7 940	10 351	18.5%
Natural science	1 768	1 736	2 263	6.4%
Science and information technology	10 041	11 715	15 270	11.0%
Education (science)	9 762	10 068	13 124	7.7%
Education (arts)	39 050	52 869	68 914	15.3%
Business management and administration	18 177	25 178	32 818	15.9%
Law and social science	34 632	46 607	60 752	15.1%
Total public and private university enrolment	123 435	167 980	218 959	15.4%

Source: *Tanzanian Universities Commission 2016b*

Table 11.5 organises the enrolment data according to the categories for field of study used by the Herana project. The table shows that over the five years about two-thirds of enrolments in the Tanzanian university system were in (a) the field of education, which would include mainly teacher training; and (b) the fields of humanities and social sciences, which would include languages, literature, fine art, music, law, psychology, sociology, political science and development studies.

Table 11.5 Proportions of students enrolled in public and private universities by Herana field-of-study categories: 2010, 2012 & 2014

	2010	2012	2014
Science & technology (including health & medical sciences)	18%	21%	21%
Business, economics & management	15%	26%	26%
Education, humanities & social sciences	68%	53%	53%
Total university enrolment	100%	100%	100%

Source: *Calculations based on Table 11.4, using CHET 2014b*

Issues arising from the Tanzanian national context

The national government's expectations of the role that should be played by public and private universities are unclear. Searches of official websites failed to uncover any publicly available information about (a) the roles universities should fulfil; (b) how the academic cores of public universities should be constituted; and (c) the shape of student enrolments by qualification and field of study over an extended period. Neither the

Universities Act of 2005 nor the ‘TCU Strategic Plan: 2015/16–2019/20’ offered sufficient, detailed information required to build a proper profile of the higher education system’s national role.

The low participation rates in university education in Tanzania – 3% in 2010 and 4.7% in 2014 – indicated inequitable access to the sector. However, a target of 10% participation by the year 2020 was set, which led to rapid enrolment growth. The number of students enrolled in the system grew at an annual rate of 15.4% from 2010 to 2014.

Meanwhile, the pattern of enrolments by field of study remained almost the same over this period. The proportion of students enrolled in science and technology (including health sciences) programmes increased from 18% in 2010 to 20% in 2014. A large majority of students (68% in 2010 and 65% in 2014) were registered in education, humanities, and social sciences programmes. Enrolments in business, economics and management disciplines remained low at about 15%.

Focus on the University of Dar es Salaam

Basic data

Table 11.6 summarises the numbers of student enrolled at the University of Dar es Salaam from 2010 to 2015 by field of study. These data were extracted from tables prepared for the Herana project. It should be noted that no medical and/or clinical students are included in the category of science and technology after the students and staff for this discipline were moved from the university and incorporated in the Muhimbili University of Health and Allied Sciences in 2010.

Table 11.6 Students enrolled at the University of Dar es Salaam by field of study: 2010–2015

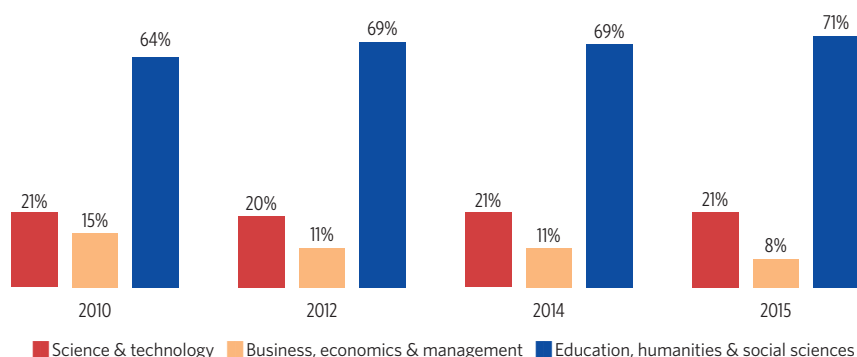
	2010	2011	2012	2013	2014	2015	Average annual increase
Science & technology	3 986	4 446	4 201	4 530	4 596	4 906	4.2%
Business, economics & management	2 835	2 477	2 287	2 347	2 338	1 904	-7.7%
Education, humanities & social sciences	12 146	12 960	14 224	16 055	15 086	16 485	7.1%
Total	18 967	19 883	20 712	22 932	22 020	23 295	4.8%

Sources: CHET 2017b and 2017c

The number of students enrolled grew by 4.8% annually over the six years, which was well below the overall growth rate of 15.4% for the public plus private systems.

Figure 11.1 focuses on the University of Dar es Salaam’s enrolment shape by field of study. It indicates an increasing preponderance of enrolments in

Figure 11.1 University of Dar es Salaam enrolments by fields of study: 2010–2015



Source: Calculations based on Table 11.4.

education, humanities and social sciences, while the proportion of enrolments for science and technology courses remained constant, and the share of business, economics and management enrolments dropped sharply from 15% in 2010 to 8% in 2015.

Table 11.7 offers a picture of the number of student enrolled at the University of Dar es Salaam by type of qualification. Undergraduate degrees, diplomas and certificates are included in the ‘undergraduate’ category and postgraduate diplomas and certificates are included in the ‘postgraduate below masters’ category.

Table 11.7 Students enrolled at the University of Dar es Salaam by type of qualification: 2010–2015

	2010	2011	2012	2013	2014	2015	Average annual increase
Undergraduate	16 162	16 901	18 388	20 180	19 624	22 011	6.4%
Postgraduate below masters	149	281	113	351	133	98	-8.0%
Masters	2 614	2 654	2 168	2 165	2 064	1 617	-9.2%
Doctoral	42	47	43	236	199	199	36.5%
Total	18 967	19 883	20 712	22 932	22 020	23 925	4.8%

Sources: CHET 2017b and 2017c

Table 11.7 shows that the University of Dar es Salaam’s main source of enrolment growth has been in undergraduate students. Enrolments in this category grew by 5 849 (36%) in 2015 compared with 2010. Masters enrolments fell by about 1 000 (38%) in 2015 compared with 2010. This indicates that the University of Dar es Salaam has become an increasingly undergraduate university, as its proportion of masters and doctorate students fell from 14.0% in 2010 to only 7.8% of the total in 2015.

The Herana project has recognised that the number of enrolments in doctoral degree programmes constitutes an important indicator of a

university's engagement in research. Table 11.7 shows that UDSM's doctoral enrolments increased from 42 in 2010 to 199 in 2015. However, in order to meet the Herana targets, at least 1 000 students should have been enrolled for doctorates in 2015 given the total size of University of Dar es Salaam's cohort.

In order to measure the university's strength within its national research environment, account must also be taken of its share of the national output of research publications, which was measured in a bibliometric study undertaken by the Stellenbosch University. Table 11.8 summarises the production of research articles by institution from 2010 to 2016.

Table 11.8 Research articles allocated to Tanzanian institutions: 2010–2016

University of Dar es Salaam	826	14.0%
Muhimbili University of Health and Allied Sciences	744	12.6%
Sokoine University of Agriculture	679	11.5%
Ifakara Health Institute	478	8.1%
National Institute for Medical Research	424	7.2%
International universities	2 159	36.6%
All other Tanzanian institutions	592	10.0%
Total	5 902	100.0%

Source: CHET 2017d

The publication data in Table 11.8 indicate a low national output of research articles. A total of 5 902 research articles were produced from 2010 to 2016 – an average of only 843 a year. University of Dar es Salaam produced 14% of the total, but at a low annual average of only 118 articles.

Herana analyses show that if the University of Dar es Salaam were to be regarded as a research-led university, its average annual output of research articles would have to be much higher.

The University of Dar es Salaam's strategic planning

University of Dar es Salaam has published two strategic plans on its website: (1) a 'Rolling Strategic Plan: 2008/2009–2012/13' and (2) a 'Corporate Strategic Plan 2014–2023'. The university's 'Rolling Strategic Plan' summarises the University of Dar es Salaam's vision and mission as set out in Table 11.9.

Table 11.9 University of Dar es Salaam vision and mission: 2008/2009–2012/13

Vision statement	To become a reputable world-class university that is responsive to national, regional and global development needs through engagement in dynamic knowledge creation and application.
Mission statement	Transmit knowledge from one generation to another, conduct scientific research to advance the frontiers of knowledge, provide teaching and public services in order to continuously meet the high-level human resource needs of the general public and beyond.

Source: *University of Dar es Salaam 2009: 5*

The *Rolling Strategic Plan* further noted: ‘The broad objects of the university are advancement, diffusion and extension of the arts, science, technology and learning, the provision of higher education and research and the nurturing of the intellectual, aesthetic, social and moral growth of the students at the university’ (UDSM 2009: 6).

The ‘Rolling Strategic Plan’ lists the following functions for the university (UDSM 2009: 6):

- to assume a leading role in providing university education and professional or vocational training in centres of learning, and in promoting research;
- to be a producer and supplier of key policy-makers, experts and personnel for national development;
- to stimulate and promote intellectual, cultural, scientific and technological development; and
- to promote research into economic, political, social, cultural, scientific and technological areas with particular reference to the interests of mankind.

The ‘Rolling Strategic Plan’ also lists a number of weaknesses affecting University of Dar es Salaam’s ability to fulfil these functions (UDSM 2009: 19):

- low output-related research skills and professionalism in its academic staff;
- inadequate marketing of the university’s programmes, strengths and capabilities;
- an overcrowded teaching space; and
- inadequate books and other teaching and learning materials.

Implementing the objectives of the strategic plan

At Herana project meetings held in South Africa in November 2014 and November 2016, representatives of University of Dar es Salaam discussed

the implementation of its 'Rolling Strategic Plan: 2008/2009–2012/13', identifying a number of key challenges and achievements (CHET 2017a, CHET 2015):

- Low levels of funding for research were a major problem in Tanzania. An important national policy had been that at least 1% of gross domestic product (GDP) should be allocated to research, but this had rarely been implemented.
- Due to a lack of research funds, nationally and institutionally, the university's doctoral programmes had only been developed slowly. Sponsorships for doctoral students were limited and insufficient space and equipment had been allocated. It was expected that the recent incorporation of a new medical school and an agricultural studies department at University of Dar es Salaam, replacing academic units that had been merged into other public universities, would increase interest and enrolments in doctoral programmes.
- The need for greater academic diversity was flagged as a strategic issue, particularly in relation to promoting research and the provision of doctoral training. Since its establishment, the University of Dar es Salaam had produced three new universities, and in so doing, had lost three major disciplines. In 1984, the university's agriculture faculty became a fully-fledged university and agriculture was no longer offered as a result. Similarly, the Muhimbili University of Health and Allied Sciences and Ardhi University, which provided architectural science studies, were established by 2008. In order to compensate, University of Dar es Salaam re-introduced agricultural, medical and health science studies by 2016.
- The University of Dar es Salaam had recognised that its research agenda should become more relevant to national strategic priorities and should help to address the socio-economic needs of the country. The university had prioritised efforts to expand its knowledge-production and applied research capacity accordingly. The university was creating new structures to support research activities, which included appointing a deputy vice-chancellor for research and knowledge exchange with a specific mandate to improve research standards to enable the university to move towards being recognised as a flagship institution.
- The University of Dar es Salaam's academic staffing had been damaged by a ten-year government freeze on hiring, which had impeded succession planning and created a gap in standards between senior professors and a growing number of junior

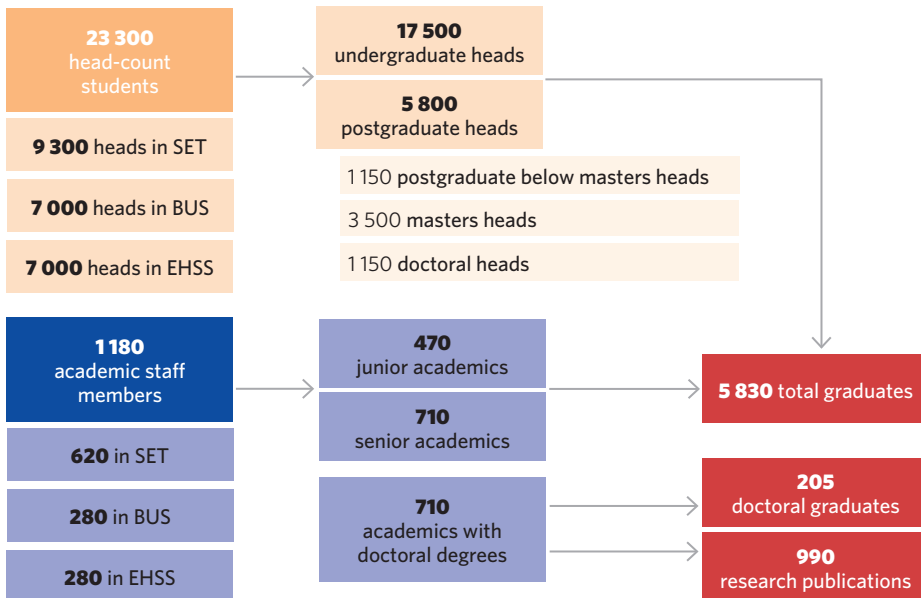
lecturers. The University of Dar es Salaam had attempted to bridge the gap by raising the retirement age for professors and deploying them as research mentors.

- The government had imposed an ‘Open Performance Review and Appraisal System’ under which academics signed employment contracts setting individual targets. Staff were obliged to report against these targets and the universities reviewed their performance accordingly every six months. The reporting structure had enabled University of Dar es Salaam to collect comprehensive information on staff research activities.
- University of Dar es Salaam had begun to prepare an annual research report in which academic staff gave details of their research activities and outputs. To ensure that there was institutionalised data collection, the university had established facilities in all academic units for the collection of research data.

Assessing the University of Dar es Salaam according to academic core criteria

Figure 11.2 offers a sketch of what the University of Dar es Salaam would have looked like in 2015 if it had satisfied the Herana academic core criteria.

Figure 11.2 Model of University of Dar es Salaam as a university meeting Herana academic core criteria



The ratios employed in Figure 11.2, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;
- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;
- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;
- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate;
- Doctoral graduates = 0.29 per academic with doctorate

Table 11.10 compares some of the main data in Figure 11.2 against the University of Dar es Salaam's actual enrolment, staffing and knowledge outputs for 2015. Some key differences between the actual data and the data for the model should be noted:

- Enrolments in science and technology were 47% below the total projected by the model and those in the fields of business and management were 73% below the projected total. Enrolments in the fields of education, humanities and social sciences were 136% above the totals in the model.
- Enrolments in doctoral programmes were well below the total envisaged by the Herana model. The total of 200 was 950 (83%) below the model's projection for a university with 23 300 students.
- The University of Dar es Salaam had only half the number of senior academic staff required to meet the Herana target, although it satisfied the criterion for the number of permanent academic staff because of its many junior academics.
- The University of Dar es Salaam's performance in relation to its knowledge outputs was variable. The number of graduates produced was 29% above the target set by the model, but the number of doctoral graduates was nearly 160 (72%) below target. Meanwhile, only 127 articles were produced, compared with the model's minimum target of 960.

Table 11.10 University of Dar es Salaam actual 2015 data compared with academic core model

	Actual 2015 data	Data generated by academic core ratios	Difference between actual data and data in model
Total head-count enrolment	23 300	23 300	0
Enrolment by qualification:			
undergraduate	22 010	17 500	+4 510
postgraduate below masters	98	1 150	-1 052
masters	1 620	3 500	-1 880
doctoral	200	1 150	-950
Enrolment by field of study:			
science & technology (including health)	4 900	9 300	-4 400
business, economics & management	1 900	7 000	-5 100
education, humanities & social sciences	16 500	7 000	9 500
Permanent academic staff:			
professors, associate professors and senior lecturers	349	710	-361
lecturers and below	824	470	354
total academic staff	1 173	1 180	-7
academic staff with doctorates	624	710	-86
Knowledge outputs:			
total graduates	7 520	5 830	1 690
doctoral graduates	61	220	-159
research publications	127	960	-833

Sources: CHET 2017; Figure 11.2 for academic core ratio data

Further assessment of the University of Dar es Salaam on academic core criteria

In assessing the performance of the Herana universities the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators. Accordingly, the first two columns of Table 11.11 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2. The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios.

Table 11.11 University of Dar es Salaam: Data for assessing academic core performance

	Target	Three-year average 2013-2015	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	21%	2.1
Limit on % undergraduate enrolments	75%	90%	3.3
% masters enrolments	15%	8.6%	2.3
% doctoral enrolments	5%	0.9%	0.7
% senior academics	60%	31%	2.1
% of SET academics with doctorates	60%	49%	3.3
% BUS academics with doctorates	60%	42%	2.8
% EHSS academics with doctorates	60%	35%	2.3
Favourable student-to-academic ratios in SET	15	12	4.0
Favourable student-to-academic ratios in BUS	25	47	2.1
Favourable student-to-academic ratios in EHSS	25	20	4.0
Output targets			
Ratio of total graduates to total enrolments	0.25	0.33	4.0
Ratio of masters graduates to masters enrolments	0.25	0.44	4.0
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.12	1.3
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.17	3.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.23	4.0
Ratio of SET research articles to academics with doctorates	2.00	0.36	0.7
Ratio of BUS articles to academics with doctorates	1.00	0.10	0.4
Ratio of EHSS research articles to academics with doctorates	1.00	0.09	0.4

Sources: Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The numerical values in the fourth column can be understood in these broad ways:

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

The targets and 4-point scale scores can be used to depict the university's academic core performance in two radar graphs: one for its inputs and

the other for its outputs. The shapes of these two radar graphs flag the extent to which University of Dar es Salaam has failed to meet the Herana academic core.

Figure 11.3 indicates that University of Dar es Salaam met only two of the input academic core targets set by the Herana project in relation to student-to-staff ratios in science and technology and in education, humanities and social sciences. However, the university reported relatively low numbers and proportions of doctoral enrolments, and of senior academics.

Figure 11.4 shows that University of Dar es Salaam met three of the output targets set by the Herana project, for total number of graduates, the total number of masters graduates across all fields of study, and the ratio of doctoral graduates in education, humanities and the social sciences to academics with doctorates. The University of Dar es Salaam performed particularly poorly in relation to its low outputs of research publications in all fields, and its low output of doctoral graduates in SET programmes.

Figure 11.3 University of Dar es Salaam: Inputs based on averages for 2013 to 2015

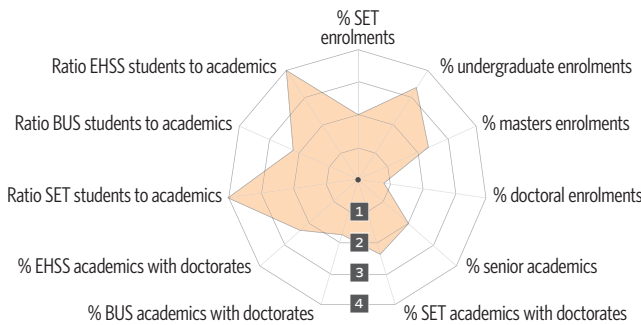
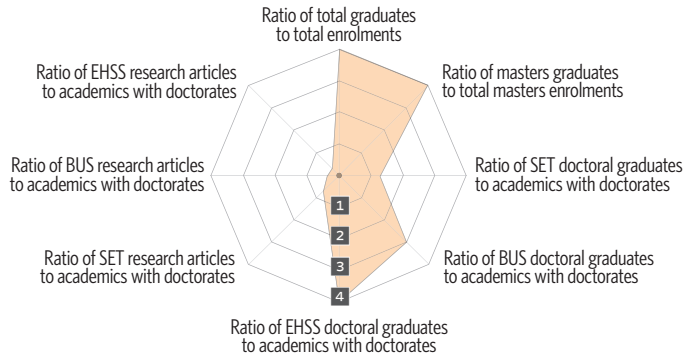


Figure 11.4 University of Dar es Salaam: Outputs based on averages for 2013 to 2015



Summary

Tanzania is classified by the World Bank as a low-income country and has a total population of 52.4 million. Tanzania's gross participation rate in higher education was only 4.7% in 2014, indicating highly inequitable access to universities. Recognising the problem, a national target of 10% participation has been set for 2020. University enrolments will have to grow at exceptionally high rates to achieve this.

Aside from targeting an increase in gross participation rates, the national government's expectations of the role that should be played by public and private universities are unclear. Searches of official websites failed to uncover any publicly available information about (a) the roles universities should fulfil; (b) how the academic cores of public universities should be constituted; and (c) the shape of student enrolments by qualification and field of study over an extended period.

Despite the lack of clearly established roles and goals for higher education institutions in Tanzania, the University of Dar es Salaam formulated a vision to becoming a reputable, world-class university. In implementing this vision, the University of Dar es Salaam sought to stimulate intellectual, cultural, socio-economic, political and scientific and technological development through engaged research.

The University of Dar es Salaam acknowledged that it faced major problems in achieving this goal:

- Low levels of funding for research were a major problem in Tanzania. An important national policy had been that at least 1% of GDP should be allocated to research, but this had rarely been implemented.
- Due to a lack of research funds, nationally and institutionally, the university's doctoral programmes had only been developed slowly. Sponsorships for doctoral students were limited and insufficient space and equipment had been allocated.
- The University of Dar es Salaam's academic staffing had been damaged by a ten-year government freeze on hiring, which had impeded succession planning and created a gap in standards between senior professors and a growing number of junior lecturers. The university had attempted to bridge the gap by raising the retirement age for professors and deploying them as research mentors.

A total of 5 902 research articles were produced from 2010 to 2016 – an average of only 843 a year. The University of Dar es Salaam produced 14% of the total, but at a low annual average of only 118 articles.

The University of Dar es Salaam has made some progress towards the Herana targets for research outputs. The number of doctoral graduates increased from eight in 2009 to 61 in 2015. The number of doctoral students enrolled at the university increased from 78 in 2009 to 199 in 2015. However, the numbers still fell well short of the Herana target that 5% of enrolments should be in doctoral programmes.

The number of research articles produced by staff at the university increased from 100 in 2009 to 135 in 2015. However, its ratio of articles per academic staff member remained low.

The data suggest that the University of Dar es Salaam was correctly classified as a research-oriented university. It has research aspirations and has met some of the Herana criteria for research outputs but can show little evidence of major improvements over time in its research inputs and outputs.

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Chapter 12

Eduardo Mondlane University

National context

Population data

Mozambique's population estimates, covering the years 2007, 2010 and 2014 and including totals for the 20–24 age band, are summarised in Table 12.1. (Estimates derived from the Countrymeters, IndexMundi and United Nations Statistics Division websites indicate that the average ratio in Mozambique of those aged 20–24 to the total population was 8.7%, which is the percentage used to generate the numbers for this age group in 2007, 2010 and 2014.)

Table 12.1 Mozambique population: 2007, 2010 & 2014 ('000)

	2007	2010	2014	Average annual increase
Total population	20 250	24 200	26 800	4.1%
Estimate of population in 20-24 age group	1 760	2 100	2 330	4.1%

Sources: Countrymeters.info 2018; United Nations Statistics Division 2018; IndexMundi 2018

Extrapolating from this data, the gross participation rates in higher education for 2007, 2010 and 2014 are listed in Table 12.2.¹

1 The gross participation rate is defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20–24.

Table 12.2 Mozambique's gross participation rate in higher education: 2007, 2010 & 2014

	2007	2010	2014
Total enrolment of higher education students	63500	101400	157000
Gross participation rate	3.6%	4.8%	6.7%

Sources: Langa 2013 for enrolment data for 2007 and 2010; Unesco 2018 for 2014 enrolment data

It is worth noting that Mozambique's gross participation rate in higher education increased from 3.6% in 2007 to 6.7% in 2014. Notwithstanding the rise, the 2014 percentage could be regarded as too low for a country which is committed to improving equity of access to higher education.

Higher education at the national level

The account of higher education in Mozambique which follows is taken from *Higher Education in Portuguese Speaking African Countries: A Five Country Baseline Study* (Langa 2013).

Between 1976 and 1984, Eduardo Mondlane University (UEM) was the sole higher education institution in Mozambique. In 1985 and 1986, two new public higher education institutions were created: the Higher Pedagogical Institute, a teacher training institution; and the Higher Institute for International Relations, an institution training civil servants (Langa 2013: 63–64).

The higher education system changed in 1993, when a new law was introduced which made provision for multiple suppliers of higher education, including private institutions. The first two private higher education institutions were opened in 1995, followed by at least a further ten over the next ten years. Two of the first 12 private higher education institutions were labelled as universities, with the other ten being called higher institutes or higher schools. Each of these private institutions was designed to train professionals in specific areas (Langa 2013: 65).

Mozambican legislation established three criteria for classifying higher education institutions (Langa 2013: 66–68):

- The type of property and mechanism for funding. Higher education institutions can be private or public. Public institutions are owned by the state and depend on public funding. Private ones are owned by private collective entities, such as limited liability companies, foundations and corporations, which derive most of their income from private sources.
- The focus and importance attributed by each higher education institution to technical/professional training and scientific research and the kinds of qualification that it can award. Accordingly,

higher education institutions may be classified as universities, higher institutes, higher schools, polytechnic institutes, academies or faculties. Universities, higher institutes and faculties combine technical training with scientific research, while the mission of higher schools and polytechnic higher institutes is primarily technical/professional training. Polytechnic higher education institutes are not allowed to award doctoral degrees.

- Profitability: Some private institutions are supposed to be for-profit while others are non-profit.

Eduardo Mondlane University was, up to 2011, the country's largest higher education institution in terms of the scope of its academic programmes and its infrastructure. The Pedagogical University founded in 1985 is the second largest public higher education institution in Mozambique, with most of its academic programmes oriented towards teacher training. The third oldest public higher education institution is the Higher Institute of International Relations, which was founded in 1986. This institution offered BA honours degrees in public administration and in international relations, and in 2011 introduced masters degree programmes in development studies and policy analysis. By 2009, the government had established 14 public higher education institutions offering academic programmes in the fields of civil service, security, defence, health, law, business, social sciences, communications, arts, engineering and natural sciences (Langa 2013: 67).

Private stakeholders established 24 higher education institutions between 1995 and 2011, with the focus on law and business science, followed by engineering and natural sciences, arts and social sciences, education, and communication (Langa 2013: 77).

Table 12.3 indicates the numbers of students enrolled in higher education in Mozambique between 2002 and 2014 (data for 2015 were not available).

Table 12.3 Students enrolled in public and private higher education institutions in Mozambique: 2002–2014

	2002	2006	2010	2014	Average annual increase from 2002 to 2014
Total public and private institutions	17 397	43 233	101 362	157 000	20.1%

Sources: Langa 2013 for enrolment data for 2002 to 2010; Unesco 2018 for 2014 enrolment data

In 2006, 43 233 students were enrolled in the higher education system, of whom 26% were at private institutions and 74% at public institutions. Between 2006 and 2010, enrolment more than doubled to over 100 000 students, with most of the growth in the public sector largely due to the introduction of fee-paying evening classes at the two largest public

universities, Eduardo Mondlane University and the Pedagogical University (Langa 2013: 77–78).

Total enrolments in the sector increased by 56 000 between 2010 and 2014, at an average annual rate of 11.6%, which was about half the average annual rate of increase from 2002 to 2014, which was 20.1% (Unesco 2018; calculations based on Table 12.3).

Table 12.4 lists the public and private higher education institutions in Mozambique by date of foundation in 2011 (no such information for 2012 to 2015 could be sourced).

Table 12.4 Public and private higher education institutions in Mozambique: 2011

Public higher education institutions	Founded	Public higher education institutions	Founded
Eduardo Mondlane University	1962	Higher Polytechnic Institute	1995
Pedagogical University	1985	Catholic University	1996
Higher Institute of International Relations	1986	Higher Institute of Science and Technology	1996
Academy of Police Sciences	1999	Mussa Bin Bik University	1998
Higher Institute of Health Sciences	2003	Higher Institute of Transports and Communication	1999
Military Academy	2003	Technical University of Mozambique	2002
Higher School of Naval Sciences	2004	Saint-Thomas University of Mozambique	2004
Higher Institute of Accounting and Auditing	2005	Jean-Piaget University of Mozambique	200?
Higher Polytechnic Institute of Gaza	2005	Higher School of Economics and Management	200?
Higher Polytechnic Institute of Manica	2005	Higher Institute of Education and Technology	200?
Higher Polytechnic Institute of Tete	2005	Christian Higher Institute	2005
Higher Institute of Public Administration	2005	Higher Institute of Training, Research and Science	2005
UNI-Lúrio University	2006	Dom Bosco Higher Institute	200?
Zambeze University	2006	Higher Institute of Technology and Management	2005
Higher Institute of Journalism	2006	Monitor Higher Institute	2008
Higher Institute of Arts and Crafts	2008	Higher Institution of Communication and Image	2008
Higher Polytechnic Institute of Songo	2008	Indian University of Mozambique	2008
		Maria Mother of Africa Higher Institute	2008
		Higher Institute of Management, Finance and Business	2009
		Alberto Chipande Higher Institute of Technology	2009
		Higher Institute of Science and Management	2009
		Adventist University of Mozambique	2011
		Frelimo or Nachingweia University	2011
		Higher Institute of Management and Business of Manjacaze	2011

Source: Langa 2013: 67–68

Note: The dates marked as ‘200?’ are ones in which only the first three digits were printed in Langa’s text.

Focus on Eduardo Mondlane University

Basic data

Table 12.5 and Figure 12.1 summarise the number of students enrolled at Eduardo Mondlane University by field of study from 2009 to 2015. The number of students enrolled at Eduardo Mondlane University doubled in 2015 compared with 2009. The average annual growth rate in enrolments

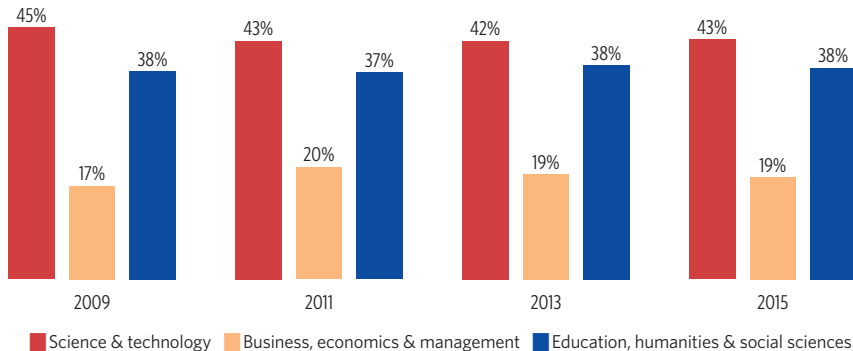
was exceptionally high at 11.9%, with the highest growth rate in business, economics and management (14%). Eduardo Mondlane University's enrolment shape by field of study remained stable over this period, with the share of students enrolled in science and technology disciplines proportion consistently over 40%.

Table 12.5 Students enrolled at Eduardo Mondlane University by field of study: 2009–2015

	2009	2011	2013	2015	Average annual increase
Science & technology	8 895	10 011	14 647	16 958	11.4%
Business, economics & management	3 349	4 704	6 593	7 348	14.0%
Education, humanities & social sciences	7 318	8 667	13 219	14 094	11.9%
Total university enrolment	19 652	23 481	34 490	39 247	11.9%

Sources: CHET 2017b and 2017c

Figure 12.1 Eduardo Mondlane enrolments by fields of study: 2009–2015

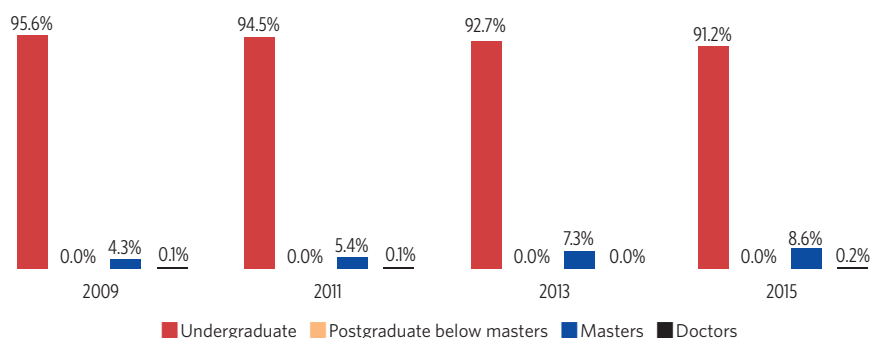


Source: Calculations based on Table 12.5

Figure 12.2 and Table 12.6 summarise the number of students enrolled at Eduardo Mondlane University by qualification type. The number of students enrolled in undergraduate courses at Eduardo Mondlane University increased by 16 240 in 2015 over 2009, partly as a result of the university's entry into the competitive evening-class market. The number of masters students enrolled quadrupled in 2015 over 2009, to 3 376. Notwithstanding this increase, Eduardo Mondlane University remained an undergraduate university, at which more than 90% of enrolments were in undergraduate programmes. The number and proportion of students enrolled in doctoral degrees in 2015 (62 and 0.2%) were low. A university of Eduardo Mondlane University's size with research aspirations should have about 2 000 students enrolled for doctorates.

The Herana project has recognised that the number of enrolments in doctoral degree programmes constitutes an important indicator of a university's engagement in research. However, in order to measure the

Figure 12.2 Eduardo Mondlane University enrolments by qualification type: 2009–2015



Source: Calculations based on Table 12.6

university's strength within its national research environment, account must also be taken of its share of the national output of research publications, which was measured in a bibliometric study undertaken by Stellenbosch University.

Table 12.6 Students enrolled at Eduardo Mondlane University by qualification type: 2009–2015

	2009	2011	2013	2015	Average annual increase
Undergraduate	18 700	22 094	31 903	34 940	11.0%
Postgraduate below masters	0	0	0	0	
Masters	848	1265	2518	3376	25.9%
Doctors	14	23	17	62	34.8%
Total	19 562	23 382	34 459	38 400	11.9%

Sources: CHET 2017b and 2017c

Table 12.7 summarises the production of research articles by institution in Mozambique from 2010 to 2016. Overall, the data indicate a low national output, with only 195 articles produced on average each year. Eduardo Mondlane University produced 38% of the total over the seven-year period but at a low annual average of only 73 articles.

Table 12.7 Research articles allocated to Mozambican institutions: 2010–2016

	Total for period	% of total
Eduardo Mondlane University	513	37.6%
Other Mozambique institutes and institutions	706	51.7%
South African universities	70	5.1%
Other international universities	77	5.6%
Total	1 366	100.0%

Source: CHET 2017d

Eduardo Mondlane University's changing aspirations

This account of changes in UEM's aspirations is taken from a presentation by Patricio Langa at a Herana seminar held in Cape Town in November 2014 (Langa 2015).

By 2007, Eduardo Mondlane University faced two major challenges. The first was a growing awareness that the relevance of the institution could not be based solely on the training of civil servants and the production of human resources for the state. The second resulted from increases in the number of public and private higher education institutions, which forced the university to compete for enrolments from a common pool of students. These pressures led to debates about whether Eduardo Mondlane University should in fact be competing with the public and private sectors in trying to attract more students. It was accepted that Eduardo Mondlane University could not expect, in the changing national and external contexts, special consideration as the first and oldest higher education institution in Mozambique (Langa 2015: 9).

The external context, which included Eduardo Mondlane University joining the Herana project, brought an end to the university's 'illusion of perfection'. Eduardo Mondlane University had based its high assessment of itself on the number of government ministers and other senior officials that it had trained, but comparisons with other regional higher education institutions clearly showed that the university was actually under-performing. Eduardo Mondlane University could no longer sustain its claims to excellence unless it improved its performance relative to the Herana and other African universities (Langa 2015: 9).

A comprehensive evaluation indicated that Eduardo Mondlane University's focus on teaching and the reproduction of existing knowledge had inhibited its production of new knowledge. The university had become a place where students went to listen to teachers, usually in overcrowded classrooms, and, as a result, its research environment was weak (Langa 2015: 10–11). Accordingly, a new vision and mission were approved by the university's council in October 2013 (see Table 12.8).

Table 12.8 Eduardo Mondlane University vision and mission: 2013

Vision statement	Mission statement
Become national, regional and international in the production and dissemination of scientific knowledge and innovation, highlighting research as the foundation of teaching and learning and extension processes.	Produce and disseminate scientific knowledge and promote innovation through research in support of teaching and learning and extension processes. Educating generations with humanistic values in order to face the current challenges of the society's development.

Sources: CHET 2015; CHET 2016

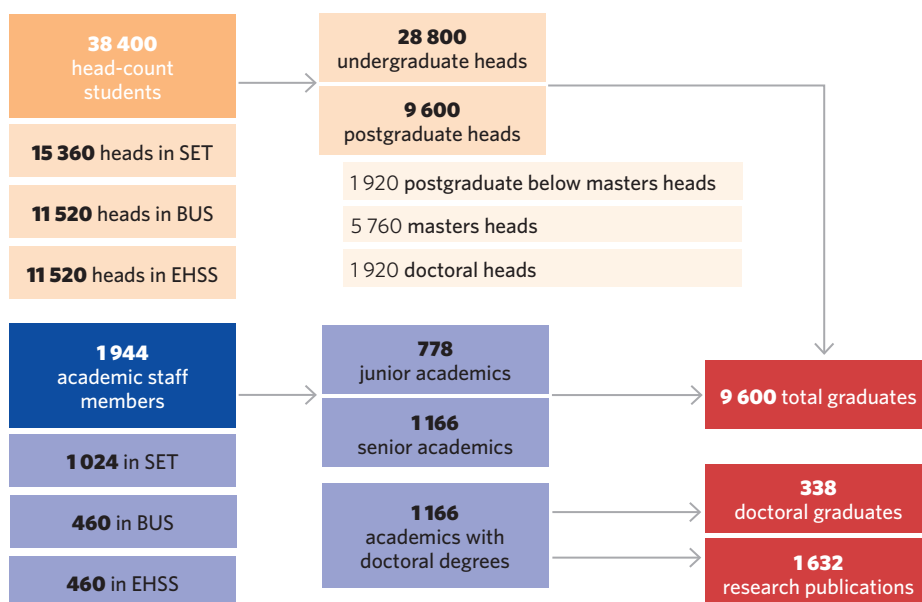
However, a lack research incentives and inadequate facilities have hindered the implementation of the new vision and mission and have led to frustration among academics and the unintended consequence of increasing conflict within faculties (Langa 2015: 15).

Assessing Eduardo Mondlane University according to Herana academic core criteria

Figure 12.3 offers a sketch of what Eduardo Mondlane University would have looked like in 2015 if it had satisfied the targets in the Herana academic core criteria. The enrolment total is taken as the actual one for that year. The ratios employed in Figure 12.3, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;
- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;
- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;

Figure 12.3 Model of Eduardo Mondlane University as a university meeting the Herana academic core criteria



- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate;
- Doctoral graduates = 0.29 per academic with doctorate

Table 12.9 compares some of the main data in Figure 12.3 against Eduardo Mondlane University's actual enrolment, staffing and knowledge outputs for 2015.

Table 12.9 Eduardo Mondlane University actual 2015 data compared to academic core model

	Actual 2015 data	Data generated by academic core ratios	Difference between actual data and data in model
Total head-count enrolment	38 400	38 400	0
Enrolment by qualification:			
undergraduate	34 940	28 800	+6 140
postgraduate below masters	0	1 920	-1 920
masters	3 376	5 760	-2 384
doctoral	84	1 920	-1 836
Enrolment by field of study:			
science & technology (including health)	16 958	15 360	+1 598
business, economics & management	7 348	11 520	-4 172
education, humanities & social sciences	14 094	11 520	+2 574
Permanent academic staff:			
professors, associate professors and senior lecturers	347	1 166	-821
lecturers and below	1 443	788	+655
total academic staff	1 790	1 944	-154
academic staff with doctorates	380	1 166	-786
Knowledge outputs:			
total graduates	2 280	9 600	-7 320
doctoral graduates	19	338	-319
research publications	80	1 632	-1 542

Sources: CHET 2017; Figure 12.3 for academic core ratio data

The differences between the actual data and the data from the model can be explained in a number of ways:

- Eduardo Mondlane University has too many undergraduates and too few postgraduates. The actual number of undergraduates exceeds the total in the model by more than 6 000 (21%).
- Actual masters enrolments were 2 400 below the number produced by the model, and actual doctoral enrolments were 1 800 below the model's total.
- The actual number of academic staff employed by Eduardo Mondlane University was only 154 (9%) below the number produced by the model. However, the distribution of staff

between the senior and junior categories was distorted. Only 20% could be categorised as senior staff compared with the model's projection of 60%.

- Eduardo Mondlane University's outputs of graduates, doctoral graduates and research articles fell well below the model's targets. The number of graduates produced was more than 7 300 (76%) below target. Only 19 doctoral graduates were produced against a target of 388. Only 80 research articles were produced compared with the 1 542 envisaged by the model.

Further assessment of Eduardo Mondlane University on academic core criteria

In assessing the academic core performance of the Herana universities, the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators. Accordingly, the first two columns of Table 12.10 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2.

Table 12.10 UEM: Data for assessing academic core performance

	Target	Three-year average 2013-2015	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	43%	4.0
Limit on % undergraduate enrolments	75%	92%	3.3
% masters enrolments	15%	7.9%	2.1
% doctoral enrolments	5%	0.1%	0.1
% senior academics	60%	19%	1.3
% SET academics with doctorates	60%	16%	1.1
% BUS academics with doctorates	60%	8%	0.5
% EHSS academics with doctorates	60%	25%	1.7
Favourable student-to-academic ratios in SET	15	15	4.0
Favourable student-to-academic ratios in BUS	25	23	4.0
Favourable student-to-academic ratios in EHSS	25	28	3.6
Output targets			
Ratio of total graduates to total enrolments	0.25	0.06	1.0
Ratio of masters graduates to masters enrolments	0.25	0.03	0.5
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.03	0.3
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.03	0.5
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.06	1.0
Ratio of SET research articles to academics with doctorates	2.00	0.32	0.6
Ratio of BUS research articles to academics with doctorates	1.00	0.06	0.2
Ratio of EHSS research articles to academics with doctorates	1.00	0.19	0.8

Sources: Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, social sciences and humanities

The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university’s average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios.

The numerical values in the fourth column can be understood in these broad ways (see above for the methodology used to arrive at these values):

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

The targets and 4-point scale scores can be used to depict the university’s performance as a research-led institution in two radar graphs: one for its inputs and the other for its outputs. The shapes of these two radar

Figure 12.4 Eduardo Mondlane University: Inputs based on averages for 2013 to 2015

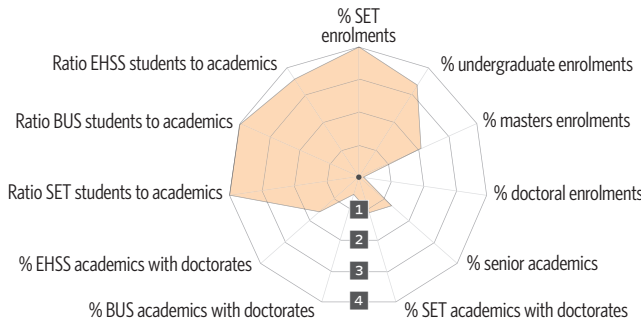
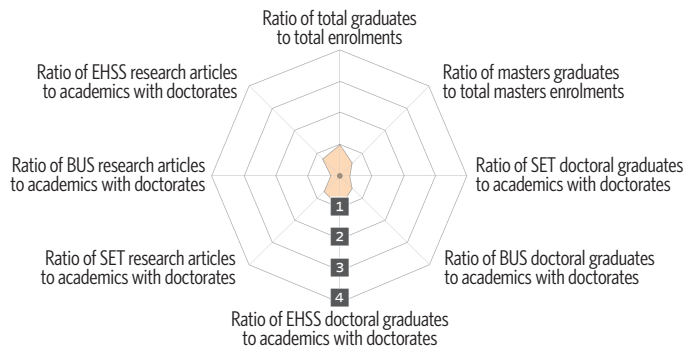


Figure 12.5 Eduardo Mondlane University: Outputs based on averages for 2013 to 2015



graphs flag the extent to which Eduardo Mondlane University has failed to meet the Herana targets for being research-led.

In relation to inputs, Figure 12.4 indicates that Eduardo Mondlane University met the Herana targets for enrolments in science and technology and for student-to-staff ratios in science and technology and business, economics and management. However, its proportions of masters and doctoral enrolments were low, as were its numbers for senior academics and the proportion of academics with doctorates in all fields.

In relation to outputs, Figure 12.5 indicates an extremely poor performance according to the Herana criteria. All eight of Eduardo Mondlane University's scores for the key output indicators were either 1.0 or below.

Summary

With a population of 26.8 million, of whom 2.33 million were aged 20–24 in 2014, Mozambique is classified by the World Bank as a low-income country. Its gross participation rate in higher education was only 6.7% that year.

In 2006, 43 233 students were enrolled in the higher education system, of whom 26% were at private institutions and 74% at public institutions. Between 2006 and 2010, enrolment more than doubled to over 100 000 students, with most of the growth in the public sector largely due to the introduction of fee-paying evening classes at the two largest public universities.

The number of students at Eduardo Mondlane University rose from 19 652 in 2009 to 38 400 in 2015, which represented an exceptionally high average annual growth rate of 12.0%. Eduardo Mondlane University's undergraduate enrolments increased by 16 200 in 2015 over 2009, which was partly due to the university's entry into the competitive evening-class market for undergraduate students. The number of masters students quadrupled in 2015 over 2009, rising from 848 to 3 376. However, Eduardo Mondlane University remained an undergraduate university over this period, with over 90% of students enrolled in its undergraduate programmes.

Increases in the numbers of public and private higher education institutions after 2002 changed Eduardo Mondlane University's institutional aspirations. It had to decide whether it should be competing with the institutions in both the private and public sectors to try and attract more students, or whether it should focus on trying to improve its performance in producing knowledge. In 2007, it decided to try and become national, regional and international in the production and dissemination of scientific knowledge and innovation. Research activities should, it decided, lay the foundations of its teaching, learning and extension services.

Eduardo Mondlane University's numbers and proportions of enrolments in doctoral degree programmes have remained low. In 2009,

14 doctoral students were enrolled; in 2015, 84 were enrolled. These numbers represent only 0.1% and 0.2% of Eduardo Mondlane University's total enrolments in those years. The 2015 ratio of doctoral enrolments was still well short of the Herana target of 5% of total enrolments.

Eduardo Mondlane University's low number of doctoral students has had a clear, adverse impact on its research outputs. The Mozambican national research system produced 1 366 research articles from 2010 to 2016, with only 195 articles produced on average each year. Eduardo Mondlane University produced 38% of the total over the seven-year period but at a low annual average of only 73 articles. Its ratio of articles per academic staff member with a doctorate remained low, at 0.1 per academic in both 2009 and 2015.

The data suggest that the Chapter 2 classification of Eduardo Mondlane University as a research-aspirational university is correct. It has some research aspirations but can provide only minimal evidence of improvements in the outputs flowing from its research activities.

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Chapter 13

University of Ghana

National context

Population data

Ghana's population grew from 23.3 million in 2008 to 27.6 million in 2015, at an average annual rate of 2.4%, with the number of people aged 20 to 24 growing at the same rate (see Table 13.1).

Table 13.1 Ghana population: 2008–2015 ('000)

	2008	2010	2013	2015	Average annual growth
Total population	23 300	24 658	26 358	27 600	2.4%
Population in 20–24 age group	2 190	2 323	2 478	2 594	2.4%

Sources: Ghana Statistical Services 2012; Trading Economics 2017

Note: Official data for 20–24 age groups were available only for 2010. The 2010 ratio of 9.4% for 20–24 age group to total population was used to calculate estimates for 2008, 2013 and 2015.

The kinds of institutions in the tertiary education sector in Ghana according to the *Composite Statistics Report for 2012/13* are listed in Table 13.2. Extrapolating from available data, the gross participation rates in tertiary education in Ghana in 2008 and 2015 are summarised in Table 13.3.¹

It is notable that the gross participation rates more than doubled between 2008 and 2013, although it could be regarded as low for a country which is committed to improving equity of access to tertiary education.

1 These gross participation rate is defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20–24.

Table 13.2 Tertiary education institutions in Ghana: 2012/2013

Categories of tertiary institutions	Number of institutions in category
Public universities	9
Quasi-public tertiary institutions	7
Public colleges of agriculture	3
Polytechnics	10
Public colleges of education	38
Public nursing colleges	10
Total public tertiary institutions	77
Private universities/private colleges	61
Private colleges of education	3
Private nursing colleges	5
Total private tertiary institutions	69
Total public and private tertiary institutions	146

Source: National Accreditation Board 2015

Table 13.3 Gross rates of participation in tertiary education in Ghana: 2008 & 2013

	2008	2013
Total tertiary enrolments (thousands)	132.6	390.0
Gross participation rates	6.1%	15.0%

Source: Calculations based on data in Table 1 above and Table 4 below. Also see UNESCO Institute of Education 2017.

Tertiary education at the national level

The Ghanaian Ministry of Education is responsible for the planning, oversight and control of education in the country at primary, secondary, and tertiary levels. On its 2017 website, the ministry noted that its main function involves: ‘Working towards achieving the overall goal of providing relevant and quality education for all Ghanaians, including the disadvantaged, to enable them to acquire skills, which will help make them functionally literate and productive to facilitate poverty alleviation and promote rapid socio-economic growth.’

This function is consistent with the strategy for tertiary education set out in Volume 1 of the ministry’s ‘Education Strategic Plan: 2010 to 2020’ published in February 2012. The strategic goals outlined in the plan include achieving equity of access for disadvantaged students, contributing to national social and economic development, and improving the operational efficiency and effectiveness of the tertiary education system.

The data from the plan, which was the only available public source for information on the national tertiary education system, covers the academic years 2010/11, 2011/12 and 2012/13. These years are taken to be

equivalent to the calendar years 2011, 2012, and 2013 in order to align these data with those produced from the University of Ghana as part of the Herana project.

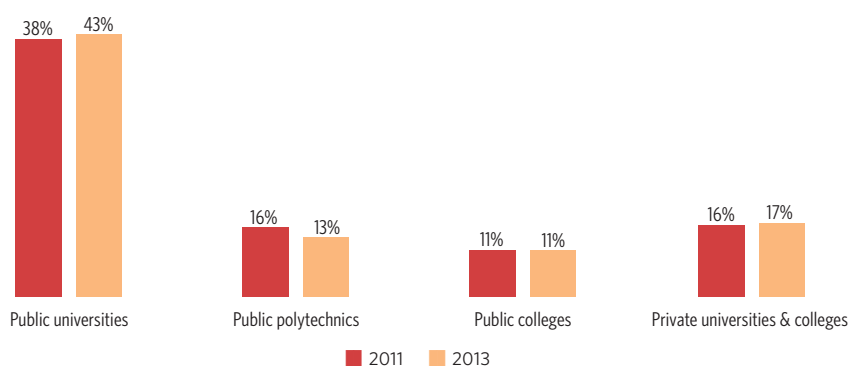
Table 13.4 details the numbers of students enrolled by type of institution in the tertiary sector in Ghana in 2011, 2012 and 2013. Figure 13.1 offers a broad summary of the distribution of enrolments by type of institution.

Table 13.4 Tertiary education enrolments in Ghana: 2011–2013

	2011	2012	2013	Change from 2011 to 2013	
Public universities, including agriculture colleges	166 444	191 664	226 750	60 306	36%
Public polytechnics	46 221	47 628	52 040	5 819	13%
Public colleges of education and nursing	31 867	39 041	44 491	12 624	40%
Public tertiary education totals	244 532	278 333	323 281	78 749	32%
Private universities and colleges	47 180	52 992	65 890	18 710	40%
Total all tertiary universities	291 712	331 325	389 171	97 459	33%

Source: National Accreditation Board 2015

Figure 13.1 Distribution of enrolments by sector in Ghana: 2011 & 2013



Source: Education Strategic Plan: 2010 to 2020

Table 13.5 shows how enrolments were distributed by type of qualification across the tertiary education system in 2013. Data in Table 13.5 show that Ghana's tertiary education system mainly caters to undergraduates. In 2013, less than 30 000 (8%) of enrolments were in postgraduate programmes. Only 1 135 of the postgraduate students were registered in doctoral programmes in 2013.

Table 13.5 Public and private tertiary education in Ghana by qualification type: 2013

	Public universities	Public polytechnics	Public colleges of education and nursing	Private universities and colleges	Total
Undergraduate diploma	41 290	51 169	44 491	2 781	139 731
Undergraduate degree	158 383	871	0	59 714	218 968
Postgraduate diploma	2 933	0	0	0	2 933
Masters	23 009	0	0	3 395	26 404
Doctoral	1 135	0	0	0	1 135
Total	226 750	52 040	44 491	65 890	389 171

Focus on the University of Ghana

Basic data

Table 13.6 summarises, by type of qualification sought, the number of students enrolled at the University of Ghana from 2011 to 2015.

Table 13.6 Students enrolled at the University of Ghana by qualification type: 2011–2015

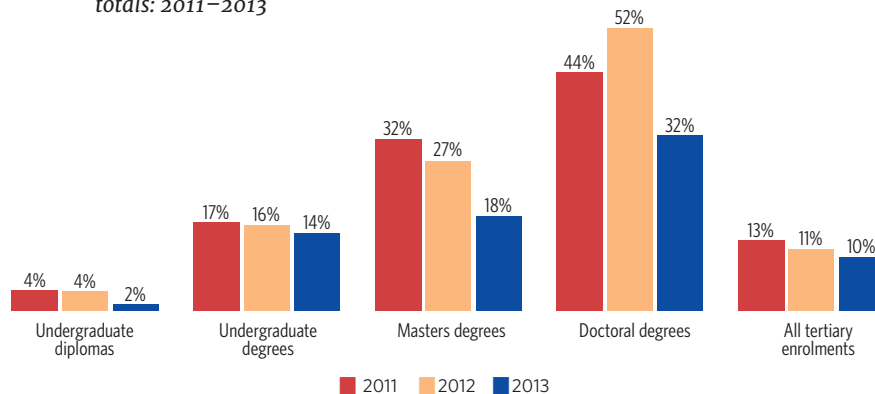
	2011	2012	2013	2014	2015	Average annual increase
Undergraduate	31 828	28 163	33 040	29 964	33 419	0.4%
Postgraduate below masters	0	0	0	0	0	-
Masters	4 312	4 400	4 654	4 800	5 010	3.8%
Doctoral	316	437	372	536	671	20.7%
Total	38 456	33 000	38 066	35 600	40 100	1.1%

Sources: CHET 2017b and CHET 2017c

Table 13.4 shows that the number of students enrolled at public universities grew from 166 444 in 2011 to 226 750 in 2013, an increase of 36%. Over the same period, the number enrolled at the University of Ghana dropped by about 0.5%. Table 13.6 shows that the numbers of students enrolled each year at the University of Ghana from 2011 to 2015 remained almost unchanged, increasing at an average annual rate of only 1.1%.

Figure 13.2 indicates the number of students enrolled at the University of Ghana as a percentage of the national cohort by qualification type from 2011 to 2013. Figure 13.2 indicates that the University of Ghana's share of national undergraduate diploma and degree enrolments fell from 21% in 2011 to 16% in 2013, and its share of masters enrolments dropped even more sharply over the same period from 32% to 18%. The University of Ghana's share of doctoral enrolments increased from 44%

Figure 13.2 University of Ghana enrolments as proportions of national tertiary enrolment totals: 2011–2013



Source: Calculations based on data in Table 13.4 and Table 13.5

in 2011 to 52% in 2012, before dropping by 20 percentage points to 32% in 2013. The overall effect of these changes was that the university's share of total national tertiary enrolments fell from 13% in 2011 to 10% in 2013.

The Herana project has recognised that the number of enrolments in doctoral degree programmes constitutes an important indicator of a university's engagement in research. Table 13.6 shows that the number of students enrolled for doctorates at the University of Ghana more than doubled from 316 in 2011 to 671 in 2015. However, 671 doctoral enrolments is a low total for an institution of the University of Ghana's size with strong aspirations to become a research-led university.

In order to measure the university's strength within its national research environment, account must also be taken of its share of the national output of research publications, which was measured in a bibliometric study undertaken by Stellenbosch University. Table 13.7 summarises the production of research articles by the university from 2010 to 2016.

Table 13.7 Research articles allocated to Ghanaian institutions: 2010–2016

	Total for period	% of total
University of Ghana	2 641	43%
Other public universities	2 125	35%
Government research agencies	538	9%
All other Ghanaian institutions	806	13%
Total	6 110	100%

Source: CHET 2017d

The publication data in Table 13.7 indicates a low national output of research articles. A total of 4 766 research articles were produced by public universities from 2010 to 2016 at an annual average of only 77 articles per public university. The University of Ghana produced 2 641 during this period, an average of 377 a year, which represented 43% of the national annual output.

Although these data averages indicate that the University of Ghana could be considered a major player in Ghana's research system, the number of research articles fell well short of the Herana targets set for a research-led university of this size. According to the Herana criteria, the University of Ghana's average annual output of articles should have been at least four times higher than the recorded annual average.

Strategic planning

University of Ghana's 'Strategic Plan 2014-2024' published on the university's website set out the institution's latest vision and mission statements (see Table 13.8).

Table 13.8 University of Ghana vision and mission: 2014 to 2024

Vision statement	The university's vision is to become a 'world-class research-intensive university' over the next decade.
Mission statement	The university will create an enabling environment that makes it increasingly relevant to national and global development through cutting-edge research as well as high quality teaching and learning.

Source: University of Ghana 2014

The preamble to the 'Strategic Plan 2014-2024' provided background for the emphasis placed on research in the vision and mission statements (University of Ghana 2014):

University of Ghana has undergone significant change since it invited a Visitation Panel in 2006 to review its processes, outputs and outcomes in the pursuit of its core mission. The mission of the university in the context of our last strategic plan (2001-2011) has been to produce world-class human resources. ... It is further anticipated that the demand for other services from the university, beyond the training of minds, will grow as research becomes more and more important to African economies and society. ...

The research output of University of Ghana faculty members is growing steadily, but it remains far less than that of its 'natural' peers in some African countries. The university is taking steps

to address this through various initiatives that support the conduct of research and facilitate the publication of findings in high-impact journals and other relevant outlets.

The university's strategic plan lists nine priorities (University of Ghana 2014): research; teaching and learning; internal stakeholders; gender and diversity; institutional processes; financial performance; asset management; monitoring and evaluation; and external stakeholders.

Tables 13.9 and 13.10 summarise the objectives and key performance indicators for the university's research, and training and learning functions.

Table 13.9 Strategic objective and key performance indicators for research at the University of Ghana

Objective	Key performance indicators
Create a vibrant intellectual climate that stimulates relevant cutting-edge research and community engagement.	<ul style="list-style-type: none"> • Should rank among top 20 African universities. • At least 50% of labs and research facilities should be re-equipped. • User access for all library facilities should increase by at least 50%. • The number of students (undergraduate and postgraduate) working with industry, either as interns or on commissioned research, should increase significantly on an annual basis. • Publications by faculty members in high-impact journals should be increased by 200%. • Funding for research should be increased by at least 150%.

Source: University of Ghana 2014

Table 13.10 Strategic objective and key performance indicators for teaching and learning at the University of Ghana

Objective	Key performance indicators
Promote academic excellence using the highest international standards of teaching, learning and leadership development.	<ul style="list-style-type: none"> • At least 85% of the faculty in all departments should have PhDs by 2018. • 100% of newly trained PhDs should have access to one form of post-doctoral support by the end of their third post-doctoral year. • At least 60% of eligible mid-career academics should have access to competitive University of Ghana research and training support and access to external support. • Departments should achieve at least 75% of teaching performance targets.

Source: University of Ghana 2014

Implementing objectives of strategic plan

At Herana project meetings held in South Africa in November 2014 and November 2016, representatives of the University of Ghana discussed the implementation of the university's research-led goals and high-level objectives, raising the following points (CHET 2017a, CHET 2015):

Ghana's National Council for Tertiary Education (NCTE) had agreed that a specific category of 'research universities' should be established and had started discussing what criteria should be

used to identify these in Ghana. University of Ghana was making a strong case to be recognised as Ghana's research university. However, a number of other public universities had also sought such recognition.

The university's 'Strategic Plan 2014–2024' set the following key goals:

- The numbers and proportions of postgraduate students should increase at the university. A target ratio of 1:1 had been established for undergraduate on-campus admissions in relation to postgraduate admissions, which would require the number of students to be capped at 35 000.
- Academic staff numbers should grow to ensure acceptable teacher-to-student ratios.
- Doctoral programmes should be restructured to ensure appropriate quality and theoretical depth. Overall programmes should be at least four years long and should include a comprehensive examination which students would have to pass before moving into research. Internships, involving collaboration with other institutions should be introduced.
- The university's academic structure should be decentralised into four colleges, each of which should take charge of its own teaching and research agendas. Each college should develop its own incentive structures to support greater research.

Even though research agendas would be devolved to its internal colleges, the university should look for substantial funding in four thematic areas: malaria research and control; enhancing food production and food processing; trans-disciplinary research into climate change adaptation; and development policy and poverty monitoring and evaluation.

The establishment of a research development office, which assisted academic staff by identifying funding opportunities and helping with the management of their research grants, had provided some indirect support for research activities. However, apart from offering funding for conferences, the University of Ghana provided few direct incentives to academic staff to increase their research outputs, relying instead on the ambition of individual academics and their desire for promotion.

The University of Ghana had accepted the Herana project's performance measurement processes as fair, comprehensive and applicable to its situation and context. The university had established a central statistics office which was responsible for collecting and disseminating data on the academic core and using this information to promote awareness among the university's leaders on the need for greater efficiency in

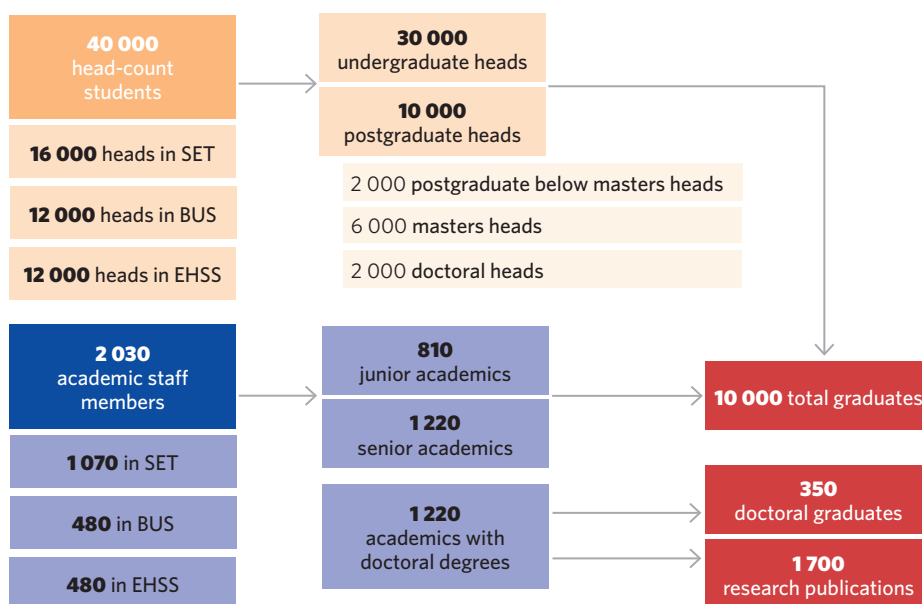
research and teaching. The Herana data were also used to draft research grant applications, promote collaborative projects and lobby the Ghanaian government for the additional funding required to improve the university’s research performance, particularly in the priority areas of science, engineering and technology.

Assessing University of Ghana according to the Herana academic core criteria

Figure 13.3 offers a sketch of what the University of Ghana would have looked like in 2015 if it had satisfied the Herana academic core criteria. The ratios employed in Figure 13.3, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;
- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;
- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;

Figure 13.3 Model of University of Ghana as a university meeting Herana academic core criteria



- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate;
- Doctoral graduates = 0.29 per academic with doctorate

Table 13.11 compares some of the main data in Figure 13.3 against University of Ghana's actual enrolment, staffing and knowledge outputs for 2015.

Table 13.11 University of Ghana actual 2015 data compared with data from academic core model

	Actual 2015 data	Data generated by academic core ratios	Difference between actual data and data from model
Total head-count enrolment	40 000	40 000	0
Enrolment by qualification:			
undergraduate	34 319	30 000	+4 319
postgraduate diplomas	0	2 000	-2 000
masters	5 010	6 000	-900
doctoral	670	2 000	-1 330
Enrolment by field of study:			
science & technology (including health)	9 200	16 000	-6 800
business, economics & management	8 100	12 000	-3 900
education, humanities & social sciences	22 700	12 000	+10 700
Academic staff:			
professors, associate professors and senior lecturers	492	1 220	-728
lecturers and below	778	810	-32
total academic staff	1 270	2 030	-760
Knowledge outputs:			
total graduates	7 300	10 000	-2 700
doctoral graduates	25	350	-325
research publications	312	1 700	-1 388

Sources: CHET 2017; Figure 13.3 for academic core ratio data

Some marked differences between the actual data and the data may be noted. Although the university has aimed to cap enrolments at 35 000 as a strategic objective, the actual count in 2015 was, at 40 000, 5 000 (13%) above this target. In 2015, only 8% of the university's students were enrolled in postgraduate programmes despite the university seeking to increase the number and proportion of postgraduate students as a strategic objective.

Another strategic objective established by the university was to increase the number of academic staff, thus improving student-to-academic-staff ratios. Between 2011 and 2015, the number of staff grew from 1 070 to 1 270. However, the student-to-academic-staff ratios in all fields other than science and technology remained unfavourable.

Further assessment of the University of Ghana on academic core criteria

In assessing the academic core performance of the Herana universities, the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators. Accordingly, the first two columns of Table 13.12 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2.

Table 13.12 University of Ghana: Data for assessing academic core performance

	Target	Three-year average 2013-2015	Relating average to target on 4-point scale
Input targets			
% SET enrolments	40%	22%	2.2
% undergraduate enrolments	75%	86%	3.5
% masters enrolments	15%	12.8%	3.4
% doctoral enrolments	5%	1.4%	1.1
% senior academics	60%	42%	2.8
% of SET academics with doctorates	60%	64%	4.0
% BUS academics with doctorates	60%	77%	4.0
% EHSS academics with doctorates	60%	55%	3.7
Favourable student-to-academic ratios in SET	15	8	4.0
Favourable student-to-academic ratios in BUS	25	91	1.1
Favourable student-to-academic ratios in EHSS	25	44	2.3
Output targets			
Ratio of total graduates to total enrolments	0.25	0.19	3.0
Ratio of masters graduates to masters enrolments	0.25	0.34	4.0
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.06	0.6
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.06	1.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.09	1.6
Ratio of SET research articles to academics with doctorates	2.00	0.43	0.9
Ratio of BUS research articles to academics with doctorates	1.00	0.16	0.2
Ratio of EHSS research articles to academics with doctorates	1.00	0.27	1.1

Source: *Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data*

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The third column in Table 13.12 contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the

actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios.

The numerical values in the fourth column can be understood in these broad ways (see above for the methodology used to arrive at these values):

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

The targets and 4-point scale scores can be used to depict the university's performance relative to the academic core targets in two radar graphs: one for its inputs and the other for its outputs. The shapes of these two radar graphs flag the extent to which the University of Ghana has met the Herana academic core targets.

Figure 13.4 indicates that the University of Ghana has performed quite well in relation to the Herana academic core input targets, although with considerable room for improvement:

- The university scored 4.0 for SET and business academics with doctorates and 3.7 for humanities and social sciences academics with doctorates, indicating a relatively well-qualified academic staff complement. However, the proportion of senior academics among the staff was at 2.8 well below the academic core target.
- The university scored 1.1 for student-to-staff ratios in business and 2.3 for these ratios in social sciences and humanities, indicating insufficient staff numbers in fields other than SET.
- The proportions of students enrolling in doctoral programmes were low, with the university scoring only 1.0 for this indicator.
- The university scored 3.4 for the proportion of students in masters programmes, which is close to the Herana target.

Figure 13.5 indicates that the University of Ghana performed poorly in relation to the output targets. The institution only met or came close to the Herana targets in its production of masters graduates and its overall output of graduates. The university scored below 1.6 for five of the other six output targets indicating major weaknesses in knowledge production. Its outputs of doctoral graduates per academic with a doctorate were particularly low, as were its production of research articles per academic with a doctorate in all fields of study.

Figure 13.4 University of Ghana: Inputs based on averages for 2013 to 2015

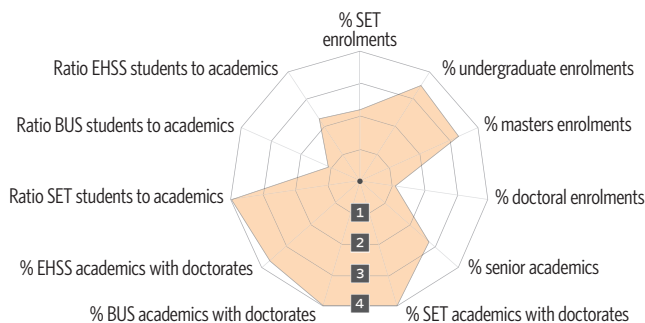
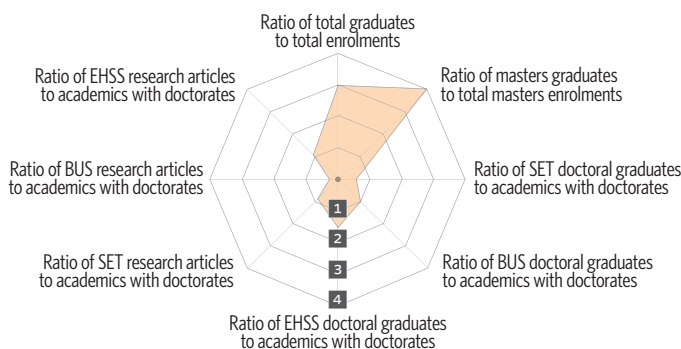


Figure 13.5 University of Ghana: Outputs based on averages for 2013 to 2015



Summary

Ghana, which is classified by the World Bank as a low middle-income country, had a population of 26.4 million, of whom 2.6 million were aged 20–24, in 2015. Its gross participation rate in higher education was 6.8% in 2008 and 15.0% in 2013.

The gross participation rate doubled between 2008 and 2013, reflecting high growth rates in student enrolments. For example, the number of students enrolled in tertiary education grew by 33% from 291 712 in 2011 to 389 171 in 2013. The rapid growth in enrolments may be attributed to national policies directed at improving equity of access to tertiary education. At the same time, the national government emphasised the contribution that tertiary education should make to social policies.

Notwithstanding the growth in the number of students entering tertiary education nationwide, the numbers of student enrolled each year at University of Ghana from 2011 to 2015 increased at an average annual rate of only 1.1%. Most of this growth occurred at postgraduate level,

with masters enrolments, for example, increasing from 4 312 in 2011 to 5 010 in 2015.

Recent vision and mission statements indicate that the University of Ghana is aiming to become a world class research-led university which is closely connected to national and global development through its cutting-edge research and high-quality teaching.

An initial view of the University of Ghana's commitment to high-level research activities can be obtained from its doctoral enrolments which rose from 316 in 2011 to 671 in 2015. However, the 2015 total is a low number for an institution of the University of Ghana's size with strong aspirations to become a research-led university. According to the Herana academic core criteria, it should have had at least 2 000 doctoral students in 2015.

A further indication of national and institutional commitments to high-level research activities can be found in the production of research articles. A total of 6 110 research articles were produced from 2010 to 2016 at an annual average of only 873 articles for the national research system. The University of Ghana was a major player in the system during this period, producing an average of 377 a year, which represented 43% of the national annual output.

In relation to the Herana academic core criteria for inputs, the University of Ghana performed reasonably well, meeting three of the 11 targets and registering satisfactory scores in relation to three other measures. The data indicated that the University of Ghana has a relatively well-qualified academic staff complement, although the proportion of senior academics in the staff and the staff-to-student ratios in all fields apart from SET were well below the Herana targets.

The University of Ghana performed poorly in relation to the academic core output targets. The institution only met or came close to the Herana targets in its production of masters graduates and its overall output of graduates. The university scored poorly in output targets related to knowledge production. Its outputs of doctoral graduates per academic with a doctorate were particularly low, as were its production of research articles per academic with a doctorate in all fields of study.

The University of Ghana has made some progress towards the Herana targets. For example, the number of doctoral graduates increased from 16 in 2009 to 62 in 2013, before falling to only 25 in 2015. Its enrolment of doctoral students grew from 132 in 2009 to 670 in 2015, which nearly quadrupled its ratio of doctoral-to-total-student enrolments from 0.4% in 2009 to 1.4% in 2015. However, this still fell short of the Herana target of 5% for this indicator. Meanwhile, the number of research articles increased from 150 in 2009 to 312 in 2015 and the university's ratio of articles per academic staff also improved, from 0.2 in 2009 to 0.3 in 2015.

The data suggest that the University of Ghana falls on the borderline between the Chapter 2 research-activity categories of emerging-research and research-oriented universities. On balance the Chapter 2 conclusion that the University of Ghana should be classified as an emerging-research university can be accepted. It has strong research aspirations, has met some of the Herana research targets and shows evidence of improvements over time in its research inputs and outputs.

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Chapter 14

Makerere University

National context

Population data

Uganda's population grew at an average annual rate of 3% between 2002 and 2014, with the number of those aged 20 to 24 growing at a faster average annual rate of 3.3% over this period (see Table 14.1).

Table 14.1 Uganda population: 2002 & 2014 ('000)

	2002 census	2014 census	Average annual growth
Total population	24 227	34 635	3.0%
Population in 20-24 age group	2 156	3 186	3.3%

Source for population data: Uganda Bureau of Statistics 2016

The Ugandan post-secondary education system is split into two types of institutions according to the country's Ministry of Education and Sport, which classifies them as belonging to either the 'higher' or 'tertiary' education sectors depending on the kinds of courses and qualifications that they offer. Higher education is defined as a post-secondary level in which universities offer programmes leading to bachelors degrees and other degree courses. Tertiary education is defined as a post-secondary level in which institutions, other than universities, offer certificates and diplomas (Ministry of Education and Sport 2016). The country's gross participation rate for higher and tertiary education in 2002 and 2014 is summarised in Table 14.2.¹

1 The gross participation rate is defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20-24.

Table 14.2 Gross rates of participation in the higher and tertiary education sectors in Uganda: 2002 & 2014

	2002	2014
Gross participation rate in degree awarding institutions (universities)	2.6%	5.6%
Gross participation rate in diploma and certificate awarding (tertiary) institutions plus universities	3.6%	7.8%

Sources: population data in Table 1 above; enrolment data in Ministry of Education and Sport 2016

Although the gross participation rates doubled between 2002 and 2014, they remained low. A gross university participation rate as low as 5.6% is an indicator of inequities in access to such education.

Higher and tertiary education at the national level

The Ugandan Ministry of Education and Sport is responsible for the planning, oversight and control of education in the country at primary, secondary, tertiary (non-degree) and higher (degree) levels. The Department of Higher Education within the ministry monitors the functioning and operations of all public and private universities. The country's private universities are licensed to offer degree-level programmes to academically qualified school leavers who cannot be accommodated by a public university (Ministry of Education and Sport 2017b).

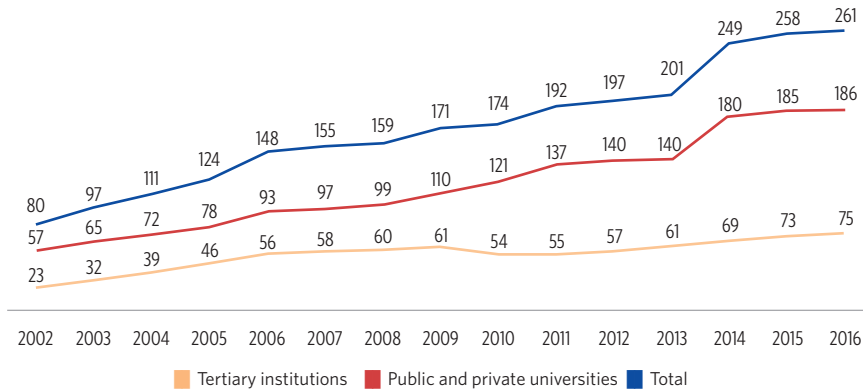
In 2013, 140 400 students were enrolled in the 6 public and 27 private universities. Of these, 59 600 (42% of the total) were enrolled in public institutions and 80 800 (58%) in private ones (Ministry of Education and Sport 2016).

A total of 60 900 students were enrolled in tertiary (or non-degree) institutions in 2013. The numbers of student enrolled from 2002 to 2015 in Ugandan universities and tertiary education institutions are summarised in Figure 14.1.

Strategic plans published by the Ministry of Education and Sport in June 2004 and in September 2008 emphasised the demand-driven pressures for admission to universities, as well as the equity-driven need to improve access to them for women and needy students.

The 2004 plan also prioritised the delivery of an 'education system relevant to Uganda's national development goals'. The higher education sector was expressly charged with delivering 'graduates prepared to be innovative, creative, and entrepreneurial in private and public sectors'. In order to achieve this objective, the plan advocated reforming higher education curricula and instruction in disciplines linked to Uganda's national development needs and its labour markets. In this regard,

Figure 14.1 Enrolments in Ugandan universities and tertiary institutions ('000): 2002–2016



Source: Ministry of Education and Sport 2016

science, mathematics and technology courses and programmes were prioritised (Ministry of Education and Sport 2004).

The higher education sector was also charged with promoting ‘research, particularly applied research, and publications’. The 2004 plan noted (Ministry of Education and Sport 2004):

The National Council of Higher Education will help universities further develop their capacity for research – particularly applied research – intellectual exchange, and publications. It will encourage faculty and students to make research part of their normal working lives and to keep up-to-date with current research in their fields. The ministry will establish a fund for research to which all institutes, private and public, will contribute 5% of gross salary of each staff member.

The revised 2008 plan for education assigned the higher education sector the role of producing a high-level work force which would meet Ugandan developmental needs. The plan made no mention of the need for the university sector to produce high-level knowledge through research-related activities. The 2008 plan’s main purpose was to manage the expectations of high growth established under the previous 2004 plan. The new plan predicted that higher and tertiary enrolments would not be affected by an anticipated bulge in primary and secondary enrolments before 2012. However, after that date, the plan predicted the number of students enrolled at the post-secondary level would double between 2013 and 2018 (Ministry of Education and Sport 2008).

In fact, the numbers of students enrolling at universities and other tertiary institutions nearly doubled, increasing by 94%, in 2007 compared with 2002. The growth in enrolments then slowed to 27% in total between 2007 and 2012. From 2012 to 2016, when rapid growth had been predicted, enrolments across the post-secondary sector rose by 33%, or an average annual rate of 7.4% (Ministry of Education and Sport 2016).

Notwithstanding the apparent slow-down in enrolment growth, the policy drivers for university education in Uganda remained to increase participation rates, particularly of women and needy students; provide the human resources required by the Ugandan economy and encourage research activities at universities.

Focus on Makerere University

Basic data

Table 14.3 compares the numbers of students enrolled at Makerere University to the numbers at all public and private higher education institutions between 2003 and 2015. Ugandan tertiary (or non-degree awarding) institutions are not included in the comparison.

Table 14.3 Comparison of numbers of students enrolled at Makerere University and at all universities in Uganda: 2003–2015

	Enrolments in government and private universities ('000)	Makerere University enrolments ('000)	Enrolments at Makerere University as % of the total for all universities
2003	65.2	31.9	49%
2005	78.1	32.7	42%
2007	96.8	35.0	36%
2009	109.8	34.1	31%
2011	136.6	34.0	25%
2013	140.4	37.1	26%
2015	185.3	38.7	21%
Average annual increase: 2003-2015	9.1%	1.6%	

Sources: Ministry of Education and Sport 2016; CHET 2017b and 2017c

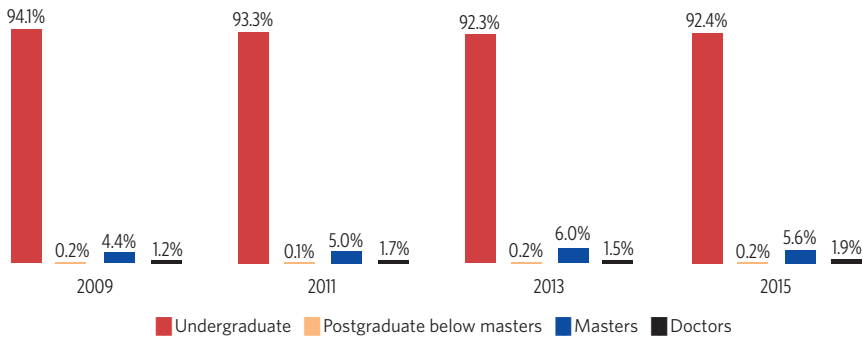
Table 14.3 indicates that Makerere University failed to play a major role in the national drive for increased participation in university education. The number of students enrolled at Makerere University increased at an average annual rate of less than 1% from 2003 to 2015 and, as a result, its share of total university enrolments fell from 49% in 2003 to 21% in 2015.

Table 14.4 summarises the numbers of students enrolled at Makerere University by type of qualification from 2009 to 2015. The table shows that the number of students enrolled as undergraduates grew at an annual average rate of only 1.9% from 32 083 in 2009 to 32 995 in 2015. Meanwhile, postgraduate enrolments grew at the faster average rate of 5.4% a year, from 2 004 in 2009 to 2 745 in 2015. Doctoral enrolments rose from 420 in 2009 to 680 in 2015. Figure 14.2 illustrates that notwithstanding these variable growth rates Makerere University remained primarily an undergraduate university during the period 2009–2015.

Table 14.4 Students enrolled at Makerere University by qualification type and field of study: 2009–2015 ('000)

	2009	2011	2013	2015	Average annual increases
Undergraduate	32 083	31 735	34 254	35 995	1.9%
Postgraduate below masters	68	26	64	71	0.7%
Masters	1 516	1 705	2 227	1 994	4.7%
Doctoral	420	563	554	680	8.4%
Total	34 087	34 029	37 099	38 700	2.1%

Figure 14.2 Makerere University student enrolments by qualification type: 2009–2015



Source: Table 14.4

The Herana project has recognised that the number of enrolments in doctoral degree programmes constitutes an important indicator of a university's engagement in research. Figure 14.2 shows that Makerere University's doctoral enrolments constituted 1.9% of total enrolments in 2015. However, 680 doctoral enrolments in 2015 is a low total for an institution of Makerere University's size with strong aspirations to become a research-led university. In order to cement its claim as a major

player in the national research system, the university should have enrolled at least 1 900 students for doctorates that year.

In order to measure the university's strength within its national research environment, account must also be taken of its share of the national output of research publications, which was measured in a bibliometric study undertaken by Stellenbosch University.

Table 14.5 summarises Uganda's production of research articles from 2010 to 2016.

Table 14.5 Research articles allocated to Ugandan institutions: 2010–2016

	Total	% of total
Makerere University	3 563	57%
Other government universities	441	7%
Research institutions and centres	660	10%
Partnership agreements with international universities	1 638	26%
Total	6 302	100%

Source: CHET 2017d

The publication data in Table 14.5 indicates a low national output of research articles. A total of 6 302 research articles were produced from 2010 to 2016, at an average of only 900 a year. Although Makerere University produced 57% of the total, its average annual output was only 509.

Makerere University's strategic planning

The vision and mission statements formulated in Makerere University's strategic plans for 2001–2007 and 2008–2018 are listed in Table 14.6.

Table 14.6 Vision and mission statements from Makerere University's strategic plans

	2001 to 2007 plan	2008 to 2010 plan
Vision statement	To be a centre of academic excellence, providing world-class teaching, research and services relevant to the sustainable development needs of society.	To be the leading institution for academic excellence and innovations in Africa.
Mission statement	To provide quality teaching, carry out research and offer professional services to meet the changing needs of society by utilising worldwide and internally generated human resources, information, and technology to enhance the university's leading position in Uganda and beyond.	To provide innovative teaching, learning, research and services responsive to national and global needs

Source: Makerere University 2004 and 2008

The 2008–2018 plan established ‘three pillars’ to transform the university. The first two are (Makerere University 2008):

- Makerere is to refocus from teacher-centred instruction to learner-centred problem-based instruction, providing experiential and flexible learning.
- The current outreach paradigm is to be replaced by a knowledge transfer partnership impelled by the realisation that the community, public and private sectors also command knowledge bases.

The focus of the third pillar is on Makerere University repositioning itself as a research-led university (Makerere University 2008):

The rise of the knowledge-driven economy has made it imperative for universities to vigorously undertake research to generate knowledge to power national economies. Makerere University being the oldest university in the continent with elaborate infrastructure for research execution is uniquely positioned to provide leadership as a research university in Uganda. The strategic repositioning of Makerere University as a research-driven university will enable Makerere to focus more on knowledge production to support evidence-based decision-making and power the growth of Uganda’s economy.

The 2008–2018 plan outlines a range of actions required to achieve the goal of becoming research-led (Makerere University 2008):

- develop and operationalise Makerere University’s research agenda;
- strengthen the research capacity for staff and students;
- strengthen the university’s research execution, management and coordination;
- mobilise more funds from both budgetary and extra budgetary sources to strengthen the university’s capacity to support and disseminate research; and
- mainstream laboratory services in research and university partnerships.

The plan established two broad performance indicators to measure the success of the university’s efforts to become a research-led institution: the volume and quality of the university’s research outputs, and Makerere University’s international ranking for generating new and applied knowledge and innovations.

Implementing objectives of strategic plans

At Herana project meetings held in South Africa in November 2014 and November 2016, representatives of Makerere University offered accounts of the progress made by the university towards its goal of becoming a research-led institution (CHET 2017a, CHET 2015).

Makerere University has had to produce its own definition of ‘research-led’ and its own strategic pathways to become such an institution outside the context of Uganda’s national higher education framework which offers only a brief account of the role of higher education in research and development. Although Makerere University is acknowledged as the premier public research university in Uganda, such recognition has been of little benefit in the absence of clearly defined strategies at national level and a comprehensive national financing mechanism for research.

Makerere University derived only a small share of its funding for research from the Ugandan government or its own resources, with most of the funds donated by universities in other countries to strengthen its research capacity in agriculture and food security, but most particularly in the field of health and health systems. In 2013/14, external donors provided more than USD62 million for research into health and health systems, USD8.8 million for natural sciences research, USD4.5 million for engineering and technology, and US\$3.1 million for agriculture and food security (CHET 2015).

Makerere University has accepted that, in order to become a research-led university, it would have to increase the proportion of academic staff holding doctoral degrees. Although more of its junior academic staff members were obtaining doctorates, Makerere University experienced problems in raising the overall percentage of academic staff with doctorates. One reason was that the university required all academics at lecturer level to hold doctorates, which had resulted in a brain drain to other Ugandan universities, where a doctorate could qualify a junior academic for a better-paid post than was available at Makerere University. A further problem was that the university’s relatively early retirement age of 60 had forced many older, well-qualified academics to resign although they may still often be leading research projects.

Makerere University had established a research monitoring framework, which included a traditional performance-based system of incentives to increase research production. Academic staff members, for example, moved up the promotion ladders on the basis of their research outputs. In addition, some internal monetary incentives had been introduced for project-based research. Efforts to promote greater knowledge production, which were overseen by a directorate of research and graduate training,

had also included requiring all doctoral students to publish at least two research papers during their registration period.

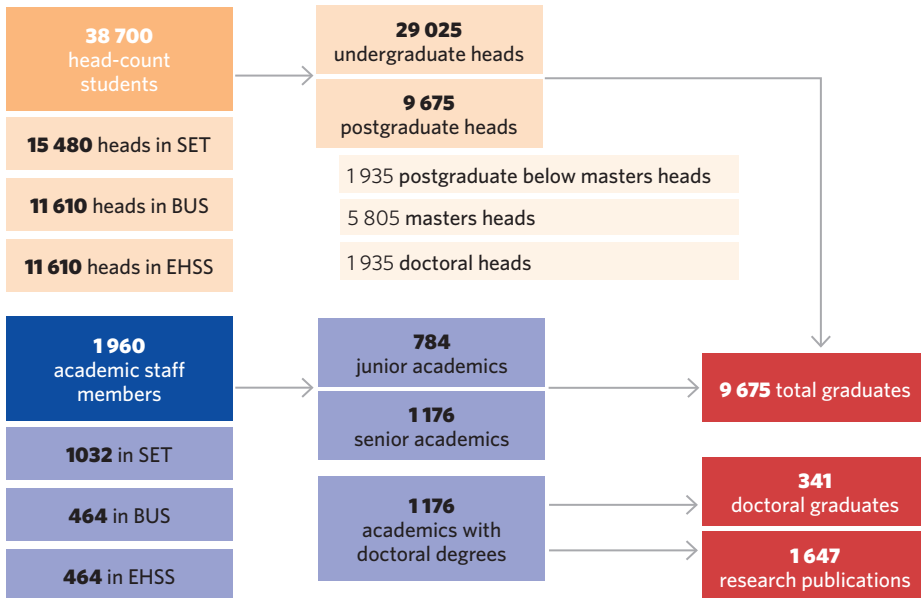
Notwithstanding its efforts to increase research production, Makerere University had failed to establish research performance indicators for academic staff. Research outputs were reported in an annual fact book, which was used to promote debate on increasing support to graduate students and providing more money for research. However, the approach appeared to have failed to boost research outputs significantly, particularly in the context of a long-standing dispute within the higher education sector over salaries in which the university had sought top-up funding from the government and academic staff had withdrawn their labour.

Makerere accepted the Herana project's performance measurement processes as fair, comprehensive and applicable to the university's situation and context.

Assessing Makerere University according to Herana academic core criteria

Figure 14.3 offers a sketch of what Makerere University would have looked like in 2015 if it had satisfied the Herana academic core criteria.

Figure 14.3 Model of Makerere University as a university meeting Herana academic core criteria



The ratios employed in Diagram 1, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;
- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;
- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;
- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate; and
- Doctoral graduates = 0.29 per academic with doctorate.

Table 14.7 compares some of the main data in Figure 14.3 against Makerere University's actual enrolment, staffing and knowledge outputs for 2015. The differences between the actual data in Table 14.7 and the data for the model indicates some of the challenges faced by Makerere University in seeking to satisfy the Herana academic core criteria while pursuing its own strategic objectives. Some key points for 2015 are worth noting:

- The actual number of undergraduates in 2015 exceeded by 6 970 (24%) the upper-limit target of 29 025 set by the Herana academic core criteria.
- The numbers of students enrolled for doctoral qualifications in 2015 was 1 255 (65%) below the Herana target for an institution the size of Makerere University.
- The number of academic staff with doctorates was 561 (48%) below the target total in 2015. The number and proportion of senior academic staff total were also low. The number of academics who were professors, associate professors or senior lecturers was 766 (65%) of the Herana academic core target.
- Makerere University's high-level knowledge outputs in the form of doctoral graduates and research publications were well below those targeted by the Herana academic core criteria. Doctoral graduates were 277 (81%) below target, and research publications were 1 034 (63%) below target.

Table 14.7 Makerere University actual 2015 data compared with data from academic core model

	Actual 2015 data	Data generated by academic core ratios	Difference between actual data and data in model
Total head-count enrolment	38 700	38 700	0
Enrolment by qualification:			
undergraduate	35 995	29 025	+6 970
postgraduate diploma	71	1 935	-1 864
masters	1 954	5 865	-3 911
doctoral	680	1 935	-1 255
Enrolment by field of study:			
science and technology (including health)	12 885	15 480	-2 595
business, economics and management	8 036	11 610	-3 574
humanities, education and social sciences	17 779	11 610	+6 169
Academic staff:			
professors, associate professors and senior lecturers	410	1 176	-766
lecturers and below	1 007	784	+223
total academic staff	1 417	1 960	-543
academic staff with doctoral degrees	615	1 176	-561
Knowledge outputs:			
total graduates	10 100	9 675	+425
doctoral graduates	64	341	-277
research publications	613	1 647	-1 034

Sources: CHET 2017c; Figure 14.3 for academic core ratios data

Further assessment of Makerere University on academic core criteria

In assessing the performance of the Herana universities, the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators. Accordingly, the first two columns of Table 14.8 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2. The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios

The numerical values in the fourth column can be understood in these broad ways:

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

Table 14.8 Makerere University: Data for assessing academic core performance

	Target	Three-year average: 2013-2015	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	35%	3.5
Limit on % undergraduate enrolments	75%	92%	3.3
% masters enrolments	15%	5.8%	1.5
% doctoral enrolments	5%	1.6%	1.3
% senior academics	60%	29%	1.9
% SET academics with doctorates	60%	41%	2.7
% BUS academics with doctorates	60%	27%	1.8
% EHSS academics with doctorates	60%	42%	2.8
Favourable student-to-academic ratios in SET	15	18	3.3
Favourable student-to-academic ratios in BUS	25	89	1.1
Favourable student-to-academic ratios in EHSS	25	40	2.5
Output targets			
Ratio of graduates to total enrolments	0.25	0.27	4.0
Ratio of masters graduates to masters enrolments	0.25	0.48	4.0
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.14	1.5
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.37	4.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.13	2.3
Ratio of SET research articles to academics with doctorates	2.00	1.30	2.6
Ratio of BUS research articles to academics with doctorates	1.00	0.18	0.7
Ratio of EHSS research articles to academics with doctorates	1.00	0.46	1.8

Source: *Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data*

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The targets and 4-point scale scores can be used to depict the university's performance as a research-led institution in two radar graphs: one for

Figure 14.4 Makerere University: Inputs based on averages for 2013 to 2015

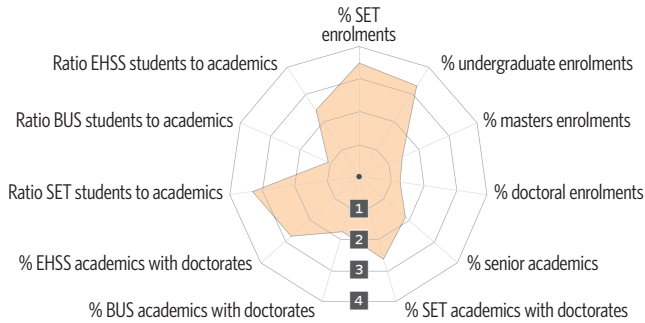
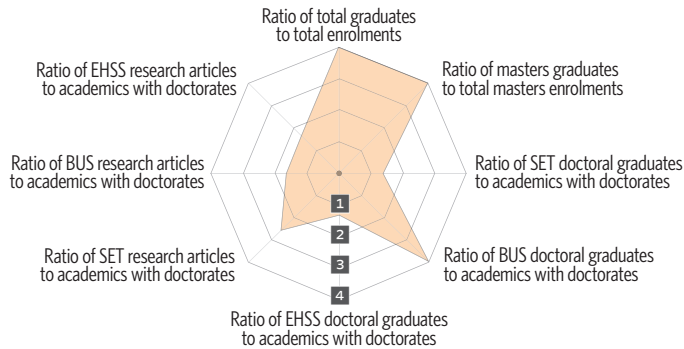


Figure 14.5 Makerere University: Outputs based on averages for 2013 to 2015



its inputs and the other for its outputs. The shapes of these two radar graphs flag the extent to which Makerere University has met the Herana academic core targets.

Figure 14.4 indicates that Makerere University met none of the 11 academic core input targets set by the Herana project. The university performed poorly in relation to the academic core input targets related to the production of high-level knowledge: its proportion of students in doctoral programmes, its proportion of senior academics, and its proportions of academic staff with doctoral qualifications.

The shape of Figure 14.5 flags the extent to which Makerere University has not achieved either the academic core targets for outputs or its own goals in seeking to become a research-led institution. It exceeded the targets for the number of graduates and masters graduates, and the ratio of doctoral graduates per academic with a doctorate, by considerable margins. However, its performance against the other targets indicated weakness, particularly in relation to the numbers of doctoral graduates and research articles per academic with a doctorate.

Summary

The population of Uganda, which is classified by the World Bank as a low-income country, grew at an average annual rate of 3% between 2002 and 2014 to 24.6 million, with the number of those aged 20 to 24 growing at a faster average annual rate of 3.3% over this period

Uganda's gross participation rate in higher education (universities offering degrees) was 2.6% in 2002 and 5.6% in 2014. Its gross participation rate in higher education and tertiary education (institutions offering post-school diploma and certificates) was 3.6% in 2002 and 7.8% in 2014.

The number of students enrolled in Uganda's higher and tertiary education sectors grew rapidly between 2002 and 2016 from 80 000 to 261 000. Although enrolment growth slowed from 2012 to 2016, it still sustained a relatively high average annual rate of 7.4%.

The Department of Higher Education within the Ugandan Ministry of Education and Sport monitors the functioning and operations of all public and private universities in the context of plans established by the ministry. The policy drivers set for public universities are:

- to increase gross participation in universities, with a particular focus on access for women and needy students;
- to produce the high-level human resources required by the Ugandan economy; and
- to encourage research activities.

Makerere University did not play a major role in the national drive for increased participation in university education. The numbers of student enrolled at Makerere University increased at an average annual rate of about 2% from 2003 to 2015 and, as a result, its share of total university enrolments fell from 49% in 2003 to 21% in 2015. It is noteworthy that doctoral enrolments rose from 420 in 2009 to 680 in 2015.

Makerere University's 2008–2018 vision and mission statements indicate that it aims to become the leading institution for academic excellence and innovations in Africa, while providing innovative teaching, learning, research and other services in response to national and global needs. Previously, in its 2001–2007 vision and mission statements, the university aimed to be a centre of academic excellence, providing world-class teaching, research and service relevant to the sustainable development needs of society; and to provide quality teaching, conduct research and offer professional services to enhance the university's leading position in Uganda and beyond.

A number of challenges hampered Makerere University's efforts to implement the aspects of its vision and mission that related to research:

- Makerere has had to produce its own definition of 'research-led' and its own strategic pathways to become such an institution outside the context of Uganda's national higher education framework which offers only a brief account of the role of higher education in research and development.
- Makerere University derived only a small share of its funding for research from the Ugandan government or its own resources, with most of the funds used to strengthen its research capacity provided by external donors.
- Makerere University had accepted that, in order to become a research-led university, it would have to increase the proportion of academic staff holding doctoral degrees. However, it had experienced problems in raising the overall percentage of academic staff with doctorates. One reason was that the university required all academics at lecturer level to hold doctorates, which had resulted in a brain drain to other Ugandan universities.
- Makerere University's effort to significantly boost research outputs apparently failed partly because of a long-standing dispute within the higher education sector over salaries in which the university had sought top-up funding from the government and academic staff had withdrawn their labour.

Despite the university's stated commitment to boosting its high-level research activities and the rise in doctoral enrolments at the institution from 316 in 2011 to 673 in 2015, it fell far short of the target required to be classified as a research-led institution according to the Herana criteria.

A further indication of national and institutional commitments to high level research activities is provided by the level of production of research articles. However, a relatively low total of 6 302 research articles were produced nationwide from 2010 to 2016, at an average of only 900 a year. Although Makerere University produced 57% of the total, its average annual output was only 509, well short of the Herana academic core target.

Makerere University has made some progress towards the Herana targets. Its number of doctoral graduates increased from 38 in 2009 to 64 in 2015. Its enrolment of doctoral students grew from 420 in 2009 to 680 in 2015, raising its ratio of doctoral-to-total-enrolments from 1.2% in 2009 to 1.6% in 2015. The number of research articles produced at Makerere University increased from 321 in 2009 to 613 in 2015 and the

ratios of articles per academic staff member improved over the same period, even though they were still below the Herana academic core target.

The overall picture presented by that the data is that Chapter 2 is correct in concluding that Makerere University should be classified as an emerging-research university. It has strong research aspirations, has met some of the Herana research targets and can show evidence of improvements over time in its research inputs and outputs.

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Chapter 15

University of Mauritius

National context

Population data

The population of Mauritius grew from 1.22 million in 2005 to 1.26 million in 2015, at an average annual rate of 0.3%, while the number of those aged 20 to 24 remained at about 100 000 over the same period (see Table 15.1).

Table 15.1 Mauritius population: 2005–2015 ('000)

	2005	2008	2013	2015	Average annual growth
Total population	1222	1244	1250	1259	0.3%
Population in 20-24 age group	98	87	99	100	-0.3%

Sources: *Worldometers 2017*; *Tertiary Education Commission 2016*

In calculating the gross participation rate in higher education, the Tertiary Education Commission (TEC) of Mauritius includes Mauritian students enrolled at overseas tertiary education institutions, which represents a departure from the method used by UNESCO to calculate this rate. It is also important to note that the data used by the Tertiary Education Commission to calculate the rate include foreign students studying in Mauritius, although this number is low (only 1 524 in 2015). Tables 15.2 and 15.3 indicate the gross participation rates as calculated using the Tertiary Education Commission's and UNESCO's methods.¹

1 UNESCO defines the gross participation rate as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20–24.

Table 15.2 Gross participation rate in tertiary education in Mauritius using the TEC's definition of relevant students: 2005–2015

	2005	2008	2013	2015
Total enrolment of all students studying in Mauritius plus Mauritian students studying overseas (thousands)	28.9	38.6	49.4	47.5
Gross participation rates	29%	44%	50%	47%

Sources: Table 15.1 for population data; Tertiary Education Commission 2015 for calculation methodology; Ministry of Finance and Economic Development 2016 for enrolment data

Table 15.3 Gross participation rate in tertiary education in Mauritius using UNESCO's definition of relevant students: 2005–2015

	2005	2008	2013	2015
Total enrolment of tertiary students studying in Mauritius (thousands)	21.5	27.4	41.6	37.9
Gross participation rates (excluding Mauritian students studying overseas)	21%	27%	42%	38%

Sources: Table 15.1 for population data; UNESCO for calculation methodology; Ministry of Finance and Economic Development 2016 for enrolment data

Mauritius's gross participation rates increased by around 20% from 2005 to 2015, giving it the highest rate among the eight countries in which the Herana universities were based.

Tertiary education at the national level

The Tertiary Education Commission, which was established by parliament to oversee public and private tertiary education in the country has a range of functions, including advising the appropriate minister, allocating money to publicly funded tertiary education institutions, and fostering, planning and coordinating the development of the sector. It regulates private institutions through institutional registration and programme accreditation (Tertiary Education Act 1988; Tertiary Education Commission 2017a).

The government strategy ostensibly shaping the work of the Tertiary Education Commission is to develop the country into a centre for tertiary education, enabling it to become a regional knowledge hub (African Universities 2017). However, the notion of what constitutes a 'centre for tertiary education' is unclear. It could be taken to mean that Mauritius as a country will become a centre catering primarily to undergraduate enrolments, or that it should become a hub for high-level knowledge-production in the form of doctorates and other research outputs.

The Tertiary Education Commission is responsible for 10 publicly-funded and 45 private tertiary institutions (which it has accredited and regulates). The publicly-funded institutions include four universities and six specialist institutions (Table 15.4).

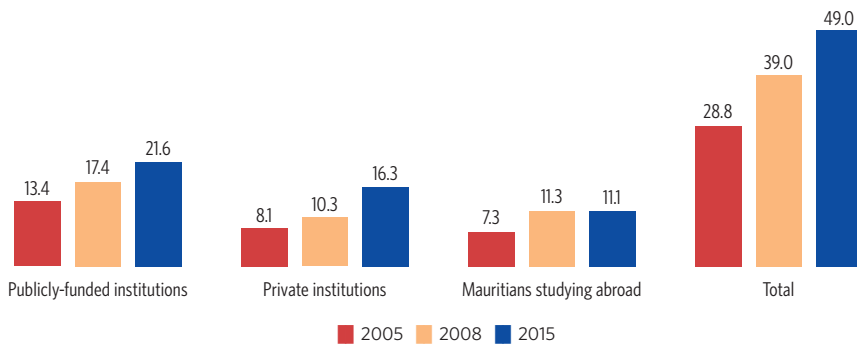
Table 15.4 Publicly funded tertiary institutions in Mauritius

Universities	Specialist institutes
University of Mauritius	Mauritius Institute of Education
University of Technology, Mauritius	Mahatma Gandhi Institute
Open University of Mauritius	Rabindranath Tagore Institute
Université des Mascareignes	Mauritius Institute of Training and Development
	Mauritius Institute of Health
	Fashion and Design Institute

Source: Tertiary Education Commission 2017b

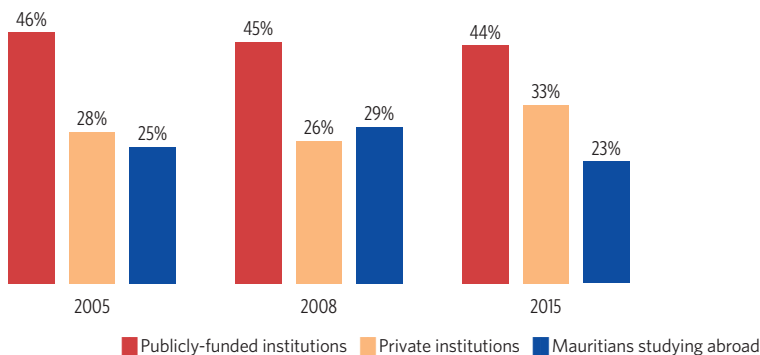
Figures 15.1 and 15.2 summarise the number of students who enrolled across the public and private tertiary sector, including those studying overseas. These overseas students are included in the Tertiary Education Commission data as stakeholders in the Mauritius government's strategies to improve access to tertiary education.

Figure 15.1 Enrolments in Mauritian tertiary education institutions: 2005, 2008 & 2015 ('000)



Sources of enrolment data: Ministry of Finance and Economic Development 2016 and 2008 and 2005

Figure 15.2 Distribution of Mauritian student enrolments: 2005, 2008 & 2015



Source: Calculations based on data in Figure 15.1

The number of students enrolled in private tertiary institutions doubled from 2005 to 2015, rising at an average annual rate of 7.2%. Meanwhile, enrolments grew by 4.9% a year on average at publicly funded institutions – a relatively high rate of growth for a country with almost no population growth. The number of Mauritian students studying overseas also grew over the ten years, albeit at a lower rate, although a relatively high one for a country with almost no population growth.

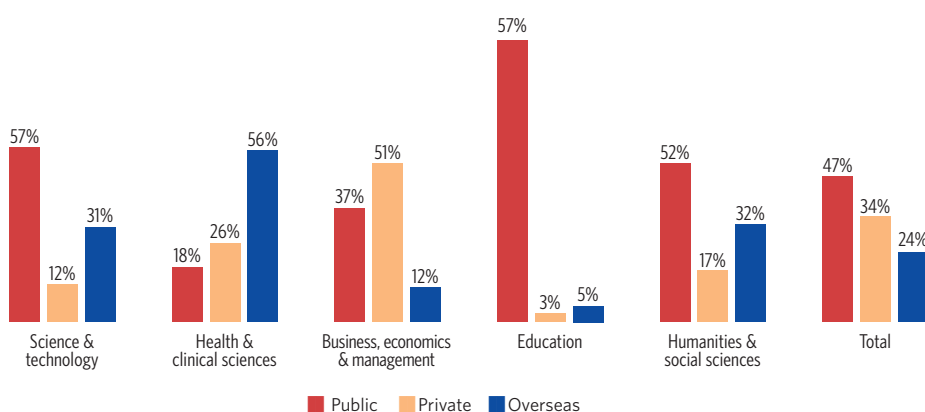
By 2015, 44% of all tertiary students in Mauritius were enrolled in publicly-funded institutions and 33% were enrolled in private institutions, while 23% were enrolled at overseas institutions.

Figure 15.3 shows the distribution of students by broad fields of study across the three sectors of domestic public, domestic private and overseas institutions in 2015.

In summary tertiary education in Mauritius appear to be driven by plans to:

- increase the participation rate of Mauritians in tertiary education, whether in publicly funded or private institutions in Mauritius, or in programmes in universities based overseas;
- make Mauritius a regional centre or hub for tertiary education; and
- increase Mauritius’s knowledge production, even if this was primarily at undergraduate level.

Figure 15.3 Distribution of enrolments by fields of study and sector: 2015



Source: Ministry of Finance and Economic Development 2016

Focus on University of Mauritius

Basic data

Table 15.5 summarises the number of students enrolled at the University of Mauritius by broad field of study from 2005 to 2015.

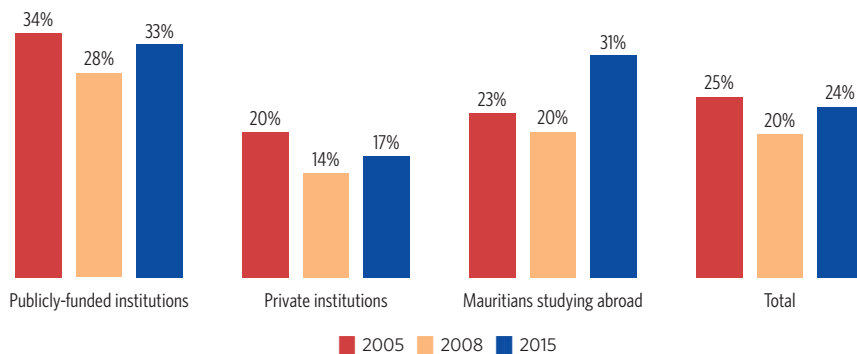
Table 15.5 Students enrolled at the University of Mauritius: 2005–2015

	2005	2008	2015	Average annual increase: 2005-2015
Science, engineering & technology (including health & clinical sciences)	3 333	3 400	4 708	3.3%
Business, economics & management	2 220	2 400	3 908	5.0%
Education, humanities & social sciences	1 735	1 970	3 084	4.6%
Total	7 288	7 770	11 700	4.2%

Sources: CHET 2017b and 2017c

The proportion of the national cohort of students enrolled at University of Mauritius by field of study is shown in Figure 15.4. The data in Figure 15.4 largely indicate the proportions of undergraduate students enrolled at University of Mauritius, given the low numbers of, in particular, doctoral students reported by the university and the other institutions in the Mauritian tertiary system. The best data available on doctoral enrolments at University of Mauritius is shown in Table 15.6. It should be noted that masters enrolments include MPhil/PhD students who had not yet transferred to a doctoral programme. At the University of Mauritius, students register for a doctorate if they hold a masters degree by research or if they have submitted a satisfactory MPhil transfer report.

Figure 15.4 University of Mauritius share of national tertiary enrolments by fields of study: 2005–2015



Source: Ministry of Finance and Economic Development 2016

Table 15.6 University of Mauritius masters and doctoral enrolments: 2009–2015

	2009	2011	2013	2015
Masters	692	908	1100	1 048
Doctoral	46	49	29	72
Total masters and doctoral	738	957	1129	1120

Sources: CHET 2017b & 2017c

The Herana project has recognised that the number of enrolments in doctoral degree programmes constitutes an important indicator of a university's engagement in research. Table 15.6 indicates that the number of students enrolling for doctorates at University of Mauritius rose from 46 in 2009 to 72 in 2015, while masters enrolments increased by 51% in 2015 compared with 2009. The numbers of masters and doctoral enrolments are low for an institution of University of Mauritius's size with strong aspirations to become a research-led university.

In order to measure the university's strength within its national research environment, account must also be taken of its share of the national output of research publications, which was measured in a bibliometric study undertaken by Stellenbosch University. Table 15.7 summarises the number of research articles produced in Mauritius from 2010 to 2016.

Table 15.7 Research articles allocated to Mauritian institutions: 2010–2016

	Total for period	% of total
University of Mauritius	539	65%
Other public universities	21	3%
Research organisations and ministries/institutions	122	15%
All other	142	17%
Total	824	100%

Source: CHET 2017d. Note that 'all other' includes research publications allocated to international universities and organisations which would have been involved in collaborative activities with tertiary institutions in Mauritius.

The data in Table 15.7 indicate that 560 research articles were produced by the four publicly funded universities and six other publicly funded tertiary institutions in Mauritius from 2010 to 2016, at an annual average total of only 80 articles a year. The University of Mauritius produced 65% of the overall total of 824 research articles, at an average annual output rate of 77.

Although University of Mauritius is a major player in Mauritius's research system according to these data, its average annual output of research articles should have been at least three times higher in order for it to be classified as research-led under the Herana criteria.

University of Mauritius strategic planning

The vision and mission statements in the University of Mauritius's five-year 'Strategic Plan' for 2015 to 2020 are set out in Table 15.8.

Table 15.8 University of Mauritius's vision and mission for 2015 to 2020

Vision statement	To be one of the leading international tertiary education providers and a research-led university.
Mission statement	To provide quality education to students and promote knowledge creation and dissemination through research and innovative teaching while responding to the developmental needs of the country and the global community.

Source: University of Mauritius 2015

The university vice-chancellor's introduction to the 'Strategic Plan' noted (University of Mauritius 2015):

The University of Mauritius Strategic Plan 2015–2020 is a guiding document which sets out the vision and the key strategic directions of the UoM and outlines their corresponding actions and key performance indicators. It has been prepared by consulting internal and external stakeholders and by conducting an internal and external analysis of the tertiary education sector.

The plan outlines six strategic directions, two of which entail achieving excellence in teaching and learning, and research and innovation. The objectives and key actions for the research and innovation strategic direction are listed in Table 15.9.

Table 15.9 University of Mauritius: Objectives, actions and performance indicators for research and innovation strategy

Objectives	Key actions	Key performance indicators
To enhance research and innovation capacity	Promote a research culture on campus and provide more resources to faculties/centres to undertake research; Establish a knowledge transfer office to assist researchers in patenting and intellectual property rights issues; and Develop and strengthen the doctoral school to increase enrolment of students on MPhil/PhD programmes.	Percentage of University of Mauritius budget directed towards research; Number of research reports and patents emanating from projects; and Number of MPhil/PhD students and number of staff holding PhD qualification or postdoctoral experience.
To drive research based on industry and societal needs	Engage in research areas which address industrial and societal needs; Direct research expertise towards national priorities/policies and initiatives; and Support academic/industrial, multi-dimensional or multi-disciplinary, intra- or inter-institutional collaboration in research.	Number of research projects based on industrial and societal problems; Number of funded projects directly relevant to national needs and amount of revenue obtained; and Number and diversity of industrial and external institutional collaborators.

Objectives	Key actions	Key performance indicators
To promote regional and international collaborations for research	Initiate efforts for University of Mauritius to be more active in regional projects in partnership with Indian Ocean Commission, Southern Africa Development Community and Common Market for Eastern and Southern Africa countries; and Build networks within national, regional and international research communities.	Number of regional and international networks established; and Number of projects undertaken as part of regional and international collaborations.
To stimulate performance in research	Encourage staff and students to opt for short term attachments to international universities.	Number of short-term attachments to international universities.
To develop centres of excellence in niche areas	Set up new centres of excellence in emerging sectors of the economy.	Number of projects, publications and patents by centres of excellence.
To disseminate research results	Promote publications in high-indexed journals; Seek inclusion in reputable databases, indexing and marketing of UoM Research Journal; and Organise high-level conferences in collaboration with reputable institutions.	Number of peer-reviewed publications in high-indexed journals; Number of databases and indexing services that include the UoM Research Journal; and Number of conferences organised in collaboration with reputable institutions.

Source: University of Mauritius 2015

Implementing objectives of strategic plan

At Herana project meetings held in South Africa in November 2014 and November 2016, representatives of the University of Mauritius discussed aspects of the university's research- and innovation-related objectives and activities (CHET 2015, 2016, 2017a).

The University of Mauritius has had to focus on increasing student enrolments, mainly undergraduates, in response to a government policy seeking to improve the country's gross tertiary enrolment rate. The resulting emphasis on undergraduate access had impeded the University of Mauritius in its efforts to become a research-led university. The university has been funded primarily as a teaching institution, despite the government's expressed intention to transform the country into a regional knowledge hub, thus creating a national knowledge economy. Government funding for improving research infrastructure, increasing doctoral student enrolments and establishing centres of excellence has been limited.

Academic staffing levels have increased steadily but have not kept pace with the mounting number of students, which rose from 7 300 in 2005 to 11 700 in 2015. Academic workloads increased as a result, particularly in the business, law and humanities disciplines, in which student-to-staff ratios were particularly high due to government targets and the needs of the job market. Although the student-to-staff ratios in engineering, science, agriculture and ocean studies departments were lower, academics in these disciplines also experienced problems with

increased workloads. The university’s deans and pro-vice-chancellor (academia) have been assigned responsibility for promoting research, increasing doctoral enrolments and delivering less teaching-driven workloads for academic staff.

A range of challenges has been faced in establishing a research culture at the University of Mauritius, including collecting the necessary research data. Student, human resources and financial data were extracted from electronic data bases for submission to government and the Tertiary Education Commission. Meanwhile, research data were collected by an administrative office at the university, which found that about 20% of academic staff members were reluctant to submit information on published research.

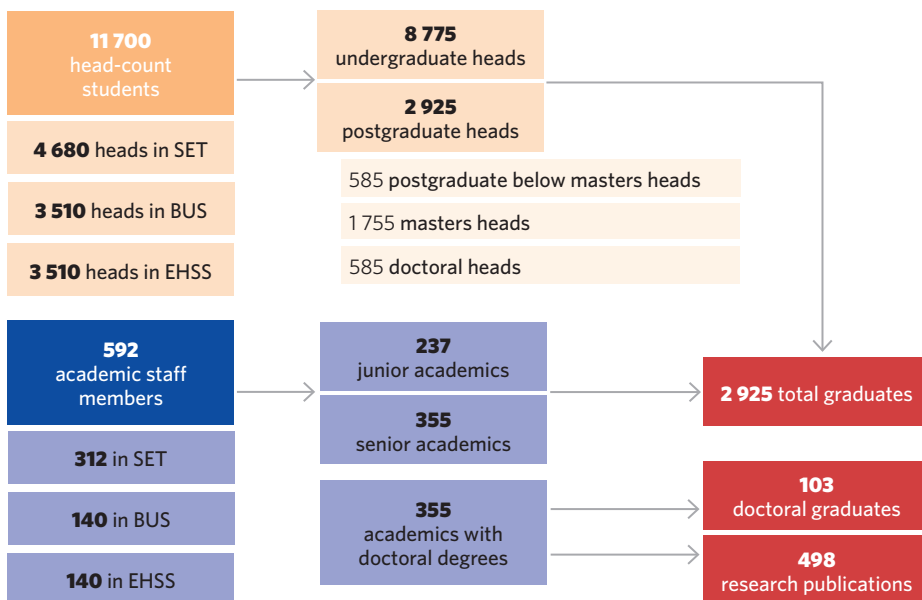
Assessing University of Mauritius according to the Herana academic core criteria

Figure 15.5 offers a sketch of what the University of Mauritius would have looked like in 2015 if it had satisfied the Herana academic core criteria.

The ratios employed in Figure 15.5, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;

Figure 15.5 Model of University of Mauritius as a university meeting Herana academic core criteria



- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;
- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;
- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate; and
- Doctoral graduates = 0.29 per academic with doctorate.

Table 15.10 compares some of the main data in Figure 15.5 against the University of Mauritius's actual enrolments, staffing and knowledge outputs for 2015.

Table 15.10 University of Mauritius actual 2015 data compared with data from academic core model

	Actual 2015 data	Data from research-led model	Difference between actual data and data in model
Total head-count enrolment	11 700	11 700	0
Enrolment by qualification:			
undergraduate	10 578	8 775	+1 803
postgraduate diploma	2	585	-573
masters	1 048	1 755	-707
doctoral	72	585	-513
Enrolment by field of study:			
science & technology (including health)	4 708	4 680	+28
business, economics & management	3 908	3 510	+398
education, humanities & social sciences	3 084	3 510	-426
Academic staff:			
professors, associate professors and senior lecturers	154	355	-201
lecturers and below	153	237	-84
total academic staff	307	592	-285
Knowledge outputs:			
total graduates	3 746	2 925	+821
doctoral graduates	21	103	-82
research publications	74	498	-424

Sources: CHET 2017c; Figure 15.5 for data on research-driven model

Some marked differences between the actual data and the data in the model may be noted. In 2015, more than 90% of the university's students

were enrolled in undergraduate programmes. As a result, the percentages of students enrolled in postgraduate programmes fell far short of those prescribed by the Herana academic core model for a research-led institution. The shortfalls between the actual masters and doctoral enrolments and the numbers prescribed by the model were 707 (40%) and 513 (about 700%) respectively.

The shortfall between the actual size of the University of Mauritius's permanent academic staff complement in 2015 and the target number generated by the model was 285 (40%). A more serious shortfall of about 100% existed between the actual number of senior staff employed in 2015 and the target set by the model.

The University of Mauritius's output of graduates from undergraduate programmes was strong in 2015, exceeding the target generated by the Herana model. However, outputs of high-level knowledge in the form of doctoral graduates and research publications were well below the targets set by the model.

Further assessment of University of Mauritius academic core criteria

In assessing the performance of the Herana universities on academic core criteria, the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators. Accordingly, the first two columns of Table 15.11 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2. The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios.

The numerical values in the fourth column can be understood in these broad ways:

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

Table 15.11 University of Mauritius: Data for assessing academic core performance

	Target	Three-year average 2013-2015	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	41%	4.0
Limit on % undergraduate enrolments	75%	91%	3.3
% masters enrolments	15%	9.1%	2.4
% doctoral enrolments	5%	0.3%	0.2
% senior academics	60%	49%	3.3
% SET academics with doctorates	60%	53%	3.5
% BUS academics with doctorates	60%	37%	2.5
% EHSS academics with doctorates	60%	42%	2.8
Favourable student-to-academic ratios in SET	15	21	2.9
Favourable student-to-academic ratios in BUS	25	38	2.6
Favourable student-to-academic ratios in EHSS	25	21	4.0
Output targets			
Ratio of total graduates to total enrolments	0.25	0.30	4.0
High ratio of masters graduates to masters enrolments	0.25	0.32	4.0
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.16	1.7
Ratio of BUS doctoral graduates to academics with doctorates	0.23	0.0	0.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.22	3.8
Ratio of SET research articles to academics with doctorates	2.00	0.67	1.3
Ratio of BUS research articles to academics with doctorates	1.00	0.18	0.7
Ratio of EHSS research articles to academics with doctorates	1.00	0.46	1.8

Source: Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The targets and 4-point scale scores can be used to depict the university's performance as a research-led institution in two radar graphs: one for its inputs and the other for its outputs. The shapes of these two radar graphs flag the extent to which University of Mauritius has met the Herana academic core targets.

Figure 15.6 indicates that University of Mauritius met two of the Herana targets for inputs, for science, engineering and technology enrolments and for student-to-staff ratios in education, humanities and social sciences. The university also scored above 3.0 for the percentage of senior academics (professors, associate professors and senior lecturers) in its staff and for the number of science, engineering and technology academic staff with doctorates. The low proportion of doctoral students indicates that concerns over University of Mauritius's low level of postgraduate enrolments are well-founded.

Figure 15.7 indicates that the University of Mauritius easily exceeded the Herana targets for the numbers of masters graduates and total graduates that it produced. With five high-level knowledge output scores

Figure 15.6 University of Mauritius: Inputs based on averages for 2013 to 2015

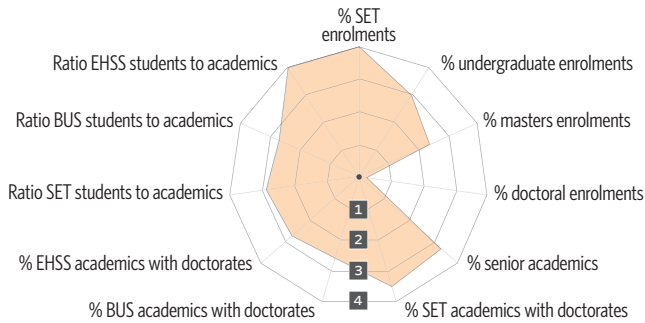
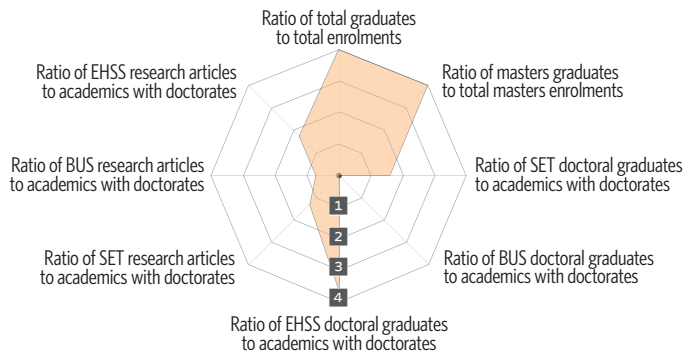


Figure 15.7 University of Mauritius: Outputs based on averages for 2013 to 2015



below 2.0 the university fell far short of the academic core targets set by the Herana project.

Summary

Mauritius, which is classified by the World Bank as an upper middle-income country, had a total population of 1.26 million in 2015, with 100 000 in the 20–24 age group. The gross participation rate in tertiary education was 21% in 2005 and 38% in 2015.

The Mauritian Tertiary Education Commission is responsible for overseeing public and private institutions in the sector. The government strategy ostensibly shaping the work of the Tertiary Education Commission is to develop the country into a centre for tertiary education, enabling it to become a regional knowledge hub. In 2015, the Tertiary Education Commission was responsible for ten publicly-funded institutions, including four universities and six specialist institutions, and accredited and regulated 45 private bodies.

The Tertiary Education Commission included all Mauritian students, whether studying locally or overseas, in its enrolment data in order to measure the overall participation of the population in tertiary education wherever offered. In 2015, 44% of all tertiary students in Mauritius were enrolled in publicly funded institutions, 33% were enrolled in private ones and 23% were enrolled at overseas institutions. The number of students enrolled for tertiary education in Mauritius grew at an average annual rate of 6% between 2005 and 2015 to a total of 37 900.

In 2015, the tertiary sector in Mauritius appeared to have been primarily driven by plans to: increase the participation rate of Mauritians in tertiary education, whether in publicly-funded or private institutions in Mauritius, or in programmes in universities based overseas; make the country a regional centre or hub for tertiary education; and increase national knowledge production, even if this was primarily at under-graduate level.

The number of students enrolled at the University of Mauritius grew by 4.2% a year on average between 2005 and 2015, to a total of 11 700. However, notwithstanding this growth remained a predominantly under-graduate institution with only 1 120 (7%) of its students enrolled in masters and doctoral programmes.

According to University of Mauritius's strategic plan for 2015 to 2020, the institution aims to become a leading international tertiary-education provider and a research-led university; provide quality education to students; and promote knowledge creation and dissemination through research and innovative teaching while responding to national and global developmental needs.

Despite the University of Mauritius's stated commitment to achieving high levels of research activity, the number of students enrolled for doctorates fell from 114 in 2001 to only 72 in 2015, which are low totals for a university with aspirations to be research-led. In addition, although the university produced 65% of the national output of research articles from 2009 to 2016, it only produced an annual average of 77 articles during this period, which is well below the Herana academic core target.

In relation to the Herana criteria for outputs, the University of Mauritius exceeded the targets for the ratios of total graduates and masters graduates to enrolments, which constitute indirect indicators of research activity. However, University of Mauritius scored poorly on the indicators directly measuring research outputs, such as the numbers of doctoral graduates and research articles produced per academic with a doctorate.

The University of Mauritius's research data show it has made some slow movements towards the Herana academic core targets. For example, the number of doctoral graduates increased from 11 in 2009 to 21 in 2015 with the ratio of doctoral-to-total-student enrolments remaining stable

at 0.6%. However, this ratio fell well short of the Herana target of 5% of enrolments. Similarly, the number of research articles produced at the university increased from 32 in 2009 to 74 in 2015 and the ratio of articles per academic staff member improved over the same period, but remained well below the Herana academic core targets.

The overall picture presented in this summary data is that Chapter 2 is correct in concluding that the University of Mauritius should be classified as a research-oriented university. The university has maintained its research aspirations despite a national context which appears to provide little financial and research support to research. The University of Mauritius has met some of the Herana research output criteria but has not displayed marked improvements over time in its research inputs and outputs.

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Chapter 16

University of Nairobi

National context

Population data

Kenya's population estimates for the period 2010 to 2015, including totals for the 20–24 age band are summarised in Table 16.1.

Table 16.1 Kenya population: 2010 & 2015 ('000)

	2010	2015	Average annual increase
Total population	40 000	44 300	2.1%
Population in 20–24 age group	3 500	3 900	2.2%

Source: Population Reference Bureau 2018

Student enrolments and gross participation rates in university education in Kenya in 2010 and 2015 are listed in Table 16.2.¹

Table 16.2 Student enrolments and participation rates in Kenyan universities: 2010 & 2015

	2010	2015
Enrolments in public universities	122 700	400 200
Enrolments in private universities	20 100	85 900
Total university enrolments	142 800	486 100
Gross participation rate in university education	4.1%	12.5%

Sources: Kenya Bureau of Statistics 2016; Kenya Bureau of Statistics 2013

¹ The gross participation rate is defined by UNESCO as the ratio of total enrolments in tertiary education, regardless of age, to the population totals in an appropriate age group. The standard age band used by UNESCO and employed in Herana's profiles of universities is 20–24.

Although Kenya's gross participation rates trebled between 2010 and 2015, they could still be regarded as low for a country which is committed to improving equity of access to tertiary education.

University education in Kenya

Kenya's Universities Act of 2012 (Universities Act 2012, section 3.1) spells out the country's objectives for university education, five of which were:

1. to advance knowledge through teaching, scholarly research and scientific investigation;
2. to support and contribute to the realisation of national economic and social development;
3. to educate, train and retrain higher level professional, technical and management staff;
4. to promote gender balance and equality of opportunity among students and staff; and
5. to promote equity for persons with disabilities, minorities and other marginalised groups.

Oversight of university education in Kenya is shared by the Ministry of Education and the Commission for University Education, with the commission appearing to be the main player. Two of the main functions of the Directorate of Higher Education, which is part of the ministry, are (Ministry of Education/Higher Education 2018):

1. formulation and review of policies on higher education in collaboration with the Commission for Higher Education and other relevant institutions and departments; and
2. coordination of plans and budgets from public universities in collaboration with the commission and other government departments.

Kenya's Universities Act of 2012 lists the Commission for University Education's functions (Universities Act 2012, section 5.1), which include:

- advising the cabinet secretary on policy relating to university education;
- promoting, setting standards and assuring relevance in the quality of university education;
- monitoring and evaluating the state of university education systems in relation to the national development goals;
- developing policy for criteria and admission requirements;

- regularly inspecting universities to ensure compliance with set standards;
- collecting, disseminating and maintaining data on university education; and
- accrediting universities in Kenya.

In November 2017, the Commission for University Education published a list of universities which it had accredited under the Universities Act of 2012. Some of these were accredited in 2015 or earlier and others were accredited in 2016 and 2017. They are accordingly listed in Table 16.3.

Table 16.3 Numbers of universities accredited by the Commission for University Education

	Charter awarded 2015 or earlier	Charter awarded 2016 or 2017	Total by November 2017
Public chartered universities	23	8	31
Public constituent colleges	2	4	6
Private chartered universities	17	1	18
Private constituent colleges	5	0	5
Interim letters of authority	12	2	14
Total	59	15	74

Source: Commission for University Education 2017

Data collected by the Commission for University Education are used by the National Bureau of Statistics to produce summaries of student enrolments in public and private universities in Kenya. Accordingly, the number of students enrolling in the sector from 2007 to 2015 is set out in Table 16.4.

Table 16.4 Students enrolled in accredited universities in Kenya: 2007–2015 ('000)

	2007	2009	2011	2013	2015	Average annual increase
Enrolments in public universities	97	123	164	202	400	19.4%
Enrolments in private universities	21	22	31	54	86	19.3%
Total university enrolments	118	145	195	256	486	19.3%

Sources: Kenya National Bureau of Statistics 2016; Kenya National Bureau of Statistics 2013

Table 16.4 indicates an exceptionally high growth rate in university enrolments. The numbers of students enrolled at both public and private universities increased by more than 19% a year on average between 2007 and 2015, representing a fourfold increase over the nine years. As a

result, Kenya's gross participation rate in university education trebled from 4% in 2010 to 12% in 2015.

Table 16.5 summarises enrolments in public universities in three broad categories:

1. undergraduate degrees, which are typically bachelors degrees;
2. diplomas and certificates, which are non-degree qualifications at undergraduate level; and
3. postgraduate qualifications, which are mainly masters degrees, but also include doctoral degrees and a few postgraduate diplomas and certificates.

Table 16.5 Students enrolled in public universities in Kenya by qualification type: 2007–2015 ('000)

	2007	2009	2011	2013	2015	Average annual increase
Undergraduate degrees	85	109	142	170	323	18.1%
Diplomas and certificates	5	7	6	7	33	26.4%
Postgraduate qualifications	7	7	16	24	44	26.4%
Total	97	123	164	202	400	19.4%

Sources: Kenya National Bureau of Statistics 2016; Kenya National Bureau of Statistics 2013

In the absence of readily available official system-wide enrolment plans for public universities, it is unclear whether the enrolment growths indicated in Tables 16.4 and 16.5 were planned or were the result of relatively unchecked demand-driven growth. The only relevant plan which could be found was the 'Strategic Plan 2014–2018' produced by the Commission for University Education, which includes a short chapter on the plan for Kenya's long-term development and the role which the university system is expected to play in its implementation. Some of the points raised in this chapter are summarised below.

The government is committed to an economic, social and political environment that will create a globally competitive and prosperous country, and which should transform Kenya into a newly industrialised middle-income country. In pursuit of this goal, the government's 'Vision 2030' document targets a sustainable average annual economic growth rate of 10% a year, and cohesive, equitable social development in a clean and secure environment (Commission for University Education 2014: 5).

In order to achieve the goals outlined by 'Vision 2030', the Commission for University Education is charged with overseeing (Commission for University Education 2014: 7):

- university expansion;
- increased access with particular emphasis on under-represented vulnerable groups;
- the establishment of centres of excellence;
- ensuring quality and relevance;
- promoting research and development;
- training and capacity building; and
- the enhancement of linkages and partnerships.

The implementation of 'Vision 2030' depends on the production of human resources by a quality education system. However, rapid increases in the numbers of students enrolled at university without commensurate increases in infrastructure and staff have placed undue pressure on facilities and undermined student-to-academic-staff ratios. The growing demand for university education also led to the apparently haphazard establishment of new institutions and alternative modes of delivery, some of which seem to have failed to have met appropriate standards of quality, relevance and regional equity (Commission for University Education 2014: 8).

Notwithstanding the rapid increases in student enrolments, access to university education remained a challenge, with at least 70% of school leavers who qualify for entry failing to gain admission to a university. In order to help the government to expand access, the commission was required to facilitate the development and establishment of new public universities, the upgrading of middle-level colleges and the development of new private universities (Commission for University Education 2014: 8-9).

Greater emphasis should be placed on the relevance of university education programmes to the goals of 'Vision 2030'. Some academic programmes had failed to keep pace with the demands of a science and technology-driven economy, leading to a mismatch between the skills being taught and the demands of the modern labour market (Commission for University Education 2014: 8).

Summary of the national context for higher education in Kenya

Kenya appears to have accepted that its national higher education system should produce graduates for the labour market as well as high-level knowledge products designed to support national socio-economic development.

The high demand for entry into university, coupled with commitments to achieving equity of access, led to high student–enrolment growth rates well above the average annual rates in the other Herana universities.

Kenya’s gross participation in university education, including public and private enrolments, was 12% in 2015, which could be regarded as low for a country committed to equity of access.

In the absence of official evidence to the contrary, it appears that public universities are considered to be equal and undifferentiated with no attempt to distinguish one or more as research–led.

Focus on the University of Nairobi

Basic data

An important difference between Nairobi and the other seven universities is that Nairobi’s data line ends in 2014 and not 2015. Nairobi was not able to provide data for the 2015 academic year.

Two data sources have been used for the numbers and kinds of student enrolments at the University of Nairobi: the annual ‘Statistical Abstract’ of the Kenya National Bureau of Statistics, and the Excel data files submitted by the university to CHET as part of the Herana project. The numbers of students at the university according to these two data sources are summarised in Table 16.6.

Table 16.6 Students enrolled at the University of Nairobi according to Statistical Abstract and Herana data: 2007–2014 ('000)

	2007	2009	2011	2013	2014
Statistical Abstract total	36.3	37.4	48.8	51.0	64.1
Herana total	35.9	45.2	61.5	73.0	68.9

Sources: Kenya National Bureau of Statistics 2016 and Kenya National Bureau of Statistics 2013; CHET 2017b and CHET 2017c

The marked difference between the numbers of enrolments extracted from the two data sets could be the result of incomplete data or different closing dates for recording data for a given academic year. The analyses that follow are based on the Herana data, which contain more detail on qualification types than the data offered by the University of Nairobi, including details of its masters and doctoral degree enrolments.

The Herana enrolment data for the University of Nairobi for the period 2007 to 2014, by type of qualification, are summarised in Table 16.7.

Table 16.7 Students enrolled at the University of Nairobi by qualification type: 2007–2015

	2007	2011	2014	Average annual increase: 2007–2014
Undergraduate	29 206	46 169	55 797	9.7%
Postgraduate below masters	855	152	200	-18.7%
Masters	5 700	11 807	11 800	11.0%
Doctors	103	249	1 103	40.3%
Total enrolments	35 864	61 377	68 900	9.8%

Source: CHET 2017b and CHET 2017c

Table 16.7 indicates that the number of students enrolled at the University of Nairobi almost doubled in 2014 compared with 2007. At 9.8%, the average annual increase in enrolments at the university was exceptionally high compared with the growth rates at some of the other Herana universities.

The increase in enrolments in doctoral degree programmes shown in Table 16.8 is an important indicator of the extent of the university's engagement in research. However, 1 103 doctoral enrolments is a low total for an institution of the University of Nairobi's student enrolment size.

Table 16.8 Postgraduate students enrolled at the University of Nairobi: 2010–2014

	2010	2012	2014	Change between 2010 and 2014	
Postgraduate below masters	198	200	200	+2	1%
Masters	10 562	12 000	11 800	+1 258	12%
Doctors	217	600	1 103	+886	408%

In order to measure the university's strength within its national research environment, account must also be taken of its share of the national output of research publications, which was measured in a bibliometric study undertaken by Stellenbosch University. Table 16.9 summarises the numbers of research articles produced in Kenya by institution from 2010 to 2016.

The publication data in Table 16.9 indicate a low national output of research articles. A total of 11 029 research articles were produced from 2010 to 2016, at an annual average of only 1 575 articles a year for a research system consisting of 40 chartered universities, a wide range of partnerships with international universities and a number of active government research institutions in 2015. The University of Nairobi produced 17% of the national output of research articles over the period,

but at a low average of only 262 articles a year, well below the number set by the Herana academic core criteria.

Table 16.9 Research articles allocated to Kenyan institutions: 2010–2016

	Number	% of total
University of Nairobi	1 833	17%
Moi University	579	5%
Kenyatta University	543	5%
Jomo-Kenyatta University of Agriculture	522	5%
Government medical research centre	1 248	11%
Livestock research	725	7%
International universities	2 691	24%
All other Kenyan institutions	2 888	26%
Total	11 029	100%

Source: CHET 2017d

University of Nairobi strategic planning

The University of Nairobi has published on its website a short, seven-page ‘Strategic Plan’ for the period 2008 to 2013. The vision and mission statements from the plan are set out in Table 16.10.

Table 16.10 University of Nairobi vision and mission for 2008 to 2013

Vision statement	To be a world-class university committed to scholarly excellence.
Mission statement	To provide quality university education and training and to embody the aspirations of the Kenyan people and the global community through the creation, preservation, integration, transmission and utilisation of knowledge.

Source: University of Nairobi 2008

The ‘Strategic Plan’ lists key challenges facing the university and strategic objectives for improving its performance in order to address these challenges (University of Nairobi 2008):

Teaching and learning strategies and objectives

Objective 1: To offer innovative academic programmes with in-built quality assurance.

- review academic programmes to ensure relevance and applicability;
- implement policies and practices designed to enhance the quality of teaching and learning;

- review the examination procedures to create a more efficient evaluation and certification system; and
- strengthen and streamline postgraduate training and supervision.

Objective 2: To nurture academic programmes to world-class status.

- competitively benchmark all academic programmes and prescribe world class standards to be met by each academic programme; and
- provide budgetary support to programmes to meet the set standards.

Objective 3: To actively promote diversified modes of delivery.

- encourage the use of technology in teaching; and
- promote and popularise open and distance education in all programmes.

Innovation, research and development and consultancy

Objective 4: To create an enabling environment and policy framework that promotes research, development and other value adding services.

- develop and implement a research policy;
- expand opportunities for local, regional and international exposure and participation in learned forums;
- mainstream consultancy into the core business of the university; and
- establish links with both public and private sectors for purposes of consultancy contracts.

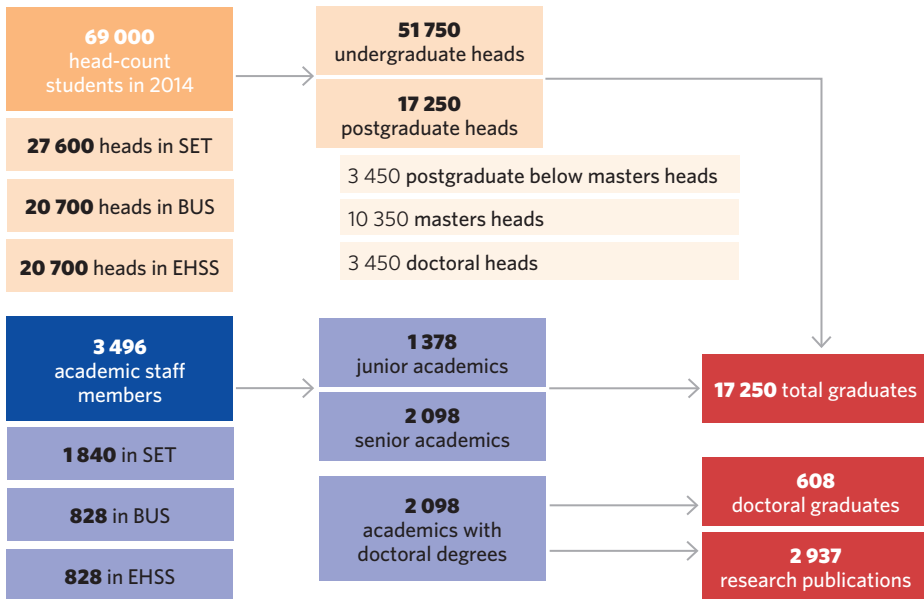
Assessing the University of Nairobi according to Herana academic core criteria

Figure 16.1 offers a sketch of what University of Nairobi would have looked like in 2014 if it had satisfied the Herana academic core criteria.

The ratios employed in Figure 16.1, and in particular those related to outputs, are adaptations of the detailed academic core ratios employed in Table 2.17 in Chapter 2. The adapted ratios are these:

- SET heads = 40%, BUS heads = 30%, EHSS heads = 30% of enrolment total;
- Undergraduate heads = 75% and postgraduate heads = 25% of enrolment total;

Figure 16.1 Model of the University of Nairobi as a university meeting Herana academic core criteria



- Doctoral heads = 5%, masters heads = 15%, postgraduate below masters = 5% of head-count enrolment total;
- Academics = SET enrolments divided by 15, business/management enrolments divided by 25, humanities/social science enrolments divided by 25;
- Senior academics = 60% of academic staff total;
- Staff with doctorates = 60% of academic staff total;
- Graduate total = 25% of overall enrolment total;
- Research publications = 1.4 per academic with doctorate;
- Doctoral graduates = 0.29 per academic with doctorate.

Table 16.11 compares some of the main data in Figure 16.1 against the University of Nairobi’s actual enrolment, staffing and knowledge outputs for 2014.

The marked differences between the actual data and the data from the model indicate the challenges faced by the University of Nairobi in satisfying the Herana academic core targets.

Enrolments in science and technology were 40% below the target projected by the model, while those in the fields of business and management were 20% above target. The number of students enrolled in doctoral programmes were well below the number set by the Herana

criteria for a university of Nairobi's size. The actual number of doctoral enrolments was 1 103, almost 2 500 (225%) below the number projected by the model.

Table 16.11 University of Nairobi actual 2014 data compared with data from academic core model

	Actual data	Data generated by academic core ratios	Difference between actual data and data from model
Total head-count enrolment	69 000	69 000	0
Enrolment by qualification:			
undergraduate	55 797	51 750	+4 047
postgraduate below masters	200	3 450	-3 250
masters	11 800	10 350	+1 450
doctoral	1 103	3 450	-2 347
Enrolment by field of study:			
science & technology (including health)	20 275	27 600	-7 235
business, economics & management	25 394	20 700	+4 694
education, humanities & social sciences	23 231	20 700	+2 531
Permanent academic staff:			
professors associate professors and senior lecturers	567	1 840	-1 273
lecturers and below	666	1 398	-732
total academic staff	1 233	3 496	-2 263
academic staff with doctorates	302	2 098	-1 796
Knowledge outputs:			
total graduates	13 180	17 250	-4 079
doctoral graduates	100	608	-508
research publications	258	2 098	-1 840

Sources: CHET 2017; Diagram 1 for data on research-led model

Shortfalls in the numbers of academic staff numbers were particularly great. The total complement of permanent academic staff at the University of Nairobi was only one third of the number of permanent academic staff required under the Herana model. The most noticeable shortfalls were among senior academic staff and staff with doctoral degrees. The University of Nairobi's actual total of senior academic staff was 567, which was 1 273 below the model's total of 1 840. The university had 302 permanent academics with doctorates compared with the target set by the academic core model of 2 098.

The University of Nairobi's knowledge outputs generally fell far short of those derived from the Herana model. The number of graduates produced was 4 079 (24%) below the number set by the model, and the number of doctoral graduates was 508 (500%) below the target. Only 258 research articles were produced at the university, compared with the model's required total of 2 098.

Further assessment of the University of Nairobi on academic core criteria

In assessing the performance of the Herana universities on academic core criteria, the Herana team has deployed quantitative data based on the averages from a three-year period, linking these to targets for the academic core of each institution using a standard set of indicators. Accordingly, the first two columns of Table 16.12 summarise these targets, which are explained and set out in detail in Tables 2.16 and 2.17 in Chapter 2. The third column contains data averages for the university according to these indicators for the three years 2013 to 2015. The fourth column compares the university's average performance with the Herana targets, converting these data averages to a 4-point scale by dividing the actual score by the target score allowing a maximum ratio of 4. Inverse ratios had to be used for targets with upper limits, such as student-to-academic-staff ratios.

Table 16.12 University of Nairobi: Data for assessing academic core performance

	Target	Three-year average 2012-2014	Relating average to target performance on a 4-point scale
Input targets			
% SET enrolments	40%	29%	2.9
Limit on % undergraduate enrolments	75%	81%	3.7
% masters enrolments	15%	17.1%	4.0
% doctoral enrolments	5%	1.5%	1.2
% senior academics	60%	46%	3.1
% SET academics with doctorates	60%	28%	1.9
% BUS academics with doctorates	60%	15%	1.0
% EHSS academics with doctorates	60%	19%	1.3
Favourable student-to-academic ratio in SET	15	15	4.0
Favourable student-to-academic ratio in BUS	25	156	0.6
Favourable student-to-academic ratio in EHSS	25	49	2.0
Output targets			
Ratio of total graduates to total enrolments	0.25	0.19	3.1
Ratio of masters graduates to masters enrolments	0.25	0.24	3.0
Ratio of SET doctoral graduates to academics with doctorates	0.38	0.24	2.5
Ratio of BUS doctoral graduates to academics with doctorates	0.23	2.90	4.0
Ratio of EHSS doctoral graduates to academics with doctorates	0.23	0.30	4.0
Ratio of SET research articles to academics with doctorates	2.00	1.17	2.3
Ratio of BUS research articles to academics with doctorates	1.00	0.22	0.9
Ratio of EHSS research articles to academics with doctorates	1.00	0.80	3.2

Sources: Indicators and targets in Table 2.17 in Chapter 2; CHET 2017c for calculations of average data

Notes: SET = science, engineering and technology (including health and clinical sciences); BUS = business, economics and management; EHSS = education, humanities and social sciences

The numerical values in the fourth column can be understood in these broad ways:

- 4 = has met the target for a research-led university;
- 3 and above = close to the target for a research-led university;
- 2 to 3 = performance below target for a research-led university;
- below 2 = performance poor and well below target for a research-led university.

The targets and 4-point scale scores can be used to depict the university’s performance relative to the academic core targets in two radar graphs: one for its inputs and the other for its outputs. The shapes of these two radar graphs flag the extent to which the University of Nairobi has satisfied the Herana academic core targets.

In relation to the inputs required by the academic core targets, the University of Nairobi met the targets for the proportions of masters enrolments and for the student-to-staff ratio in science and technology disciplines and came close to the expected enrolment shape in terms of

Figure 16.4 University of Nairobi: Inputs based on averages for 2013 to 2014

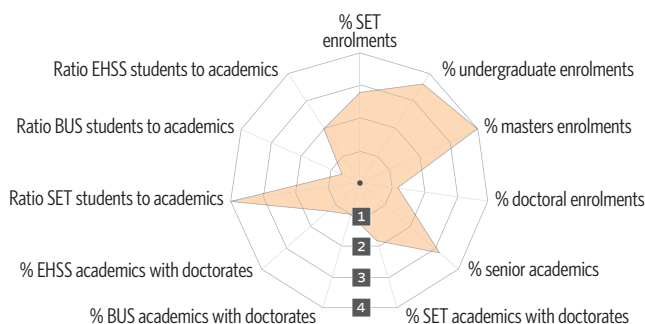
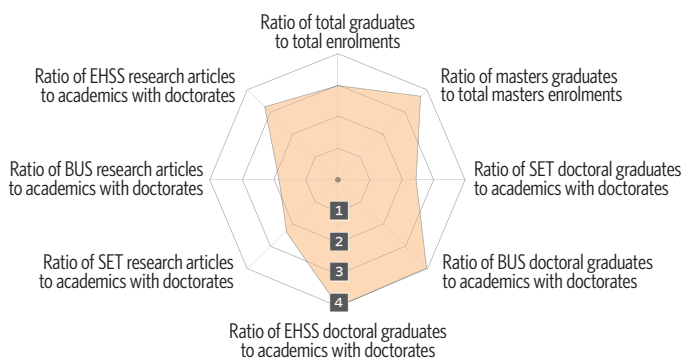


Figure 16.5 University of Nairobi: Outputs based on averages for 2013 to 2015



the required limit on undergraduate enrolments. The university's performed particularly poorly in relation to the numbers of senior academics and academic staff with doctoral degrees.

The University of Nairobi scored between 3.0 and 4.0 against the Herana targets for its output rates for masters and total graduates, as well as for its outputs for doctoral graduates in the fields of business, economics and management, and in education, humanities and social sciences. However, the University of Nairobi's output of doctoral graduates in science and technology disciplines was low, particularly in relation to the number of academic staff in this field holding doctoral degrees. The university's outputs of research publications per academic with a doctorate were well below the Herana academic core targets in all three broad fields of study.

Summary

Kenya, which is classified by the World Bank as a lower middle-income country, had a population of 40 million in 2010, which rose to 44.3 million by 2015 – an average annual increase of 2.1%. The number of 20–24-year-olds rose from 3.5 million in 2010 to 3.9 million in 2015.

Kenya's gross participation rate in university education was 4.1% in 2010 and 12.5% in 2015. This trebling of the gross participation rate indicated rapid growth in the number of students enrolled in the public and private university sectors. The total rose from 118 000 in 2007 to 402 000 in 2014 at a high average annual growth rate of 9.8%.

Key issues emerging from a consideration of the role of higher education in the national context included:

- Kenya appears to have accepted that its national higher education system should produce graduates for the labour market and high-level knowledge products designed to support national socio-economic development.
- High demand for university places, coupled with commitments to achieving equity of access, led to high student enrolment growth rates, which were well above the average annual growth rates in the other Herana universities.
- Kenya's gross participation in university education, including public and private enrolments, was 12% in 2015, which could be regarded as low for a country committed to equity of access.
- In the absence of official evidence to the contrary, it appears that public universities are considered to be equal and undifferentiated with no attempt to distinguish one or more as research-led.

According to its vision and mission statements for 2008 to 2013, the University of Nairobi aimed to become a world-class university committed to scholarly excellence; to provide quality university education and training; and to embody the aspirations of Kenyans and the global community through the creation, preservation, integration, transmission and utilisation of knowledge.

Increased enrolments in doctoral degree programmes at the University of Nairobi, from only 100 in 2007 to 1 103 in 2014 represent an important indicator of the extent of the university's engagement in research. However, the number of doctoral enrolments remains low for an institution of its size with strong aspirations to become a research-led institution.

The production of research articles also constitutes an important measure of national and institutional commitments to high-level knowledge production. A total of 11 029 research articles were produced from 2010 to 2016, at an annual average of only 1 576 articles a year for a research system consisting of 40 chartered universities, a wide range of partnerships with international universities and a number of active government research institutions in 2015. The University of Nairobi produced 17% of the national output of research articles over the period at a low average of only 262 articles a year.

The University of Nairobi's performance relative to the Herana academic core criteria was mixed. In relation to its inputs, it met two of the 11 targets and came close to a further two. The university performed particularly poorly in relation to the numbers and qualifications of its permanent academic staff. High student-to-staff ratios were recorded in education, humanities and social sciences, and in business, economics and management disciplines. A low proportion of staff held doctoral degrees.

In relation to its outputs, the University of Nairobi met one target and came close to a further three. These concerned its output rates for masters and total graduates, as well as its outputs for doctoral graduates in the fields of business, economics and management, and in education, humanities and social sciences. The university's output of doctoral graduates in science and technology disciplines was low; particularly in relation to the number of academic staff in this field holding doctoral degrees. The university's outputs of research publications per academic with a doctorate were well below the Herana academic core targets in all three broad fields of study.

The University of Nairobi's research data show that it has made some progress towards the Herana targets. For example, its number of doctoral graduates increased from 18 in 2009 to 100 in 2014. Its enrolment of doctoral students grew from 167 in 2009 to 1 103 in 2014. Similarly, the

number of research articles produced at the university increased from 207 in 2009 to 319 in 2014 and the ratio of articles per academic staff member improved from 0.16 to 0.26 over the same period.

The overall picture presented in this summary is that the Chapter 2 is correct in concluding that the University of Nairobi should be classified as an emerging-research university. It has strong research commitments, has met some of the Herana research targets and can show evidence of improvements over time in its research inputs and outputs.

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PART FOUR

CONCLUSION

The general intention of this book is to contribute to an improved understanding and empirical basis concerning the development of a specific set of African universities, that is, eight national flagship universities, towards becoming research-led universities. This book assumed a general interest in how these African universities function and perform, especially with respect to their research activities. For that purpose, university case studies were undertaken with the aim of producing valid and relevant data on university productivity.

The Herana project's intention to improve our understanding of the research productivity of African universities was affected by a number of challenges.

First was the challenge of mapping the actual performance of African flagship universities: How is research interpreted and operationalised by key actors in these universities? What data are available for identifying the kinds of research outputs that these universities are producing? How has the research productivity of these universities developed since the early 2000s? To what extent have the ways in which African flagship universities manage their research activities changed? Are there dominant trends across African flagship universities when it comes to research productivity, or are there substantial differences among the case universities covered in this book?

Second was the challenge of examining the national political and socio-economic contexts of African flagship universities and their hitherto limited impacts on university research performance: What have been the most relevant deliberate attempts by national political actors, that is, governments and their ministries and agencies, to influence the research activities of flagship universities? What other agencies and organisations, including public and private donors, without direct

political mandates with respect to universities, have attempted to influence university research performance in Africa?

Third was the challenge of exploring the possible relationships between performance and the endogenous and exogenous pressures on the university. Overall there is insufficient knowledge on the effectiveness of modes of public governance in Africa in the areas of national research policy, as well as research administration and the research activities taking place in universities.

Traditionally there have been major knowledge gaps in the global interpretation and understanding of the functioning and performance of African universities, and weak and ambiguous statistics and data are often used to legitimise strong conclusions concerning the need for specific kinds of development programmes and projects in African higher education. For example, in public and private donor organisations' programmes, these data and statistics are often used to legitimise donors' emphasis on the need to build capacity in African universities. But this capacity is not to be used for academic purposes, but rather for contributing to poverty reduction and community development, combatting tropical diseases, and stimulating agricultural exports.

In various parts of the book we have referred to the lack of a relevant analytical framework in the academic literature on African higher education, and a sound data-basis for interpreting and explaining the dynamics of the African universities, and it can be argued that university studies in Africa have to a large extent been disconnected from more general studies and knowledge on continental development processes. In addition, African higher education is nearly always treated as an isolated phenomenon in academic studies, that is, isolated from the change dynamics of its national and regional political and socio-economic contexts, and isolated from the change dynamics in science and higher education policies and practices in the rest of the world.

Given the above, the question might justifiably be asked: Why did Herana focus so single-mindedly on operationalising knowledge as the central object of the academic core? Surely the role of universities in development is broader than just the production of new knowledge and new knowledge producers? The key lies in the singular, special characteristic of knowledge as 'a global public good' (Stiglitz 1999; UNESCO 2018). Among the global public goods that UNESCO (2018) particularly recognises is internationally comparative data and statistics of the sort that Herana sought to develop. These are 'in short supply, poorly funded and rarely coordinated' (UNESCO 2018: 16, 17) as Herana was also to find.

There are fine distinctions to be made between 'public' goods, 'common' goods and 'collective' goods (see Marginson, 2018). Here we

will use the term ‘global public good’. First, knowledge is the product of collective endeavour, and is very rarely the sole product of the codifying agent. We have discussed above how the collective character of global scholarship has expanded dramatically over the past decades, which has built the global science network into a vast open resource for scholars, both emerging and established. We have also seen that for budding scholars, early interactions with eminent peers in their field has a significant influence on their later career (Reyes-Gonzalez 2018). The global science network is thus a source of collaboration, of resource-sharing and functions as an extensive and extended mentoring facility, all of which are non-private benefits that are more or less by-products of the global production of new knowledge. This aside, knowledge is public and common in a further special sense that is intrinsic to it.

There is a fundamental distinction in economics between rival goods and non-rival goods (Samuelson 1954; Romer 1990). Rival goods are made up of matter and energy. They are ‘stuff’, and when ‘stuff’ circulates in the marketplace, what one person possesses, the other person cannot possess, and vice versa. Ideas or knowledge, on the other hand, are made up of combinations of information, and when these are codified, they can in principle be shared countless times: they can be replicated at negligible cost – think of the recipe for bread; the blueprint for a building; a technique for growing rice; a scientific formula; a formula for a new drug; computer code; novels and music. All these can circulate without taking anything away from the giver. Non-rival goods are, in the language of economics, non-excludable.

Markets, set up as they are to produce value, are not well-disposed to non-rival goods. They will continually try to leash this magical property to the rival economy; and of course, the originator of the non-rival idea (the author, the composer, the scientist) may depend for her livelihood on some recompense for the product, whether it is rival or non-rival. There are a range of legal formulae to make the goods excludable and hence value-producing – patents, copyright, intellectual property provisions, exclusive use licences and so on. But the magic of ideas and knowledge being what it is, will continually contrive to remain non-rivalrous. As Marginson (2018: 11) says, ‘once knowledge is revealed (that is, made public), its non-rivalrous and non-excludable qualities become dominant’. They will perpetually try to slip the leash of the market, by fair means or foul – by illicit copying and distribution, pirating, or circumventing the barriers to access in other ways. The most fecund way to elude market barriers is to come up with a newer, better idea that builds upon the original idea but extends or improves it, marginally or by means of a large innovative leap. This exploits another magical property of ideas as knowledge, namely their cumulative nature.

This is a self-propelling process in the knowledge economy, and is the principal motor of endogenous development.

Universities, potentially at least, can be considered as major ideas factories that produce not only new ideas for very little – the pittance of professors' salaries and other running costs – but also produce the new producers of new ideas – those newly minted PhDs that universities also produce. Seen in this light, universities are potential knowledge and development engines if they are allowed to pursue their principal mission under propitious conditions. For the proponents of endogenous growth, feeding this knowledge producing engine properly is the route to developmental success. But as we have also seen throughout the Herana process, this penny has yet to drop for most of the research-aspirant universities and their custodial ministries in the Herana network.

There are then two things taking place in universities which pull the production of new ideas this way or that. The first is that a self-interested marketplace is continually trying to second-guess where the next new idea will come from. We see this in the perennial calls for 'relevance', which, when they come from market actors, means the production of new non-rival goods that can be made excludable, and hence can provide new sources of value and profit. Think of funding by large concerns like the pharmaceutical companies eager to be first in the queue to rivalrise the next non-rival new biochemical idea. This does not mean that all private funding is self-interested, and much of the world's rich store of knowledge has been produced on the basis of generous funding by private philanthropies. Indeed, without the far-sighted funding of Ford and Carnegie, Herana might never have happened.

Universities have always partly resisted the siren call of the market in its unvarnished form at least. But there is something else to be considered too. The very best new ideas are often unexpected ones. Such again is the magic of cumulative knowledge: because it is cumulative does not mean that it is predictable. When a genuinely new idea does enter the scene, it initially goes into circulation non-rivalrously, like Tim Berners-Lee's world wide web did (Brooker 2018). Some manage to survive, like Whatsapp, for example, or adapt to market conditions for a fraction of earlier user fees, like Netflix for example. The market will keep trying to rivalrise it comprehensively, but by the time it does, something else may have been thought up and produced to replace it.

We are, then, in the era, as Castells (2009, 2011) has persuasively shown, of the propulsive and productive force of new ideas. The bedrock of this propulsion is codification and communication. All sorts of networks and agents are now also in the business of producing good ideas, but the universities retain – and will retain – pride of place, for a few key reasons. First, if they are research-active at all, they will, to a

greater or lesser extent, be plugged into the very rich resources of the global science network. Universities and researchers, especially those in the developing world, have yet to maximise the benefits that are to be reaped by active participation in this global network. Second, universities are the only institutions that are also reproducing the producers of new knowledge at the cutting edge of current knowledge, and they can only do this if they themselves are producing knowledge at this edge themselves. Universities thus are primary propelling agents in the global knowledge economy, if only they are afforded the chance to do so, and if only they take up the challenge. Finally, universities might convey private benefits on qualification holders, but, as we have sought to show here, they fundamentally also serve the common good. In Marginson's words, '*the common good is inherent in the globalised higher education and knowledge system*' (Marginson 2018: 8, emphasis in the original).

In the Afterword of the book *Castells in Africa: Universities and development* (Muller et al. 2017), Castells asserts that higher education institutions are essential for both economic growth and social justice, that is, for development. This is the assumption from which the Herana project departed in 2007 – the links between universities and development. What Herana also confirmed is that the links are neither linear nor simple. The network consequently focused on strengthening a group of universities who understood that the university itself must have certain characteristics to be able to produce new knowledge that could directly and, more likely, indirectly contribute to development.

The Herana project can be regarded as a step forward in producing a better knowledge basis in relation to the multiple challenges faced by universities in Africa aspiring to become research-led. The case studies and data in this book provide new insights into the research performance of African universities that are relevant to the issue of how the development of African societies can be strengthened and become more sustainable through focused and effective investments in universities.

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Appendix

Herana publications

Books

1. Cloete, Bailey, Pillay, Bunting & Maassen (2011) *Universities and Economic Development in Africa*. Cape Town: African Minds
2. Luescher–Mamashela with Kiiru, Mattes, Mwollo–ntallima, Ng’ethe & Romo (2011) *The University in Africa and Democratic Citizenship: Hothouse or training ground?* Cape Town: African Minds
3. Cloete, Maassen & Bailey (2015) *Knowledge Production and Contradictory Functions in African Higher Education*. Cape Town: African Minds
4. Muller, Cloete & Van Schalkwyk (2017) *Castells in Africa: Universities and development*. Cape Town: African Minds
5. Cloete, Bunting & Van Schalkwyk (2018) *Research Universities in Africa*. Cape Town: African Minds

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1. Mattes & Luescher-Mamashela (2012) The roles of higher education in the democratisation of politics in Africa: Reports of Herana studies. *Journal of Higher Education in Africa* 10(1): 139-170
2. Kgosithebe & Luescher (2015) Are African flagship universities preparing students for citizenship? *Journal of Student Affairs in Africa* 3(1): 49-64. DOI: 10.14426/jsaa.v3i1.92
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9. Cloete & Bunting (2013) Challenges and opportunities for African universities to increase knowledge production. Paris: OECD
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1. Cloete, Wangenge-Ouma, Luescher-Mamashela & Muller (eds) (2013) *Historical Development of Higher Education in Africa*. Higher Education Masters in Africa Course Readers Vol. 1. Cape Town: Compress
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1. Special Africa Edition: Differentiation in South African higher education. Issue 1, 29 January 2008
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 - Universities in Africa strengthen democracy
 - Herana: A basis for redefining universities
 - The Herana instruments and applications
 - Possible uses of Herana by universities
 - Herana 2 - New research on higher education
3. Africa Higher Education Summit, Issue 357, 8 March 2015
 - Performance – not aspiration – needed to revitalise HE
 - Africa needs to support emerging research universities
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 - University engagement as interconnectedness
4. Herana 3 Meeting, Issue 442, 16 January 2017
 - Indicators show flagship African universities on rise
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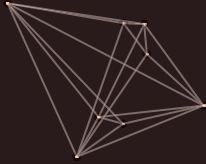
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Reviews

1. Case (2018) Book review: Castells in Africa: Universities and development. *Higher Education*. doi: 10.1007/s10734-018-0287-5
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The quality of research universities is an essential component of the development process in the Information Age, in Africa and elsewhere. This volume, produced by a network of outstanding African researchers, provides the best analysis to-date on the state of higher education in Africa, and discusses key policies to steer their positive transformation.

- **Manuel Castells**, Professor Emeritus of Sociology, University of California, Berkeley, Fellow at St John's College, Cambridge & Donald Gordon Fellow, Stellenbosch Institute of Advanced Studies

This is an important book, synthesising 15 years of carefully gathered data and analysis, digging deep into the institutional lives of some of Africa's best-known universities, and asking challenging questions about what it means to produce knowledge for society and whether these universities are really being enabled to do so. It offers a substantive guide to university leaders and planners, and by connecting empirical evidence to an examination of incentives, funding systems and policy prescriptions, it highlights the competing and contradictory pressures that many institutions and their staff face – and which must be urgently resolved if the potential of African higher education – for the world, not just the continent – is to be realised.

- **Jonathan Harle**, Director of Programmes, INASP, Oxford

The higher education landscape in Africa has changed considerably in the last two decades. Research universities are emerging as the more competitive of the universities in each country. Their effectiveness is driven by national and institutional cultures and the ability of leadership to manage change. This book documents, in a way no other book has done, the nature of the changes taking place in the region and the forces behind them. It is very analytical and it is very informative. Above all, it is comprehensive and essential reference material.

- **Ernest Aryeetey**, former Vice-Chancellor, University of Ghana & Secretary-General, African Research Universities Alliance (ARUA)

Research Universities in Africa is a welcome addition to the academic literature on African universities. This well-researched book which, in addition to the contribution of the main three authors, incorporates valuable inputs from a large number of researchers from sub-Saharan Africa and beyond, carefully analyses the challenges faced by African research universities through a skillful combination of theoretical pieces and case studies of eight universities. The book presents a balanced assessment of the role and potential contribution of research universities in the African context. The authors should be congratulated for this excellent contribution that can guide African universities all over the continent in thinking more strategically and achieving better results as they seek to develop their research capacity and increase the relevance of their research output.

- **Jamil Salmi**, global tertiary education expert, former co-ordinator of tertiary education at the World Bank & Emeritus Professor of Higher Education Policy, Diego Portales University (Chile)

