



Reviewing Some Implications of the Green Economy for Higher and Further Education Institutions

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Abstract

The world is set to apply green economy as a framework for achieving sustainable development, eradicate poverty and inequality and create jobs. This reality follows the consensus on green economy by global leaders during Rio+20 in June 2012. At the centre of the green economy is the need to address negative impacts associated with one of the global challenges of our epoch, climate change. Higher education (including further education) is viewed by many as an enabling platform for the generation and acquisition of green economy knowledge and skills for the future we want. The question this paper seeks to address is: are African institutions of higher education green economy ready? This question is not only limited to the curricula, but to broader impact areas in higher education that include the institutionalisation of green economy in policy, research and research management structures, in depth understanding of the green economy concept and the manner in which it links to existing paradigms like sustainable development as well as higher education–private sector partnerships. The paper shows that there are a number of emerging initiatives that can be seen to be developing green economy education and training in higher/further education contexts, but that much more needs to be done. The paper shows a ‘slow awakening’ to the green economy call as revealed by activities from the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the Environmental Education Association of Southern Africa (EEASA) and selected universities and private sector initiatives.

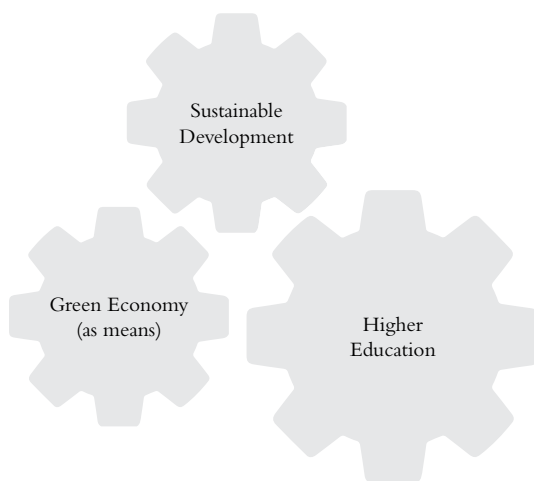
Introduction

Article 4(i) of the United Nations Framework Convention on Climate Change (UNFCCC) contains a promissory note by the Parties in terms of education, training and public awareness with regards to climate change (UNFCCC, 1992). Parties agreed that they would promote and cooperate in these aspects and encourage the widest participation in the process, including that of the involvement of non-governmental organisations. In fact, Article 6 is wholly dedicated to education, training and public awareness. Parties are reminded of their responsibilities to promote and facilitate such at the national and, as appropriate, sub-regional and regional levels. In accordance with national laws and regulations, and within their respective capacities, they should focus specifically on: the development and implementation of educational and public awareness programmes on climate change and its effects; public access to information on climate change and its effects; public participation in addressing climate change and its effects and developing adequate responses; and training of scientific, technical and managerial personnel.

Parties are also tasked to cooperate in and promote, at the international level, the development and exchange of educational and public awareness material on climate change and its effects; and the development and implementation of education and training programmes, including the strengthening of national institutions and the exchange or secondment of personnel to train experts in this field, in particular for developing countries.

Higher education (including further education) has a potentially critical role to play in green economy (including climate change) readiness globally. Higher education is viewed by many as an important knowledge generation and acquisition platform where skills can also be developed for the future we want. The world's higher education institutions have been involved in initiatives that include conservation education, environmental education, education for sustainable development and climate change education. If one is to portray a stronger relationship concerning higher education and the green economy, it will probably be represented as shown in Figure 1.

Figure 1. Higher education, green economy and sustainable development links



Source: Author.

Figure 1 indicates that higher education has a central role to play in both the emergence of green economy and sustainable development. This does not necessarily imply that green economy and the quest for sustainable development are dormant phenomena in this relationship as they too influence the manner in which higher education responds to the old and emerging challenges, driving changes in these institutions. Hence, it is inevitable that higher education 'gets ready' to engage the green economy agenda within the context of sustainable development, poverty eradication, equity and jobs creation. Jobs must not only be created but they must be sustained through the role of higher education in re-skilling and remaining on the cutting edge in terms of research and innovation that address issues at the heart of the green economy and sustainable development agendas. These are inclusive of, but not limited to climate change adaptation and mitigation as well as movement away from a world focused on resource intensive growth to

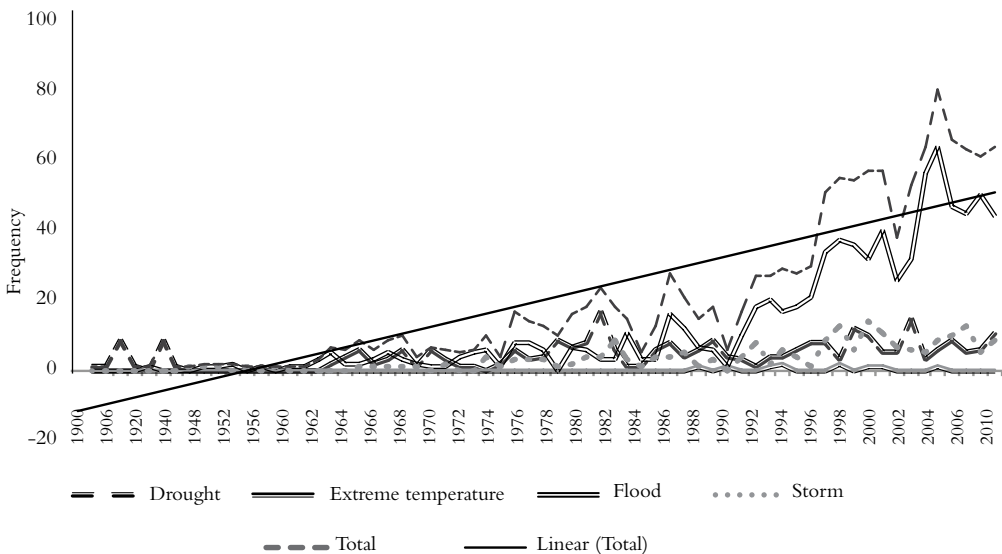
one that uses fewer resources. Hence, as the wheel of higher education turns in response to green economy transition and sustainable development phenomena, it triggers the wheels of green economy and sustainable development that will in turn signal continuous motion in the three wheels showing a contextually reflexive relationship between higher education and these development trajectories.

This paper is structured into four main sections. The first section looks at the central role of climate change in green economy transition. This is followed by a review of the emergence of the green global economy discourse, which is also often seen to be interchangeable with the green growth discourse. The third section narrows the focus to deliberations on green skills and green jobs, whilst section four presents emerging initiatives from African higher education and associated partners that feed into the central argument of the paper on higher education ‘readiness’ for green economy transitions and sustainable development.

Central Role of Climate Change in Green Economy

The United Nations Economic Commission for Africa (UNECA) (2012) advises that nations ought not to talk of transition to green economies without making reference to climate change – as this phenomenon is central to such debates. To get a better picture on Africa trends in relation to climate change induced natural disasters (that include droughts, floods, extreme temperature and storms), data were retrieved from a globally recognised source, the EM-DAT.¹ The findings are represented in Figure 2 and reveal that natural disaster trends in Africa are ever increasing.

Figure 2. African trends in selected natural disasters (1900–2011)

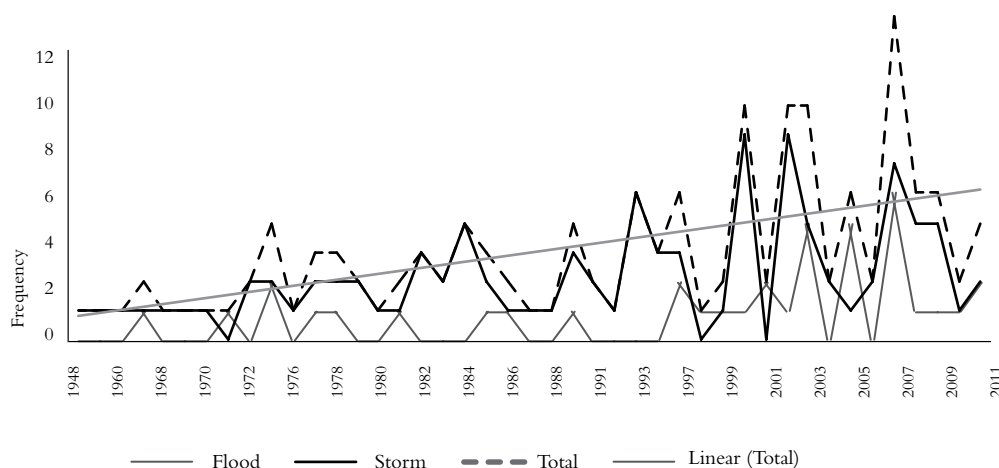


Source: Author (data from www.emdat.be – visited 6 April 2013).

The trend shows an increase in only one disaster recorded in 1900 to a peak of 80 disasters recorded in 2007. Other noticeable records of these disasters include 64 apiece for 2006 and 2011, 88 reported in 2008, 63 recorded in 2009 and 61 for 2010. Figures 2 and 3 reveal there has been a surge in floods. Floods by their nature are very destructive and can impact on livelihoods in a flash. Natural disasters are also increasing. Their recurrent periods are shortening and the intensity increasing. The damage caused by such is putting huge pressure on national budgets with many governments and organisations now taking the issue of disaster risk reduction (DRR) seriously.

To bring the disaster analysis closer to home, five countries known to be most vulnerable to floods and storms in southern Africa were sampled and data retrieved for further analysis. The countries included Madagascar, Mauritius, Mozambique, Reunion and Seychelles. The trend in floods and storms is presented in Figure 3. The picture shows that floods and storms are on the increase. Further analysis of loss of life shows that the year 2000 was the worst, with a total of 987 people dead. This is the year that Cyclone Eline struck the region, with Mozambique the hardest hit. Other years that recorded significant numbers of deaths include 1971 when 500 people lost their lives, 1977 with 313 reported deaths across the five countries, 1994 with 454 deaths recorded and 2004 with 395 deaths.

Figure 3. Floods and storms (Madagascar, Mauritius, Mozambique, Reunion and Seychelles)



Source: Author (data from www.emdat.be – visited 6 April 2013).

Emergence of a Green Global Economy

The history of the green economy can be traced from the need to address multiple global crises triggered by the financial crisis of 2008, but with increased insight into issues such as those reported above, and a suite of IPCC reports that were released before 2008 also shaping the

emphasis on green economy emergence. In response to the financial crisis of 2008, leaders then took a decision to have a comprehensive package that would stimulate growth and development addressing other crises that included among them, environmental degradation (especially climate change), energy and governance. Today, many definitions and conceptualisations have emerged regarding green economy.

Since 2008, global leaders have been promoting new sources of growth and according to the Organisation for Economic Co-operation and Development (OECD) (2012a), green growth is one of the many sources of new potential growth available. Green growth is viewed as addressing the twin challenges of poverty and environmental damage. To many developing countries, the main worry centres on potential trade barriers that green growth might present. Such barriers include aspects like aid for low-carbon development. Other challenges according to the OECD include questions like: will green growth efforts be impeded by high cost barriers and will green growth help address poverty and other development priorities? The OECD presents a green growth framework that could potentially be useful for higher education with regards to readiness (Box 1). Education and training is highlighted by the OECD as one of the six national green economy enabling conditions.

Box 1. Green growth framework

<p>National enabling conditions</p> <ul style="list-style-type: none"> • Shift government expenditure • More effective enforcement of legislation • Education and training • Resource and land rights regimes • Creating enabling conditions for psychological and behaviour change • Facilitating businesses to fully integrate sustainability and equity concerns <p>Mainstreaming mechanisms</p> <ul style="list-style-type: none"> • Public Environmental Expenditure Review • Strategic Environmental Assessment • Councils for Sustainable Development • Greening Accounting/Alternative Development Measures <p>Policy instruments</p> <ul style="list-style-type: none"> • Certification of Sustainable Production and Trade • Subsidy Reform • Payments for Ecosystem Services • Environmental Fiscal Reform • Green Energy Investment Frameworks and Incentives <p>Source: OECD (2012a:12)</p>

UNESCO paints a broad view of the green economy concept. Green economy societies, as stated by UNESCO (2012:1):

... embrace the principles of social inclusion and equity, solidarity, mutual respect, gender-equality, human rights and peaceful coexistence, within the limits and thresholds of the natural system, which are fundamental ingredients for poverty reduction and sustainable development.

In working with Brazil, the Caribbean, India and Mali, the Green Economy Coalition (2011a) discovered that the green economy concept was understood in as many ways as there were stakeholders. Earlier, the Green Economy Coalition (2010) had presented their case for a green economy. In their narrative, a green economy was necessary, among other aspects, because global economic security and human wellbeing depend on goods and services provided by Nature. However, economic behaviour was damaging the environment, and the traditional economic growth model had failed to bring equity to the majority of society. Given the forgone, it came as no surprise in the Green Economy Coalition (2011b) Rio+20 submission that the group called for radical changes in the manner the world conducted its business. The Green Economy Coalition further called for action by 2015 that would result in the production of green economy roadmaps founded on the fundamentals of sustainable development (including decent jobs and decent work policies), and delivery of overseas development aid (ODA) commitments. The Green Economy Coalition further called for the mainstreaming of ecosystems values into central banks, international financial institutions, national planning and corporate accounting by 2020 as well as achieving the United Nation's objective for sustainable energy by 2030. Linked to the Green Economy Coalition views, the United Nations summarised its findings on the green economy as presented in Box 2.

Box 2. United Nations' common understanding on green economy

- The green economy can be an innovative pathway to sustainable development.
- Infrastructure investments today offer a promising entry point for launching transformative and dynamic green growth strategies.
- A green economy must be people centred and invest in both human and social capital
- A green economy requires the reorienting of public policies supported by improved information systems for tracking and communicating progress.

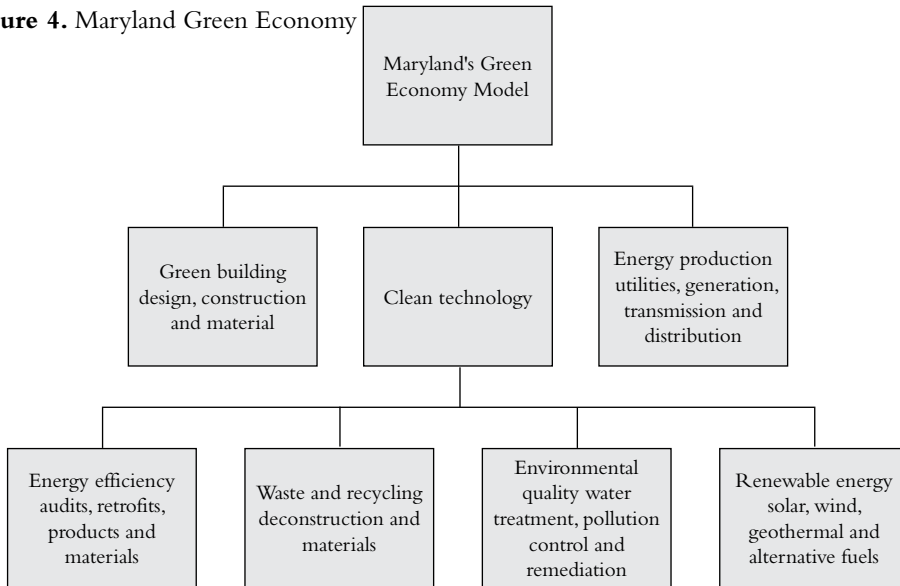
Source: United Nations (2011:171)

The African Development Bank (AfDB) (2012) identifies what they call 'low hanging fruits' projects in the area of green growth as those addressing access to renewable energy, energy efficiency, sustainable transport and sustainable cities. These are sub-sectors under the theme promoting sustainable infrastructure. Under the thematic area promoting sustainable natural resources management, it is recommended that governments focus on land (including agriculture, forests and other uses), water (including freshwater and marine) and mineral wealth. Building resilience of livelihoods under green growth considers climate change, economic and social aspects. All aspects raised herein challenge higher education to engage.

Barbier (2011:233), however, is not uncritical, and cautions that 'green growth will not ensure sustainable economic development as long as global ecosystem degradation and loss continues' unabated. This view is endorsed by Netzer and Althaus (2012:i) who believe 'the old way of doing business, based on finite fossil fuels and the exploitation of natural resources, is no longer possible'. In this regard, all countries must face the challenge of restructuring the dominant economic model so that it is ecologically more benign. Although biased towards mitigation, the Maryland's green economy model (see Figure 4 below) can assist in understanding the knowledge and skills that are needed for the green economy in as far as the mitigation agenda is concerned

(Figure 4).

Figure 4. Maryland Green Economy



Source: Governor's Workforce Board (2009:7).

In discussing green economy success, Deloitte (2012) presents what they call the Results Management Approach (RMA) to engaging green economy projects. The RMA focuses on four pillars namely: (1) developing a strategic vision (aimed at aligning green economy initiatives with broader strategy); (2) technical expertise (for projects and consistent problem solving platforms); (3) operational excellence (for clearly laid down project governance, processes and procedures) and (4) organisational alignment (to assist in adequate stakeholder engagement and buy-ins). These four pillars could be helpful for framing higher education's engagement with the green global economy (critically or otherwise).

From the Maryland Green Economy Model and other earlier deliberations in the paper, one can extrapolate the emerging areas that require general and specialised green jobs such as: developing green buildings, clean technology, energy production, energy efficiency, waste and recycling, environmental quality and renewable energy. African higher education should take note, flagging that most of the areas highlighted in the Maryland Green Economy Model are biased towards climate change mitigation as opposed to adaptation. In as much as the climate change mitigation agenda remains alive in Africa, the main worry is adaptation. What this points to is the need for African Higher Education Institutions to consider not only mitigation (especially in countries such as South Africa that are high emitters), but also adaptation, and that careful thought needs to go into conceptualising these two main responses to climate change and how they relate to green economy, development and university education.

Green Skills in the Green Economy

There are numerous processes emerging that are foregrounding the need for development of green skills for the green economy. Berkshire Publishing (2011) suggests the following for higher education:

As business leaders increasingly recognize the importance of sustainable development to their companies' futures, the greatest barrier they encounter is the shortage of a workforce with knowledge and training in sustainability. Higher education has a critical role to play by providing the programs and curriculum content that graduates need to help align the goals and actions of business with the values and practices of sustainability (www.berkshirepublishing.com).

UNESCO remains a key United Nations agency dealing with issues of education. In October 2011, an international consultation meeting on 'Transforming Technical Vocational Education and Training for Meeting the Challenges of the Green Economy' was organised in Bonn. The meeting deliberated on three main issues: policy and framework, curriculum and programmes and capacity development through networking (UNESCO, 2011). The key recommendation was that a formal guide document for greening Technical Vocational Education and Training (TVET) be developed with accompanying capacity building strategies.

In a position paper to Rio+20, the USA Partnership on the Decade of Education for Sustainable Development (DESD) maintained that education has the critical function of generating and supporting partnerships that are catalytic in nature in the context of the green economy. This is because education institutions are able to conduct research, be innovative, and share working models with industry leading to sustained green jobs. The same views are shared by the Bildungskoalition (2011) who suggest that further education training and green jobs qualifications are necessary for galvanising green jobs and addressing youth unemployment. It is said by these groups that higher education must provide scientific qualifications for academic related job opportunities in the green economy.

Utilising a system-wide approach, the United Nations (2011) proposes a conceptual framework for assessing progress towards a green economy which also provides insight into the scope of knowledge and skills required for the green economy. The conceptual framework puts indicators into three major thematic groups: green investments, jobs and sectors; decoupling impacts and resource efficiency; and aggregate indicators of progress and well-being. Decoupling impacts and resources has issues like materials and waste, energy, water, land use and ecosystem change. Indicators on progress and well-being include poverty alleviation, equity and social inclusiveness. Togo and Nhamo (2012) spoke to a need to have university graduates embedded in sustainability issues as a way of life. In Berkshire's view, the real challenge of this century is not to prepare graduates for the ever increasing numbers of green jobs but to prepare them for a labour market where each job will be green. In the realm of sustainability, the world cannot be just about solar panels, wind turbines, energy efficiency technologies etc. The world must change the way it runs its unsustainable pathways with businesses and government entities that embrace fully the relationship between the inter-related dimensions of sustainability highlighted earlier.

Examples of how this is to be done are beginning to emerge from around the world. For example a report on skills for a green economy in the UK (Department of Energy and Climate Change, 2011) identified four key sectors in which both generic and light green skills are necessary. The sectors include resource efficiency, low carbon industry, climate resilience, and natural assets. Earlier, Evans-Klock *et al.* (2009) noted that green jobs are found virtually across many sectors of the economy all of which have green skills demands.

In deliberating on the promotion of corporate social responsibility for a green economy and innovative jobs in the EU, Pop *et al.* (2011: 1020) notice that in order to sustain the green economy, education must contribute in developing the right type of abilities and competencies for greener “entrepreneurs, managers and employees”. In their view, skills aligned to the green economy come in two major categories: generic and specific. Specific skills are particularly needed and scarce. The green economy dictates that specific skills be pulled together in multidisciplinary teams of managers, engineers, planners, architects, economists, financial specialists, environmentalist etc. However, grounding in the sciences that include engineering, environmental and biological is a necessity in the emerging greener economy. In fact, all disciplines need some ‘greening’ to address key issues in the green economy such as climate change adaptation and mitigation. Carbon and energy auditing, for example, are becoming huge impact areas for climate change mitigation in a green economy. Unfortunately, not many institutions of higher and further education in Africa are offering specialisation in these fields. Skills gaps exist for green industries jobs like energy technicians, waste recycling specialists, wind turbine technicians, biofuels, carbon markets specialists, green economy strategist, solar technicians, smart grids technicians, cross sector adaptation specialists etc.

Addressing participants during the Sustainability Education Summit in Washington DC in 2010, the Under Secretary in the US Department of Education spend some time on how the several states were in the process of greening their curricula under the new green economy thinking (Kanter, 2010). The states involved were Ohio, New Jersey, Oregon, Georgia and Illinois. The states embarked on a 2 year programme to come up with prototype models that integrated green economy learning programmes of from secondary to university level study. Each state was working on a different and unique focus with Ohio specialising in biotech and agriculture, Oregon on wind, solar and sustainable building. Georgia focused on energy management, construction and transportation. The programmes combined rigour in academic and technical content. In terms of a career path, Table 1 highlights this.

Table 1. Green career pathway

Time of training	Green career path
Sixteen hours of training	Students can launch a new green career as a certified solar PV installer
2-year Associate of Applied Science degree	Students can upgrade their knowledge, skills and salary as an energy management technician
A four-year Bachelor of Science degree in renewable energy, for example	Opens up careers in energy design, management or international sustainable development, to name a few
Further along the pathway	Students may continue through graduate school to become a climate scientist

Source: Based on Kanter (2010:3)

Addressing the skills mismatch in the American economy in relation to the new demands of the green economy, particularly the clean energy sector, Gordon *et al.* (2011:44) maintains that 'Americans also need to commit to building a workforce with the basic technical literacy, and the specific technical skills, to excel at the myriad occupations that this economy will produce'. The authors encourage institutions of higher and further education to go 'beyond the traditional educational and workforce system toward a more flexible, more integrated, and more industry-focused training system'.

There are many other examples of studies that seek to explicate and outline the nature of the knowledge and skills that are needed for the green (see for example, Kanter, 2010; Cai *et al.*, 2011; Gomez, 2009; Evans-Klock *et al.*, 2009; Pop *et al.*, 2011) and to detail them all here will lead to repetition. Suffice to say that the new occupations that are emerging, are also creating need for a range of new learning pathways such as the one modelled above by the Kanter (2010:3) study. The key point emerging in this section is that if the green skills gaps are evident in a country that is believed to be efficient in its education system such as the USA, the challenge to countries of the south, including Africa could well be huge. Furthermore, given the adaptation focus outlined above, there is need for African education and training systems to give attention to the particular learning pathways that are most suited to the emergence of green economies in these countries.

Emerging Green Economy Education Interventions in Africa: Focus on Higher and Further Education

As discussed earlier, the green economy is beginning to open up a range of new challenges for education and training systems, including higher and further education. Some of the emerging initiatives from African higher and further education regarding green economy in the context of sustainable development and poverty eradication, green jobs and green skills are briefly reviewed below to show what progress is being made in this regard. The short review of initiatives shows the scope of educational engagement that is possible in educational institutions as the focus on green economy is taken up. It shows that green economy education is more than just skills training for specific jobs, but that it is a more holistic educational process that involves different types of educational institution activities and structural interventions. These are demonstrated via the short case examples that are included here. These can of course be further extended.

Policy development and policy contributions

One area in which higher and further education institutions can contribute to the green economy is via policy and strategy development for education and training. In March 2013, Unesco organised a well-attended experts meeting on Climate Change Education for Sustainable Development in Africa in Mauritius. The three day meeting was attended by over 100 climate change and sustainable development experts from across Africa who deliberated on issues pertaining to the meeting theme. What emerged from the meeting was that climate change education is now a key concern that should be addressed in the mix of general

education, and within green economy and sustainable development related education and training at all levels of the system. Box 3 contains 18 abridged key recommendations from the meeting.

Box 3. Key recommendations from the climate change education experts meeting

1. Use the concept of Education for Sustainable Development (ESD) as a common framework for climate change education (CCE).
2. Integrate CCE into teaching and learning at all levels and in all areas of education (formal, non-formal, informal) and throughout life.
3. Link the global and local perspective.
4. Address climate change adaptation but also mitigation through African education systems.
5. Take into account the complexity and interdisciplinary nature of CCE.
6. Consider the integration of values which support the ethical and spiritual appreciation of the environment as an integral part of CCE.
7. Learn from and respect different knowledge sources such as local and indigenous knowledge.
8. Encourage the development of pedagogies that support interactive participatory and future oriented learning for CCE.
9. Advocate for CCE in Africa in international mechanisms and processes.
10. Stress the importance of national policy support and policy development for CCE.
11. Include CCE competencies and skills into assessment frameworks.
12. Engage with youth in CC actions, discussions and peer to peer learning.
13. Develop group specific education and outreach programmes.
14. Integrate skills development for green jobs and employment in Technical and Vocational Education and Training (TVET) institutions and support sustainable livelihoods.
15. Develop, share, disseminate and up-scale good practices as a means to promote CCE regionally.
16. Develop indicators and monitoring tools and frameworks to measure the impact of CCE programmes, activities, and projects.
17. Promote the inclusion of CCE into international funding mechanisms.
18. Seek collaboration and partnerships for CCE.

Source: Based on UNESCO (2013:1-3).

To achieve the UNESCO recommendations from Mauritius, one is tempted to suggest that an array of short, medium and long term green learning pathways must be initiated in higher and further education settings across Africa, and in this sense the policy recommendations made at the UNESCO meeting can be further developed into curriculum development initiatives.

Curriculum development and development of specific degrees at postgraduate level

Another key area that is necessary for developing green economy education in higher education is development of curriculum, and especially new curricula for specialisation in new green economy areas. There are many such examples emerging in Africa, but for the purposes of this illustrative paper, an example here is drawn from the University of Nairobi in Kenya which now offers Master's and Doctoral degree programmes in Climate Change Adaptation. The programmes are offered in the Institute for Climate Change and Adaptation (ICCA). The ICCA has as its vision: 'To be the institution of choice for innovative climate change and adaptation research and training'. The ICCA focuses on five thematic areas addressing climate change and adaptation (www.icca.uonbi.ac.ke, visited 20 August 2013) namely: climate risk management and food security; human dimensions and health; policy and communication; technologies; and water, environment and ecosystems. The Master of Climate change Adaptation programme has a key objective of imparting trans-disciplinary knowledge to candidates on the issues related to climate change and adaptation. On the other hand, the doctoral programme focuses on specialised in-depth research in the specified focus areas of the ICCA with the hope of finding lasting solutions related to climate change and adaptation, especially in Africa. Some of TVET programmes in Kenya are also re-orienting to include a focus on green economy, showing also the influence of higher education on curriculum development at other levels of the system.

Campus interventions to offer demonstrations for green economy learning

Another area for green economy education development in higher education institutions (HEIs) and TVET institutions is campus management interventions that offer real life learning sites. The Africa Green Campus Initiative (AGCI) is one of the innovations that is facilitating green economy mainstreaming on campuses (Africa Green Campus Initiative, 2013). Case studies show how higher education institutions from a number of countries in Africa are engaged with the AGCI and how green economy issues such as energy and water management in these institutions are being taken up at campus level, offering strong demonstration sites for such learning.

Conference developments offering opportunities for peer review of knowledge

Conferences also provide a means for developing higher education knowledge as academics produce their research for peer review and feedback. In the southern African context, the 31st Environmental Education Association of Southern Africa (EEASA) Annual conference that took place in Lilongwe, Malawi was dedicated to the theme 'Green Economy: Insights and Perspectives for Environmental Education in Southern Africa' (EEASA, 2013). The call for abstracts and papers identified nine sub-themes, among them: mainstreaming green economy in southern African Education institutions; Role of education and technology in developing green economy skills, government policies and green economy, green economy and low carbon emission development strategy, workplace based learning and the role of industry in green economy, green economy communities of practice and innovations, green economy: what does the future hold for Southern Africa?, the role of labour movements in green economy, and green economy: towards wealth creation and poverty alleviation in Southern Africa. This shows some of the scope for green economy knowledge production out of higher education institutions.

Research and knowledge development

Exxaro Resources Ltd (through its Chairman's Fund) is sponsoring four university research chairs at the University of South Africa (Unisa), University of Pretoria and University of the Witwatersrand. The Exxaro Chair in Business and Climate Change at Unisa is the oldest having been established in 2008. The Chair is involved in academic research in the fields of business and climate change, green economy transition, green jobs and international climate policy (Nhamo, 2012). At the University of Pretoria Exxaro Resources Ltd sponsors two Chairs namely: Energy Efficiency and Business and Biodiversity Leadership (Exxaro Resources Ltd, 2012). The last chair at the University of Witwatersrand focuses on Global Change and Sustainability. At the University of Cape Town, there is the African Climate and Development Initiative (ACDI) (University of Cape Town, 2012). In addition, the Energy Research Centre at the University hosts the Southern African Journal on Renewable Energy that has been in existence for many years. The ACDI offers a multidisciplinary year long masters in Climate and Development. The masters comprise four core modules focusing on (1) Earth System Science, (2) Development and Climate Change Economics, (3) Climate Impacts and Adaptation, and (4) Energy and Climate Change. In addition, there is a three months long mini research project and three optional modules. The optional modules are drawn from the following areas: International Climate Law, Sustainable Urban Systems, Climate Variability and Prediction, and Climate change and Biotechnology (University of Cape Town, 2012). The Energy Research Centre staff members have been instrumental in modelling during the development of South Africa's Long Term Mitigation Scenarios and are still active today (Ibid). Through the chairs and initiatives highlighted, the green economy agenda in higher education is becoming more and more visible. There are many other similar programmes and initiatives which have recently been reviewed by SARUA (2014, www.sarua.org) which show an encouraging trend reflecting responsiveness to green economy and climate change from within all of the southern African universities reviewed.

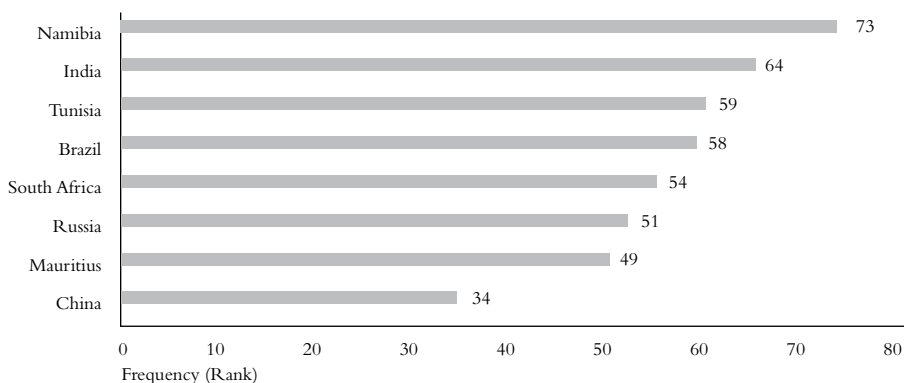
Whole institution development

Another means of engaging with green economy education and training development is strategies to strengthen whole institution development. To network into the growing green economy and sustainability agenda, Unisa approved on 22 January 2013 a proposal for the Green Economy and Sustainability Engagement Model (GESEM) (Nhamo, 2013). The GESEM responded directly to many *ad hoc* initiatives that were taking place within Unisa both from the administrative and academic perspectives aimed at addressing issues pertaining to the green economy, sustainable development, poverty eradication and jobs creation. The GESEM is championed by the Principle and Vice Chancellor's Office, the Vice Principal: Advisory and Assurance Services. The GESEM draws directly from existing and proposed initiative and thematic focus areas that include among them: Green Economy and Sustainability Policy Development and Incubations; Energy and Carbon Management; Waste, Pollution, Water and Biodiversity; Reporting and External Liaison; Records, Procedures and Awareness; as well as Complementary Initiatives.

Research system development

Closely related to and important for enabling knowledge production in higher education for a green economy is research system development. Behind every technological innovation (both successful and/or failure) there is a lot of work invested in research and development. By way of example, it is possible to see how a country, South Africa is used as case here, can intentionally drive green economy research via a system of interconnected research institutions that work closely with universities and also feed knowledge into TVET systems. The country finances a number of higher education related research councils and institutes enacted through acts of parliaments including: the Council for Scientific and Industrial Research (CSIR), Africa Institute of South Africa (AISA), Medical Research Council (MRC), Human Sciences Research Council (HSRC), National Research Foundation (NRF), The Agricultural Research Council (ARC), Water Research Commission (WRC), and South Africa Institute of International Affairs (SAIIA). A number of these are developing green economy and global change research programmes. It comes as no surprise that South Africa is ranked highly on the continent (coming in second place) after Mauritius in terms of innovation development (although not all of this is oriented towards the green economy). The country compares favourably with its emerging economies trading block partners of Brazil, Russia, India and China commonly abbreviated BRICS (Figure 5). Readers must note that in Figure 5, the lower the figure the higher the rank. A total of 141 countries were involved in the ranking.

Figure 5. Global Innovation Index 2012 ranks



Source: Author (data from Dura, 2012: xvii-xix).

Conclusion

This paper has reviewed the emergence of the green economy, scoping some of the key concepts associated with it. It further looked at some of the emerging developments internationally as educational institutions are called upon to re-orient towards a green economy and low carbon development in response to climate change. In Africa, there is a need to focus on adaptation. The paper indicated some of the scope and dynamics of the challenges that are being posed to higher and further education in response to the emergence of the green economy.

The paper then went on to review selected examples of practice from the African continent that are showing the dynamics and dimensions of educational re-orientation and green economy uptake, showing that within the educational system there are a range of ways of responding to and developing education and training for the green economy, that reaches beyond a simplistic view of training people for jobs only.

The paper was interested in scoping 'readiness' of institutions in Africa for responding to the emerging green economy. While only selective, the examples used reveal that there are policy and practice developments emerging in response to climate change and the green economy. However, there is still much room for further development of these, and of course these types of interventions would need to be present in all institutions across the continent, not only in some institutions only.

The 2013 UNESCO meeting that took place in Mauritius confirmed that one of the key ingredients to green economy transition, climate change education was still in its infancy in Africa. The National Environmental Skills Summit held in South Africa in 2012 declaration further confirms that more needs to be done to engage higher education in South Africa with green economy concerns. Insights from the USA further cement the view that skills needed to satisfy the green economy are still in short supply. Specifically, specialised green economy skills will take time to develop. The paper scoped a range of economic sectors that require specialist green economy skills like renewable energy and energy efficiency, natural resources management, waste management, green transportation and urban infrastructure programmes. Overall, green economy skills are demanded across each and every sector of the economy.

Institutions of higher and further education are therefore challenged to review existing practices (such as the few case examples alluded to above) and to expand these into more systemic efforts to remain relevant in an ever changing skills and jobs environment.

Overall, technical and vocational skills remain key in the green economy and this may also demand a revision of university programmes within a framework of green economy learning pathways as outlined in the example from the USA above in which technical and vocational training can be expanded into areas of ongoing specialisation and lifelong learning in higher education.

In sum, to support a holistic higher education system for a greener future, governments and other institutions tasked with developing policy must do so in order to prepare stakeholders that include both business and labour for the new global challenge, and that do so within a whole institution and whole system approach to educational development.

Note on the Contributor

Professor Godwell Nhamo is a Chief Researcher and Chair for the Exxaro Chair in Business and Climate Change hosted by the Institute for Corporate Citizenship at Unisa. Some of Professor Nhamo's research work has been in the broader environmental policy field. Professor Nhamo has published a number of papers addressing various policy perspectives on the Kyoto Protocol and the green global economy. Email: nhamog@unisa.ac.za.

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Endnotes

1. Known as the International Disaster Database and is maintained by the Centre for Research on the Epidemiology of Disasters (CRED) at the School of Public Health of the Université catholique de Louvain located in Brussels, Belgium.

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