Universities facing Climate Change and Sustainability

Edited by Tristan McCowan, Walter Leal Filho, and Luciana Brandli

GUC Hamburg

Global University Leaders
Council Hamburg **2021**

The Global University Leaders Council Hamburg (GUC Hamburg) is an initiative of the German Rectors' Conference, Körber-Stiftung and Universität Hamburg. It is the aim of the Council to initiate a dialogue among university leaders about the current key challenges that national higher education systems around the globe are confronted with. The process of globalization has led to a situation in which higher education systems worldwide are facing a number of similar challenges. These range from threats to university autonomy and academic freedom to conflicting theories of the university and education, and from questions of access to higher education to the financing of university teaching and research.

The co-organizers understand the GUC Hamburg as a forum for discussions on the core mission of the university in a globalized higher education landscape.

The study »Universities facing Climate Change and Sustainability« was commissioned by Körber-Stiftung in preparation for the 2021 Global University Leaders Council Hamburg.

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Initiators

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German Rectors' Conference

The German Rectors' Conference (HRK) is the association of universities in Germany. The HRK is an independent organisation, representing all types of higher education institutions. More than 92 percent of all students in Germany are enrolled at its member universities. Hence, the HRK is the political and public voice of the universities and the forum for the universities' joint opinion-forming process. The HRK helps to set the political agenda and lead public discussion on all issues relating to the universities. In this context, the HRK represents the universities' positions in Germany and Europe as well as on the international stage. Furthermore, the HRK supports its member institutions and provides them with a platform for exchange among each other.

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Social development needs dialogue and understanding. Through its operational projects, in its networks and in conjunction with cooperation partners, Körber-Stiftung takes on current social challenges in areas of activities comprising Innovation, International Dialogue and Vibrant Civil Society. Inaugurated in 1959 by the entrepreneur Kurt A. Körber, the foundation is now actively involved in its own national and international projects and events. In particular, the foundation feels a special bond to the city of Hamburg. Furthermore, the foundation holds a site in the capital of Germany, Berlin.

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Universität Hamburg

Designated a University of Excellence by the German Federal and State Governments in 2019, Universität Hamburg is one of the strongest research universities in Germany. As a flagship university in the greater Hamburg region, it fosters innovative, cooperative contacts with partners inside and outside academia. It also provides and promotes sustainable education, knowledge, and knowledge-exchange locally, nationally, and internationally. The University boasts numerous interdisciplinary research projects covering the full spectrum of disciplines in the humanities, law, economics, business administration, social sciences and the natural and life sciences. We combine excellent research and academic breadth in teaching and currently offer 170 undergraduate and graduate degree programmes, including teacher training and medicine. Additionally, we maintain an extensive partner network of leading regional, national, and international higher education and research institutions. As part of the Excellence Strategy of the Federal and State Governments, Universität Hamburg has been granted Clusters of Excellence for 4 core research areas: CUI: Advanced Imaging of Matter (photon and nanosciences); Climate, Climatic Change, and Society (CLICCS) (climate research); Understanding Written Artefacts (manuscript research); and Quantum Universe (mathematics, particle physics, astrophysics, and cosmology).

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Preface

We are all called upon to promote sustainable development and take action to address the climate crisis. Along with other societal institutions, universities across the world have the potential to play a key role in addressing two of the major challenges of our times. Providing higher education and research, they make a significant contribution to both climate protection and a sustainable future.

And yet, there is still room for improvement. It is safe to say that in many cases, universities have not yet reached their full potential impact. The lack of a coherent institutional vision or strategy, or the distraction of competing priorities and structural and financial constraints might preclude universities from focusing on climate protection and sustainable development. However, at the same time, a steadily growing number of universities across the globe are playing a leading role in the fight for a sustainable world and against climate change. Now is the time to make the contributions of universities more visible in order to inspire others, share our experience and show what is needed to overcome hurdles. This process will hopefully lead to the creation of incentives, structures, and networks that will help universities to further realise their potential. This scientific study and the Hamburg Council for which it was written aim to contribute to this goal.

The Global University Leaders Council Hamburg is a joint initiative of the German Rectors' Conference, Körber-Stiftung, and Universität Hamburg. In preparation for the 2021 Hamburg Council, Körber-Stiftung asked Professor Tristan McCowan of the Institute of Education at University College London to analyse and compare engagement in sustainability and climate action in various higher education systems around the world. McCowan and his team focus on the role universities define for themselves as well as on their actual practices in teaching, research, and innovation. In addition, they pay special attention to the challenges encountered by universities and to the role university leaders play throughout the entire process. The study looks in detail at the situation in Brazil, Germany, India, Japan, South Africa, the United Kingdom, and the United States of America. It also presents cross-national lessons learned as well as recommendations for future action.

Tristan McCowan's insightful study will provide the participants of the Global University Leaders Council Hamburg with a solid base for their strategic discussions. In June 2021, around 50 university leaders from around the world will gather in a virtual forum to formulate recommendations for the future engagement of universities in sustainability initiatives and climate action.

We would like to take this opportunity to thank Tristan McCowan, Walter Leal Filho, Luciana Brandli, and their fellow contributors for their truly excellent work. It is our firm belief that the study at hand will make an impact that will reach beyond the specific event for which it was commissioned. The 2021 Global University Leaders Council Hamburg will benefit from this volume as will future readers.

Professor Dr Peter-André Alt	Tatjana König	Professor Dr Dr h.c. Dieter Lenzen
President	Member of the Executive Board	President
German Rectors' Conference	Körber-Stiftung	Universität Hamburg

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Executive Summary

Understanding higher education and sustainability across contexts

Humanity is currently facing a critical challenge in its relationship with the natural world. Overuse of the earth's resources, emissions of greenhouse gases and other forms of pollution and loss of biodiversity are presenting significant threats to survival and quality of life, and will worsen quickly if action is not taken. Universities represent key actors in this regard. Through research and innovation, through the education of increasingly large segments of the global population and through public engagement, they are essential to societies' successful navigation of the challenges and play a key role in the search for solutions. However, the potential of higher education is not always realised. While there are numerous examples of positive contributions, universities can at times be hindered by competing priorities, poor coordination and lack of resources, amongst other factors.

This report explores the ways in which universities can overcome these obstacles and fulfil their transformative role in ensuring sustainable development. It draws together existing research along with new analyses in seven countries – Brazil, Germany, India, Japan, South Africa, UK and USA. For each country, two cases of universities were selected, representing a range of types of institution, but all engaging in different ways with the challenges of climate change and sustainability. Semi-structured interviews were carried out with senior leaders at each of these universities, along with an analysis of secondary literature, policy documents and existing datasets at the national level. The analysis covers a range of areas in which universities relate to climate change and sustainability, including curriculum, research, community engagement and campus operations, assesses the influences provided by national political context, regulatory frameworks and the financial requirements of institutions, and identifies needs for research and evidence-gathering.

The report provides examples of generative practice in relation to sustainability in higher education, as well as assessing the challenges and difficulties experienced by institutions in engaging with this task. In particular, it focuses on the change that can be brought at institutional level, through leadership in different parts of the university and the ways that staff and students can work together to fulfil the mission of sustainability.

Climate change and sustainability: concepts, evidence and global frameworks

Climate change, due to increased carbon emissions worldwide, is the greatest challenge facing sustainability efforts. It affects economic systems, increases social inequalities and causes severe environmental impacts. Sustainability represents an opportunity to ensure that both present and future generations meet their needs. This chapter explores the interconnections between these concepts, as well as presenting climate change impacts and responses.

The chapter also showcases global frameworks for climate change action and sustainability and outlines the relationship between climate change scepticism and the role of education. The successive reports of the Intergovernmental Panel on Climate Change (IPCC) have provided the scientific basis for understanding and addressing the climate crisis. The principal ways of addressing climate change are mitigation – involving amongst other things the use of renewable energy, energy efficiency, carbon trading and geo-engineering – and adaptation to the impacts already underway, including structural improvements, disaster risk management and the relocation of vulnerable populations. The UN's Agenda 2030 and the 17 Sustainable Development Goals (SDGs) have provided a global framework for working towards sustainability. Education, through formal institutions and public awareness raising, is essential to both mitigation and adaptation efforts, and to sustainable development as a whole.

The role and impact of the university

Due to their missions and strategic societal role, universities have a crucial role to play in climate action and sustainable development, both regionally and internationally. However, many universities have so far largely focused on compartmentalised rather

than holistic approaches. In addition, through their carbon emissions and other impacts, universities can be part of the problem as well as part of the solution. Institutions successfully promoting sustainable development have purposeful leadership and governance systems in place, catering for a meaningful engagement and offering a fertile ground for the design, testing and deployment of innovative practices. However, the promotion of sustainability-related approaches is not always easy for institutional leaders, as they may compete with other institutional goals (such as increasing student numbers).

The literature on sustainable development in higher education shows the complexity of barriers and drivers, but does not provide a full overview of how the barriers can be overcome, or how the drivers can be used in different contexts (e.g. social and political, or at local, regional and country level) while recognising organisational characteristics (e.g. universities' sizes, types, focus, locations). In addition, there are a number of initiatives and tools that may help evaluate and measure progress towards sustainable development implementation in higher education, which ought to be more widely used. Whereas there is no single international standard to holistically and systematically measure and evaluate the implementation of sustainable development in universities, there are some initiatives which look at the whole spectrum of sustainable development issues and provide useful insights into the complex nature of sustainable development in higher education. The choice of tools ultimately depends on the characteristics, focus and ambition of each institution, its stakeholders and its leaders.

Country cases

The chapters that follow assess the role of higher education in relation to sustainability and climate change in seven countries. In each case, the analysis and conclusions relate primarily to the two universities chosen for in-depth exploration, but some broader implications are drawn out for the whole of the higher education systems in question.

Brazil

In Brazil, the cases illustrate two different contexts – a large public university (University of São Paulo), with a long history and years of experience in sustainability practice, and a smaller and younger community university (University of Southern Santa Catarina), with important efforts related to sustainability as well. Both universities report challenges related to communicating sustainability and climate action efforts, as internal and external communication can help ensure that the academic and local communities are not only aware of these efforts, but are also willing to engage in them. Although the two universities have different leadership structures – with dedicated offices for sustainability and climate change or shared efforts throughout the organisation – it is noted in both that sustainability and climate change activities should be developed in collaboration with the academic community. These cases are examples of a specific group of Brazilian universities, with reasonable resources and with governance systems that support climate action and sustainability. Different contexts may have different challenges, but the presented cases serve as examples for other university leaders who are deploying their institutional efforts around sustainable development.

Germany

Significant efforts have been made at German organisations as a whole, and by the higher education sector in particular, to pursue sustainability and implement climate action. At the federal level, six of the 16 Federal states have introduced sustainability issues in their university development plans. Efforts to pursue sustainable development in German universities are often intimately associated with measures to address climate change. An example is the many actions that have been undertaken in the field of energy – especially in renewable energy production – aimed at reducing CO_2 emissions, which are complemented by measures such as the promotion of travel by public transport, and fiscal incentives to encourage electric mobility. But the various attempts to include sustainability and climate action in universities' policies and charters, and to reach full-scale application in teaching and research, are hindered by several problems. For instance, there are difficulties in integrating sustainability into the university curricula, and

to achieve the full involvement of teaching staff. In addition, resources to support sustainability teaching are often limited, and activities are often undertaken on an ad hoc basis. Encouragingly, students at many German universities are aware of the value of and the need for fostering sustainable development, and act as catalysts, as shown by the two universities included as case studies (Freie Universität Berlin and Eberswalde University for Sustainable Development).

India

India has a large and complex higher education system, with a small number of elite national institutions. Legislation at the national level has led to institutions incorporating environmental education into their curricula, and has encouraged them to move towards carbon neutrality. A number of climate change research centres have also been established in recent years. Nevertheless, many institutions struggle to incorporate the principles of sustainability in a meaningful way in their practice.

This chapter focuses on two cases, the Indian Institute of Technology, Gandhinagar, a small public institution in Gujarat, and Pondicherry University, a public central university with multiple campuses. Whilst situated in different contexts, both universities have made extensive efforts through a dedicated Green Office to transform their campuses to ensure sustainable design, efficient energy and water usage, reduction of pollution and protection of wildlife and ecosystems. Obstacles have been faced in the form of national regulations and local topography, and gender equality remains elusive. Nevertheless, with the benefit of public support, these institutions are trailblazers in showing the extent to which sustainability can be incorporated into all aspects of institutions, from campus operations to curriculum, research and community engagement.

Japan

Japanese universities have been making significant efforts to face the challenges of sustainability and climate change. Cases of one national research university (Tohoku University) and one private university (Ritsumeikan University) indicate two basic models of promoting the SDGs and climate action. The private university uses integrated leadership to take a whole-institution approach to promoting the SDGs. In contrast, promoting the SDGs in the national university is fragmented rather than comprehensive or collective. Moreover, the private university takes part more actively in networks at local and global level to promote the SDGs and climate change. These two case studies also unveil challenges that hinder the implementation of sustainable development in higher education in Japan. The independence of each department becomes a barrier for internal collaboration across disciplines and between faculty members and students. Furthermore, disconnectedness between research, education, campus operations and community service discourages stakeholders from jointly creating an integrated platform for promoting the SDGs and climate change in universities. In addition, it is necessary to foster a more integrated understanding and social atmosphere in Japanese society to achieve full social engagement for universities to contribute to sustainable development.

South Africa

The assessment for South Africa illustrates how the selected universities are responding to the expectation that higher education needs to assume leadership in matters pertaining to climate change and sustainability. Given the unique contexts in which the two selected universities operate, several differences in approach and focus are evident. The case of Stellenbosch University presents the context of a "research-intensive" residential university with relatively low student numbers and strategic initiatives to enable and support research and academic excellence. The aim is not to supply educational opportunities across the board, but to develop its capabilities and capacity to be positioned as world-leader in climate change and sustainability. The case of the University of South Africa (Unisa) presents the context of a university focused on open, distance and e-learning and providing educational opportunities for nearly one third of the country's higher education students. This nationwide footprint facilitates a huge impact on climate change and sustainability awareness and skills through teaching and learning, but restricts the capacity of staff to do research. The Unisa context illustrates the value of a well-developed strategic focus and policy regime for the advancement of

sustainability, especially for a large institution.

United Kingdom

Universities in the UK are addressing matters related to climate change and contributing to sustainability through their activities and in collaboration with their stakeholder networks. This is reflected and highlighted by university rankings and awards. However, there is wide variation in the extent of universities' climate action and sustainability activities.

For example, Nottingham Trent University (NTU) and the University of Edinburgh are both large institutions with a history of work in the area of sustainable development. Although they have different characteristics, they have similar approaches to embedding sustainability and climate action in their activities. These include policy development, implementation and reporting through stakeholder engagement and dedicated expert teams. Both also have some unique characteristics. The University of Edinburgh has a marked emphasis on social responsibility and ethical investments. However, NTU has worked systematically to integrate education for sustainable development in the curriculum.

The UK chapter also suggests that some of the key aspects that help universities to advance the sustainability and climate action agenda are to link policy and practice through interdisciplinary stakeholder engagement for communities; planning, achieving objectives and creating impact; a culture of continuous improvement; and strategically integrating social, environmental and economic aspects. Finally, some UK universities are using the potential of research to advance their sustainability agendas.

USA

The intersection of sustainability and higher education in the United States has deep roots dating back to the 1972 United Nations Conference on the Human Environment which issued the Stockholm Declaration. With the evolution of the field came a recognition that higher education institutions were both contributing to the problem and well-positioned to develop solutions, and thus a model that called for academic mission and operational alignment to advance sustainable development took root.

This chapter features two case examples featuring Middlebury College and Arizona State University (ASU) which provide insight into how two very different higher education institutions can develop and implement a comprehensive commitment to sustainability. Middlebury and ASU are examples of campuses that have embraced the need to train disciplinary and trans-disciplinary specialists recognising that all learners require exposure to the complexity and multi-disciplinary nature of today's global challenges. Independent of one another, both Middlebury and ASU created systems and mechanisms that led to the restructuring of disciplinary silos in order to enable and incentivise transdisciplinary teaching, research and learning. Leaders in both universities have recognised that the complexity of the global challenges we face today cannot be understood or solved by one discipline acting alone.

Overcoming obstacles to sustainability: lessons from the seven countries

Through the juxtaposition of the seven country analyses, five key elements emerged:

Leadership: all examples of successful practice in sustainability in higher education have leadership as a key element. However, it may not always express itself as visible charismatic leadership, but in more distributed ways. Given the nature of universities, the emphasis must be on nurturing bottom-up innovation and ensuring coherence across existing work, rather than imposing top-down initiatives. Three key elements are identified: presenting a vision, fostering alignment and synergy, and nurturing innovation.

Governance: while the *ad hoc* activities of staff and students may make positive contributions to sustainability, a coordinated approach and strategic planning in institutions are central to enhancing impact and ensuring continuity of activity. Central principles include student involvement, staff mobilisation, performance management, and network and relationship management.

Finance: sustainability initiatives and climate action are only possible with the necessary financial and human resources. In the context of budget squeezes,

competing priorities and rising student enrolments, these resources are hard to come by, particularly in the context of reductions in public contributions. While state funding is the most reliable way of supporting sustainability initiatives, if this cannot be achieved, there are a number of alternative ways in which institutions can generate revenue, through third stream activities, partnerships and alumni donations.

Frameworks and networks: the analyses suggest that international frameworks – in particular Agenda 2030 and the SDGs – are extensively used by universities and are instrumental in aligning work across the diverse functions of institutions. There are also a number of national and international networks that are invaluable for institutions in sharing practice, providing support and in cross-cultural learning.

Institutional diversity: there are significant differences in the institutions included in this analysis, relating to age, size, public/private, mission type and disciplinary focus. All of these different forms of institution can and must make a contribution to sustainability and climate action. However, these differences must be taken into account in designing institutional plans, avoiding a 'one size fits all' approach. Higher education sectors can best contribute if there is a diversity of institutions, with horizontal differentiation rather than vertical stratification.

While this analysis has highlighted the commonalities between contexts, there nevertheless remain significant differences in the broader political, economic and cultural contexts, and in the traditions and current practices of universities. Sustainability initiatives must necessarily adapt and be sensitive to these diverse contexts.

Conclusion

Universities across and beyond the seven countries included in this report are making extraordinary contributions to societal efforts to address the climate crisis and ensure sustainable development. However, they encounter constraints at three levels: at the global level, through the debilitating effects of marketisation and international rankings on public good orientations; at the national level, through regulations and

frameworks; and at the institutional level, through siloed working and in some cases resistance and entrenched conservativism.

Based on the analysed literature, the analysis of trends and the experiences from the case studies, the following recommendations are put forward to help overcome these obstacles:

1. Ensure a diverse system of higher education, with differentiated institutions able to contribute in distinct ways to the challenges of sustainability and climate change
2. Establish specialist sustainability-focused higher education institutions in countries where they do not exist
3. Protect public funding alongside creative diversification of sources of income and earmarking specific funding for sustainability work
4. Promote interdisciplinary research and teaching (while maintaining specialised disciplinary work), and incorporate aspects of sustainable development and climate change in arts, humanities and social sciences as well as natural sciences
5. Participate in and raise the prominence of green rankings, as a counterpoint to traditional international university rankings
6. Ensure that all students, regardless of their disciplinary area, emerge from their university studies literate in environmental challenges
7. Involve students fully as active participants in sustainability initiatives within and beyond the university
8. Create an institutional plan for carbon emission reductions and ultimately carbon neutrality (and where relevant divestment from fossil fuels)
9. Provide opportunities and incentives for academic staff to develop their own sustainability initiatives, and make available opportunities for professional development
10. Build stronger ties with local communities to support processes of climate change adaptation
11. Ensure coherence and synergies between sustainability action, and those of other global crises and challenges, including pandemics
12. Promote further research on the role of universities in climate change and sustainability,

including underrepresented themes, countries and contexts.

Building on the contributions of this report, further research and evidence generation are needed to support the process of transforming institutions and systems. The quantity of academic research on sustainability in higher education is increasing, but focuses mainly on campus operations and to a lesser extent on curriculum: more research is needed to understand areas of research coordination, service delivery and public engagement, as well as the interrelationships, synergies and trade-offs between these areas.

Section I:

The Challenge Posed

Chapter 1:
Introduction: Understanding higher education and sustainability across contexts

Tristan McCowan

While scientific evidence about the dangers of increasing planetary temperatures has been mounting for some decades, global leaders, governments and businesses have been slow to act. The Intergovernmental Panel on Climate Change (IPCC, 2018) has recommended that in order to avoid a rise of 2°C from pre-industrial levels, the world will need to move entirely to renewable energy by 2050, and reduce fossil fuel use by 45% by 2030. What is more, there are a series of other environmental hazards beyond climate change, including depletion of terrestrial and marine life, plastic waste entering the food stream, air pollution and deforestation. While there are a number of encouraging initiatives in renewable energy, reduction of waste and sustainable agriculture, amongst other areas, the causes of climate change in fossil fuel use and excessive consumption in high-income countries have not been adequately addressed (Berners-Lee, 2019; Klein, 2014).

Universities have a crucial role to play in this challenge (Cortese, 2003; Leal Filho et al., 2018; Wals and Blewitt, 2010). They are the location of much of the science that identifies the patterns in the changing climate, its causes and possible solutions. Yet the role of the university goes far beyond climate science, given the roots of the challenge in individual attitudes and behaviours, as well as political, economic and cultural structures. More than a third of the global population now goes on to some form of tertiary education, and in high-income countries the figure reaches three quarters (UNESCO Institute for Statistics, 2019). Higher education, therefore, has developed a crucial role in educating the citizenry, meaning that climate change should not only be part of environmental science courses, but taken into account in all areas, from arts and humanities to natural sciences. Furthermore, there is the third pillar of the university, its public service and community

engagement work, with a crucial role to play in adapting knowledge to local contexts, and applying scholarship for fostering sustainable development.

Many universities are already facing these challenges head on. Groupings such as the Association of University Leaders for a Sustainable Future (emerging from the Talloires Declaration), the Association for the Advancement of Sustainability in Higher Education, United Nations Academic Impact, the Higher Education Sustainability Initiative and the Inter-University Sustainable Development Research Programme, bring together universities around the world to foster sustainability. This work has been given impetus by the establishment of the Sustainable Development Goals (SDGs) by the United Nations in 2015, and the creation of a range of frameworks and global initiatives promoting them (SDSN Australia/Pacific, 2017; Sachs et al., 2019). Initiatives on sustainable development in higher education have been enabled by the more general opening of the university to society in recent years, and increasing rejections of 'ivory tower' isolation of the academy, with greater commitment to place and the non-academic impact of research (Birch, Perry and Taylor, 2013; Chubb and Watermeyer, 2017; Goddard et al., 2016; Maassen et al., 2019).

There are, therefore, many universities making significant efforts in relation to sustainability – both in terms of adapting their own operations and campuses, and engaging with external communities (Leal Filho, Tortato and Frankenberger, 2020; Liu and Kitamura, 2019; Purcell, Henriksen and Spengler, 2019). Yet higher education systems as a whole have only partially transformed, and are still part of the problem as well the solution. Shields (2019), for example, has documented the significant contribution to carbon emissions made by international student mobility in higher education. Some argue (e.g. Lotz-Sisitka et al., 2015; Kolenick, 2016; Piasentin and Roberts, 2018) that universities are still caught up in the knowledge paradigm of accumulation and exploitation of nature that has caused the environmental crisis in the first place. In addition, in some universities around the world there is still scepticism about climate change, preventing universities from taking concerted action (Leal Filho et al., 2019).

University leaders, therefore, have a challenging role in combating these forces, and aligning their institutions with sustainable development. Furthermore, these institutions exist in a global space in which there are dominant trends that in many ways act against sustainability. Examples include status competition (the dominance of international rankings that privilege academic excellence over inclusion and community engagement), marketisation (undermining equity and research in the public interest) and unbundling (leading to the fragmentation of higher education institutions and systems) (Marginson, 2011; McCowan, 2019). As they seek economies of scale and greater status, many universities are also growing in physical size and expanding the range of activities they undertake, presenting intensified challenges for sustainability and reducing carbon footprints (Cantwell, Marginson and Smolentseva, 2018). Demand for higher education has also led to a rapid growth of for-profit providers, which operate on a strict income-generation model and lack resources and incentives for investing in public good outcomes such as sustainability.

The COVID-19 pandemic has shown both the centrality of the university and its fragility, providing important lessons for understandings of its role in addressing sustainability and climate change. On the one hand, universities and their researchers have been at the forefront of documenting the pandemic (particularly open datasets maintained by Johns Hopkins University), developing vaccines and treatments, and enhancing public awareness of how to slow the spread of the virus. On the other hand, the disruption that the pandemic has caused to face-to-face classes and student mobility, as well as impacts on national economies, has led to squeezes on public and private sources of income that may lead to a financial crisis for the sector, particularly in countries dependent on revenue from international students. Understanding the role of universities in addressing sustainability and climate change requires acknowledging not only the sector's positive intentions and actions in this area, but also its constraints and vulnerabilities.

There is also significant need for research and evidence-building. There is a growing body of literature on sustainability in universities (e.g. Brandli et al.,

2015; Davison et al., 2014; Hensley, 2017; Leal Filho, 2010, 2017), and an academic journal has been established to cover this area (the *International Journal of Sustainability in Higher Education*). As regards teaching and learning, there is much general writing on education for sustainable development, although the majority is focused on basic education (Commonwealth Secretariat, 2017; Mogensen and Schnack, 2010; Vare and Scott, 2007). One exception is the development of Sulitest by the Higher Education Sustainability Initiative, to gauge the sustainability competencies of university students. However, literature is for the most part restricted to a few high-income countries (e.g. USA, Canada, UK and Germany), and there is little work providing a holistic analysis of all aspects of the potential role of the university. Furthermore, many of the accounts of the sustainability work of universities are descriptive and aspirational, and do not address in sufficient depth the challenges of implementation in practice or analyse how to overcome them.

There are other crucial aspects of this topic that need further exploration. Climate change is a highly controversial issue, with contestation over its facts, causes, proposed solutions and the values underpinning them (Hoggett, 2011; Marshall, 2014). It is embedded in broader knowledge wars in the contemporary era, with the proliferation of 'fake news', manipulation of the citizenry through social media, and distrust of experts – leading to the notion of the 'post-truth' era. The role of universities in relation to this knowledge contestation is highly complex.

More broadly, greater understanding is needed as to how universities and their leaders are negotiating dominant trends at the global, national and local levels, and the conditions and strategies needed to overcome the challenges of climate change and sustainability and ensure their institutions are part of the solution and not part of the problem. This report aims to address this gap in the knowledge and provide much-needed evidence and insights into what universities around the world can do.

Aims and objectives

Given the critical challenges facing universities and

global societies, and the lack of relevant research, this report aims to generate understanding of the ways universities can enhance their positive impact on sustainability and climate change. In particular, it focuses on the challenges of implementing sustainability initiatives in universities – across teaching and learning, research, community engagement and governance – and the role that university leaders and organisational management can play in developing effective practice.

The primary question addressed by this report is *"What challenges do universities and their leaders face in addressing climate change and sustainability, and how can they best be overcome?"*. Answering this question involves investigation of a number of subareas, including the ways in which climate change and sustainability manifest themselves in curriculum, research and community engagement; movements towards sustainable campuses; the influence of the national political context and regulatory frameworks; the influence of the mission, ethos and self-concept of higher education systems, institutions and disciplinary areas; constraints on and opportunities for sustainability presented by the economic context and the financial requirements of institutions; examples of successful institutions and initiatives in addressing climate change and sustainability; and needs for research and evidence-gathering.

This report addresses the role of the university and the challenges facing it in a multi-scalar way. Universities interact with the outside world on different levels, with influences from and potential influence on each. There are global level dynamics and trends, national level policies and regulations, as well as local contexts and factors. Equally, universities can bring impact at the global, national and local levels. For example, a university can achieve impact at the local level through working with new forms of agricultural production, at the national level through influencing energy policy, and at the international level through transferable research and partnerships with universities in other countries.

Climate change is here understood as the phenomenon of rising global temperatures that, at the present moment, has largely human causes, and that must be addressed through action at all levels, involving governments, businesses, civil society organisations and individuals, and engaging with political, economic and cultural spheres. This report addresses questions of mitigation, but also adaptation, defined as follows:

> *Mitigation objectives address the causes of climate change, whereas adaptation objectives address the impacts of climate change through an adjustment in natural or human systems in response to the actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. (Alves et al., 2020, p. 193)*

Sustainability and sustainable development include questions of climate change, but are broader, involving other environmental concerns (such as local pollution and plastic waste) as well as questions of social justice and distribution of economic resources in human communities.

The concept of sustainable development emerged in the second half of the 20th century as a confluence of two areas of global concern: on the one hand, international development – reduction of poverty, the upholding of universal human rights and ensuring social justice across all countries and communities of the world; and on the other hand, environmental protection, addressing various forms of pollution, ensuring conservation of wildlife and the maintenance of healthy ecosystems. In order to avoid these two areas of work from competing and undermining each other (i.e. economic development causing destruction of forest habitats), sustainable development was put forward as an orienting concept that could ensure both human and non-human interests were supported simultaneously. Sustainable development took centre stage in global affairs when adopted by the United Nations in its 2030 Agenda for Sustainable Development agreed in 2015.

The term 'sustainability' can in some instances be used in a distinct way: for example, a company may refer to the sustainability of its practices in terms of its ongoing viability and profit-making, even whilst exploiting the natural environment and local communities. However, for the most part sustainability

is used in an identical fashion to sustainable development, and that is the usage adopted in this report.

While the report has global relevance, there is particular focus on seven countries: Brazil, Germany, India, Japan, South Africa, UK and USA. These countries constitute some of the largest and most diverse higher education systems in the world, with many of the world's most prestigious institutions and a large proportion of the world's international students and publications. They also represent significant geographic diversity, covering the regions of North and South America, Africa, Europe and Asia, and income level, from high-income (Germany, Japan, UK and USA) to middle-income countries (Brazil, India and South Africa), with significant internal diversity and in some cases high levels of inequality. Between them, they are also responsible for a significant proportion of global carbon emissions, so mitigation work is particularly important in these contexts.

Methods and theoretical framing

The seven country case studies draw on a range of data and information sources. They involve reviews of published literature as well as primary documentary sources at the national and institutional levels: for example, policy documents, legal requirements of universities and institutional strategies on sustainability. There is also an analysis of existing datasets relating to universities, for example enrolments, funding and publications. In each of the country case studies, there is a general overview, a description of national policies supporting sustainability and climate action, an analysis of the challenges and opportunities, involving in-depth case studies of two universities that provide examples of good practice or a useful illustration of the challenges in context. While it is not possible for the universities selected to be representative of all higher education institutions in the countries in question, they encompass a range of institutional types – including academic and technical, public and private, large and small, research and teaching focused – and are located in different geographical regions. The institutions are listed in Table 1.

For each of these institutional cases, key informant interviews were carried out with one representative of senior leadership in the university. The aim was to have first hand reflections from someone with a view of the whole institution and its sustainability work, and who had been involved in the complex process of institutional decision-making. In some cases the head of the institution was interviewed (Vice-Chancellor, Rector, Principal, depending on the country); in other cases, it was considered that another member of the senior leadership team would be more appropriate, on account of their particular knowledge of sustainability issues – either a Deputy Vice-Chancellor or Pro-Rector, or in some cases Director of Sustainability. The interviews were approximately an hour in length, and followed a semi-structured format with a template common to all countries, but with some flexibility to pursue local topics of interest. The interview guide was collectively constructed by the researchers, and covered three broad areas of personal role and practice, institutional actions and reflection on challenges and outcomes. Interviews were carried out remotely in all cases on account of restrictions of the COVID-19 pandemic. It was not possible or desirable to maintain anonymity of the institutions or in most cases of their leaders[1] – given the need to discuss distinctive characteristics of each and their particular identities – and relevant permissions were thus sought and granted.

The seven case study countries also contribute to comparative analysis that is able to generate learning of broader international significance. Through the juxtaposition of these cases with diverse political, economic and cultural contexts, and distinctive histories of higher education systems, insights can be gained into the influences of context on action in relation to climate change and sustainability, as well as actions that can be effective. In proposing recommendations from these contexts, care is taken not to advocate for falsely neutral and transferable technical fixes, and to acknowledge that responses will always be contextual.

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1   Anonymity of the interviewees was maintained in the cases of Japan and South Africa, in accordance with the agreement with the participants.

Table 1. Institutional Cases

Country	Cases	Foundation year	Type	Number of students (2019)
Brazil	University of São Paulo	1934	Public	100,000
	University of Southern Santa Catarina	1964	Non-profit private	20,000
Germany	Freie Universität Berlin[1]	1948	Public	33,000
	Eberswalde University for Sustainable Development	1992[2]	Public	2,110
Japan	Tohoku University	1907	Public National	17,804
	Ritsumeikan University	1900	Private	35,772
India	Pondicherry University	1985	Public engineering	6,557
	Indian Institute of Technology - Gandhinagar	2008	Public research	1,085
South Africa	Stellenbosch University	1918	Public research	31,765
	University of South Africa	1873	Public distance	373,747
UK	Nottingham Trent University	1992	Public	34,000
	University of Edinburgh	1583	Public	40,000
USA	Arizona State University	1885	Public research	119,951
	Middlebury College	1800	Non-profit private	3,250

In analysing the actions and impacts of universities on sustainability and climate change, this report draws on the framework developed in McCowan (2020), as shown in figure 1.

This framework conceptualises the university as having five principal modalities: education, knowledge production, service delivery, public debate and institutional operations. Education (involving learning acquired through taught courses as well as informally on campus and beyond) and knowledge production (scholarship, basic research, applied research and innovation) constitute the core functions of the university. The third pillar of the university is known by a number of different names – community engagement, service, extension or third stream activities – and can take different forms. In this report it is often referred to generically as community engagement. However, a closer look shows that engagement with external communities, industry, government and the general public is captured through two distinct modalities: 'service delivery', through which direct services are provided including consultancy and secondments, and 'public debate', involving raising of awareness in society and fostering of deliberation. Finally, campus operations relate to the sustainability of the university itself, the environmental impacts of staff and students, and university investments and estate management.

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2   Free University of Berlin

3   The roots of the institutions stretch back longer to 1830 as a higher institute (Höhere Forstlehranstalt) of forestry. It became a Fachhochschule, or university of applied sciences, in 1992. In 2010 it was renamed the Entwicklung Eberswalde (FH).

Figure 1. Impact of the university on sustainability and climate change
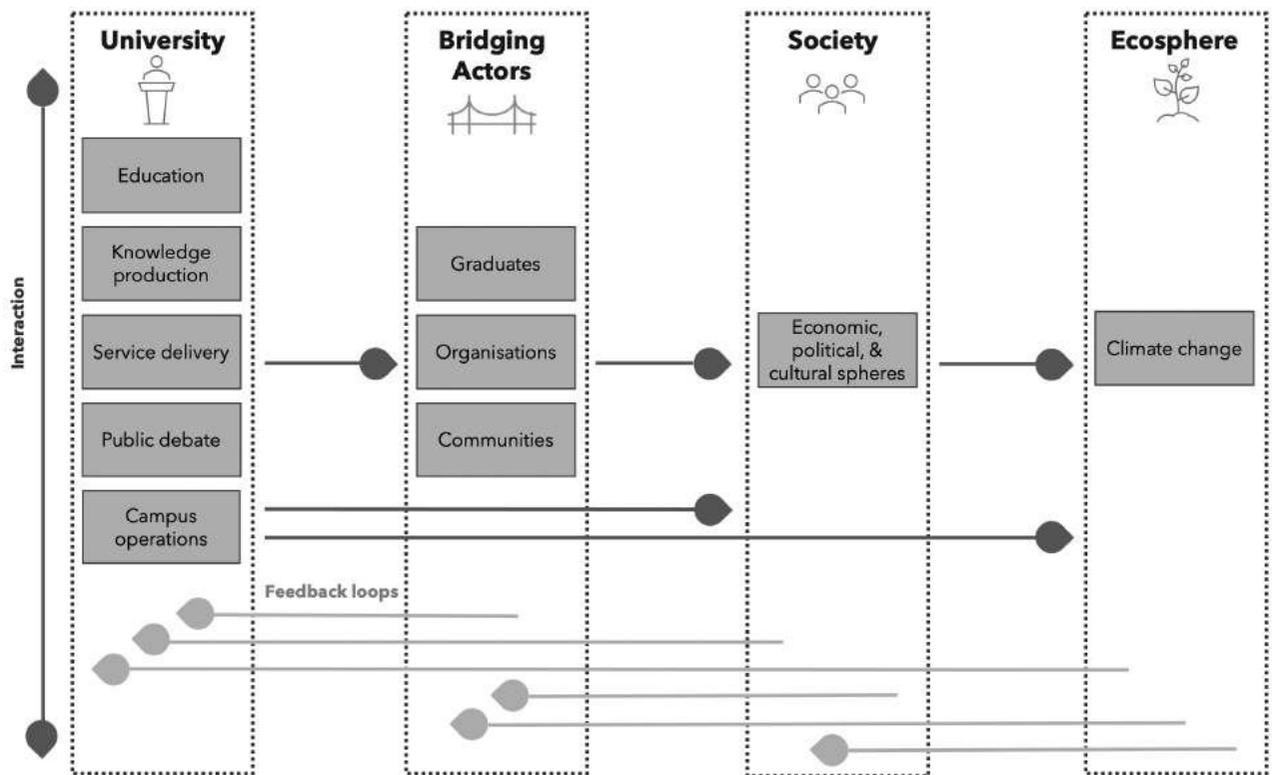
Source: McCowan (2020)

These activities can have a direct impact on the environment, for example in the case of emissions of greenhouse gases by international student travel. Yet in many cases these impacts are mediated by changes in human societies, such as household adoptions of energy saving innovations, or changes in public understandings of the dangers of climate change. Crucial to these changes are what are here called 'bridging actors' – university graduates, or communities and organisations that come into direct contact with the university – which serve to channel the actions of the university into the broader society. These influences are not mono-directional, and the arrows from right to left on the figure show the feedback loops from the environment to society and the university.

Maintaining a broader view in this way of the multiple trajectories of impact of the university, society and natural environment is crucial to the task of planning and implementing university strategies in relation to sustainability and climate change. This report will draw on this framework in understanding specific interventions in universities – such as the

introduction of modules, research programmes and campus sustainability plans – in relation to the full set of possible functions, and in light of the interactions between them.

The analyses of the seven countries and their institutional cases were carried out with this framework in mind, and with a focus on the specific research questions outlined above. Nevertheless, each analysis developed organically from the emerging findings from the context, and did not impose identical categories.

Structure

Following this introductory chapter, there are two general chapters, addressing in turn global dynamics of sustainability and climate change, and then the role of the university in addressing them, including existing research evidence on impact and effectiveness. The next seven chapters cover the country case studies, providing a general overview of the higher education systems and their work on sustainability and climate change, as well as in-depth analyses of

two institutions. Following the country focus chapters, there is a synthesis of the findings, leading to a broader analysis of institutional and national dynamics, and finally a set of recommendations for universities and their leadership in the conclusion.

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Chapter 2:
Climate change and sustainability: concepts, evidence and global frameworks

Luciana Brandli and Amanda Salvia

Introduction

The expected impacts of climate change will affect economic systems, increase inequalities within and between countries, and cause severe environmental and health impacts worldwide. Sustainability, on the other hand, represents an opportunity to secure a safe global level of living ensuring that both present and future generations meet their needs. The effect of climate change represents a convincing argument for the need for environmental sustainability.

Approaches to fight climate change range from nation or region-wide agreements (such as National Action Plans and the European Green Deal) to world-wide initiatives (e.g. at the UN level via IPCC). The most prominent sustainability global plan is the 2030 Agenda and the 17 Sustainable Development Goals, which represent a transformative commitment to a more sustainable future developed by the United Nations. Although the mainstream plan entails various actions to eradicate poverty and "leave no one behind", a specific goal refers to Climate Action (SDG 13) and indicates a series of targets to combat climate change and its impacts.

In this chapter, the interconnection between the concepts of climate change and sustainability will be covered, with their definition, their challenges and potential for action from different perspectives and involving different actors. Special attention will be given to environmental sustainability and to the impacts of climate change worldwide. From impacts to action against climate change, this chapter will present the different (but complementary) approaches of climate change adaptation and mitigation, in addition to the different spheres of transformation to limit global warming. The global frameworks for climate action will be presented, including the different targets and indicators of the SDG on Climate Action. In a final section, climate change scepticism and the role of education will be discussed.

Understanding the concepts of climate change and sustainability

Sustainable development (SD) can be defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development [WCED], 1987). There are many alternative definitions, and none of these are universally accepted (Imran, Alam and Beaumont, 2014). Nevertheless, the ecological, social and economic dimensions have been treated as pillars for SD by many researchers (Dhahri and Omri, 2018; Govindan, Khodaverdi and Jafarian, 2013).

Sustainability and sustainable development are often used interchangeably although can be described differently (Axelsson et al. 2011). Sustainable development tends to relate to the whole process and necessary measures to reach a more sustainable world. On the other hand, sustainability is considered the achievement of a sustainable world (UNESCO, n.d.). The achievement of sustainability and climate change adaptation have many interactions and common elements (Yohe et al., 2007; Krause, 2016), so it is imperative to address them jointly. This understanding comes from the necessity of interaction between these two fields of research, activity and policies and the recognition of their complementary strengths in addressing environmental problems (Cohen et al., 1998).

Swart, Robinson and Cohen (2003) present arguments for the integration of climate change and SD research, arguing for a more unified and equitable approach to global environmental and economic stewardship. The authors show that SD policies provide alternative development pathways through environmental and economic policies, and institutional changes. On the other hand, climate change policies aim to avoid climate change damage, promote the benefits, costs, spillovers and trade effects, and encourage innovation (Swart, Robinson and Cohen, 2003).

Accordingly, Munasinque and Swart (2005) reinforce the view that the potential impacts of climate change and its responses need to be analysed within the context of SD. It is necessary to understand how climate change affects SD prospects and how climate change responses can be best incorporated into broader development strategies. The Intergovernmental Panel on Climate Change (IPCC) explicitly recognises the importance of the linkages between climate change and sustainability, emphasising that climate change can undermine SD, and that SD can reduce the impacts of climate change (IPCC, 2007; 2014).

Climate change refers to:

> *a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable periods of time. (United Nations Framework Convention on Climate Change [UNFCCC], 1992)*

This conception considers that climate change is due to human activities which alter the atmospheric composition (IPCC, 2014; Pagett, 2019). Climate change affects biophysical systems, human health, agriculture and socioeconomic well-being.

Discussions about sustainability and climate change have permeated mainstream thinking. Figure 1 shows a timeline of significant developments and events. In addition to these milestones, economic and political contexts can also positively or negatively impact pathways to sustainability. Some examples include national or regional plans for climate action, popular movements such as the School Strike for Climate, politicians with clear anti-environmental attitudes, and strong political pressure to reach agreements beneficial to the oil industry.

According to Setti and Azeiteiro (2019) the global environmental agenda was strengthened at the 1992 United Nations Conference on Environment and Development, known as the Earth Summit. After this event, a new idea of development and new atmosphere of international cooperation emerged,

culminating in the adoption of the Biological Diversity Convention and the UN Framework Convention on Climate Change (Smith et al., 2019). The subsequent UN summits in South Africa in 2002 (Rio+10) and in Rio de Janeiro in 2012 (Rio+20) have reinforced these ideas.

In 2015, the United Nations General Assembly approved the '2030 Agenda for Sustainable Development', which contains a set of measures aiming to balance economic progress and protection of the environment, in the context of eradicating poverty and reducing inequality between industrialised and developing countries (Leal Filho et al., 2019a). The Agenda consists of 17 Sustainable Development Goals (SDGs) and 169 targets to eradicate poverty, promote health, energy access and food security, reduce inequalities, protect ecosystems, pursue sustainable cities and economies, among others (United Nations, 2015a). A clear preoccupation with climate change is observed through SDG 13 (Climate Action), aiming at:

> *strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries, integrating climate change measures into national policies, strategies and planning, and improving education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning. (United Nations, 2015a)*

The Paris Agreement was also signed in 2015, representing the first global accord on climate change encompassing policy obligations for all countries. This global arrangement covers mitigation and adaptation policies, climate finance and transparency, reporting and review, international cooperative mechanisms, capacity building, technology transfer, and forest policy (United Nations, 2015b; Dimitrov, 2016).

A Special Report entitled *Global Warming of 1.5°C* (IPCC, 2018), requested by world governments under the Paris Agreement, also makes clear the interactions, synergies and trade-offs of adaptation and mitigation measures relating to SD and the SDGs. According to the report, transformative change,

Figure 1. Timeline with main events of sustainable development and climate change
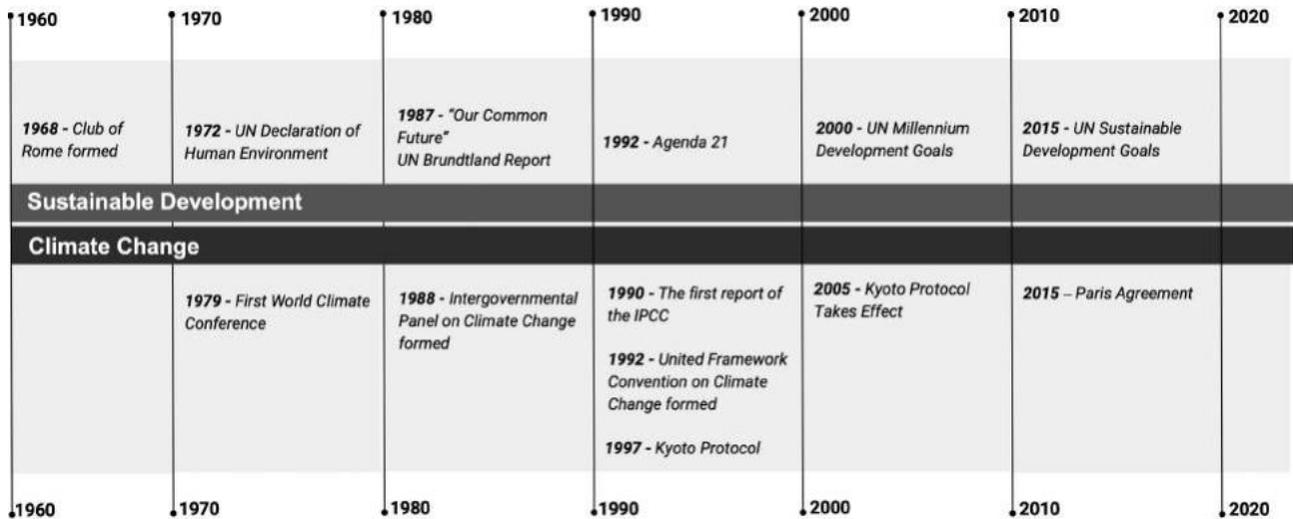
Source: Based on Peng et al. (2018) and Swart, Robinson and Cohen (2003).

adaptation and SD are needed to limit global warming to 1.5°C (IPCC, 2018). Pursuing sustainability will influence emissions, impacts and vulnerabilities, and 'well-designed mitigation and adaptation responses can support poverty alleviation, food security, healthy ecosystems, equality and other dimensions of SD' (IPCC, 2014). The next section presents evidence of climate change and its main impacts, reinforcing the need to limit global warming.

Evidence and impacts of climate change

The concentrations of carbon dioxide and other greenhouse gases (GHGs) in the atmosphere have been measured continuously since the late 1950s, and for the more distant past measured in bubbles of ancient air preserved in ice (Schneider, 2008). The data shows that these concentrations are higher than ever before over the last 650,000 years, and around 35% higher than before the industrial revolution. Warming of the climate system is unequivocal (Carter, 2018, Hearty and Tormey, 2017; Keller, 2007; Shuai et al., 2017): the atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen (IPCC, 2014).

The scientific consensus about the cause of warming is evident in all IPCC reports. According to IPCC Fourth Assessment Report AR 4 (IPCC, 2007) most of the observed increase in global average temperatures

is 'very likely' due to the increase in anthropogenic GHG emissions. The evidence for human influence on the climate system has also grown. The IPCC Fifth Assessment Report AR5 (IPCC, 2014) concluded that anthropogenic GHG emissions have led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are 'unprecedented' in at least the past 800,000 years, clearly marking the human influence on climate change. Limiting the temperature increase to below 2°C is required, along with recognising the seriousness of GHG emissions and the potential impacts especially to more vulnerable regions (IPCC, 2014). Additionally, as indicated in the last UN SDGs report (United Nations, 2019), "as greenhouse gas levels continue to climb, climate change is occurring much faster than anticipated, and its effects are evident worldwide", calling for more ambitious plans and increasing financing to fight the impacts of climate change.

In 2017, the "World Scientists' Warning to Humanity: A Second Notice" was published and formally supported by more than 15,000 scientists worldwide. The scientists highlighted the current trajectory of potentially catastrophic climate change due to rising GHGs from burning fossil fuels, deforestation and agricultural production. Progress is needed on the necessary changes in environmental policy, human behaviour and global inequalities. This requires pressure from civil society and evidence-based advocacy,

political leadership and a solid understanding of policy instruments and markets, among other factors (Ripple et al., 2017).

The IPCC (2018) reiterated that climate change is "affecting people, ecosystems and livelihoods" and these impacts are happening worldwide. How these impacts are presented and classified vary, but include precipitation patterns (Sohoulande Djebou and Singh, 2016), temperature variation (Rogelj et al., 2018), extreme weather events (e.g. droughts, floods) (Stott, 2016), increased sea level and effects on coast areas (Breslyn et al., 2016), food security and land/water use (Kundzewicz et al., 2018), effects on poverty (Hallegatte and Rozenberg, 2017), and impacts on health (Leal Filho, Azeiteiro and Alves,2016) and on ecosystems and biodiversity (Turney, Ausseil and Broadhurst, 2020). In addition to specific studies on these impacts and others, the consequences and challenges of climate change can also be approached considering particular regions (e.g. impacts in Africa (Serdeczny et al., 2017), in Latin America (Reyer et al., 2017), or in small island developing states (SIDS) (Monioudi et al., 2018).

The presence of greenhouse gases in the atmosphere is important to regulate the global climate and some of these gases exist naturally, but human activities have increased the rate of emissions, affecting global systems. Successive impacts are observed in weather and precipitation patterns. Several countries worldwide have been reporting variations in seasons and expected temperatures and precipitations (Duzheng, Yundi and Wenjie, 2003; Santer et al., 2018). Additionally, the frequency and magnitude of extreme weather events have been changing and becoming more worrying (Ebi and Bowen, 2016; Zanocco et al., 2018). The occurrence of droughts, heat waves, cyclones, hurricanes, forest fires, intense rainfalls and floods, for example affect many lives, the economy and ecosystems (Salvia et al., n.d.).

Another impact directly related to the temperature increase is the melting of glaciers and polar ice, and consequent sea level rise. Projections indicate a rise of 8 to 16mm a year during 2081-2100 in approximately 95% of the ocean area (IPCC, 2014). Significant impacts are then expected for coastal systems and low-lying regions, which may experience damage to biodiversity and natural ecosystems, submergence, flooding and erosion, affecting economic activities, urban systems and the livelihood of residents.

The impact of climate change on poverty and inequalities has a dedicated chapter in the last IPCC report (IPCC, 2018). Evidence shows that low-income countries are more exposed, more vulnerable and less resilient to climate change (Davies et al., 2009; Islam and Winkel, 2017). Consequently, the impacts of climate change are believed to worsen poverty and inequality issues. Most poorer countries already suffer from weak governance, high prevalence of informal settlements and lack of resources and institutional capacity (Choudhary, Tripathi and Rai, 2019; Orimoloye et al., 2019), which makes the impacts of climate change even more harmful. Inequality aspects of the impact have the additional problem of integrating a vicious cycle (Islam and Winkel, 2017) in which inequality "makes disadvantaged groups suffer disproportionate loss of their income and assets, resulting in greater subsequent inequality" (p. 24). It brings attention to the need for integrating social aspects in governance efforts towards reducing the impact of climate change (Hallegatte, Fay and Barbier, 2018), especially for the poorest and vulnerable, but with positive outcomes for the whole society. The next section builds upon measures for climate action and resources needed for sustainability.

Climate Change adaptation and mitigation

Adaptation refers to understanding the causes of vulnerability to climate change, responding to or anticipating its impacts through coordinated and complementary actions, and reducing the adverse impacts and realising opportunities (Roka, 2019; Tompkins and Adger, 2003). Mitigation concerns the control of greenhouse gas emissions, either through investments in renewable energy, energy efficiency, use of new technologies or change in practices and behaviour (Alloisio and Borghesi, 2019). As discussed by Choudhary, Tripathi and Rai (2019) and Frey and Gasbarro (2019), both adaptation and mitigation are necessary to fight climate change and avoid future impacts. Still, their practical characteristics need to be considered and understood separately.

Table 1. Examples of climate change responses

Adaptation	
Disaster Risk Management	Can include early warning systems, vulnerability mapping, flood gates, seawalls, and other structures to protect people and properties. With higher frequency of extreme weather events, disaster risk management is an urgent need.
Ecosystems Management	Fundamental to strengthen the resilience of vulnerable habitats, including actions to maintain wetlands and urban green spaces, promote coastal afforestation, reduce stressors on ecosystems, among others.
Structural/physical improvements	Examples include coastal protection structures, water storage and water-saving technologies, improved drainage, transportation improvements, floating houses, soil and agriculture conservation, afforestation and reforestation.
Desalination	The process of removing salt from seawater to secure stable sources of freshwater.
Relocation of vulnerable communities	Coastal communities are particularly at risk considering the impacts of climate change (such as coastal erosion and increased storms and floods).
Educational options	Investment in awareness raising and integration into education, and improved participatory research in climate change and sharing through social learning.
Mitigation	
Building retrofit/ Urban planning	Building retrofit to increase lighting, heating and cooling efficiency of buildings, saving energy and reducing GHG emissions. Urban planning to promote systemic efficiency (integrated design, low/zero energy buildings, district heating/cooling) and use of smart grids, among others.
Improving industrial processes	Optimised use of energy, reuse of waste in production, programmes for reducing emissions, use of biomass and more efficient equipment.
Renewable Energy	Increasing the use of renewable energy sources significantly reduces GHG emissions. Examples include wind, solar, bioenergy, geothermal, and hydropower. National and global policies to encourage the development of renewables are becoming more common.
Energy Efficiency	Can range from ways to reduce energy waste and consumption of primary energy, to different product designs and use of new materials.
Low-carbon fuels	Investments and research to promote the switch to the use of alternative fuels, such as hydrogen, electricity from low-carbon sources, and biofuels.
Local/individual actions	Behavioural and lifestyle changes can reduce carbon footprints. Individuals and communities can benefit from policies related to improved public transportation, walkability and use of bike lanes, besides incentives to the use of renewable energy sources and more efficient appliances.
Geo-engineering	Also known as climate engineering technologies, geo-engineering refers to efforts to stabilise the climate system through energy balance management. It refers to carbon dioxide removal and solar radiation management, in order to extract CO_2 from the atmosphere and divert sunlight from reaching the Earth's surface.
Carbon trading	Allows countries that have spare emission units to sell these to other countries. This mechanism supports through incentives the reduction in carbon emissions.
Taxation in fossil fuel markets	A regulatory measure to control and reduce carbon emissions. Similarly, phasing out of fossil fuel subsidies encourages the use of more sustainable energy sources.

Source: Based on IPCC (2014), Klaus, Ernst and Oswald (2020), Monasterolo and Raberto (2019), National Academy of Sciences (2018), UNFCCC (n.d.),.

The UNFCCC and the IPCC help shape mitigation and adaptation actions (Inogwabini, 2019). In addition to providing important assessments for action, they also support the stabilisation of greenhouse gas concentrations in the atmosphere.

Climate change responses vary considerably depending on socio-political and environmental contexts and can be classified by the extent of change/investment, or the main characteristics of each action, coverage and nature (e.g. collective or individual). However, it is worth highlighting that both adaptation and mitigation are complementary strategies, since they are needed to prepare for changes and reduce negative effects, limiting emissions in order to reduce the speed of climate change (U.S. Global Change Research Program [USGCRP], 2018). Table 1 presents a summary of climate change responses, classified according to their main approach (adaptation and mitigation).

Although both types of actions intend to address impacts of climate change, mitigation policies tend to have global focus and can be applied to all sectors that can reduce carbon emissions, with effects in the long term and are relatively easy to monitor (in terms of reduced emissions) (Grafakos et al., 2019). On the other hand, adaptation policies may have local or regional scales of impact with more complex ways of measuring results in the short/medium term, and implementation often takes place in particular sectors/impacts (Grafakos et al., 2019). Either way, current projections of carbon emissions and impacts of climate change necessitate both approaches.

Decision-makers need to be more than just leaders: they must lead towards climate action and be willing to secure top management support, collaborate with partners that have the same interests and priorities and embed the initiatives within institutional culture (Gallagher, 2016). Evidence also points to the need for real integration of climate change into legislation and policy-making, establishing as priority the issues of adaptation and mitigation demand (Keskitalo et al., 2016).

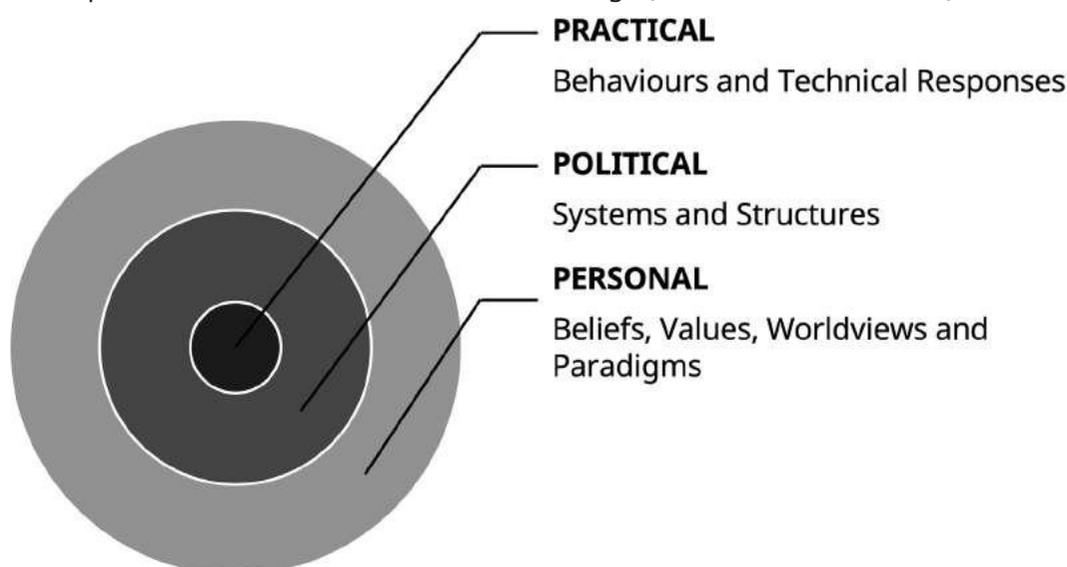As clearly stated by the IPCC (2018), "limiting warming to 1.5ºC is possible within the laws of chemistry and physics but would require unprecedented transitions in all aspects of society" (p. vi). Several authors mention the need for important transitions and transformations in governance, in distribution of resources, in policy-making, in technology use, among others (Luderer et al., 2018; Millar et al., 2017; Rogelj et al., 2018; Su et al., 2017; van Vuuren et al., 2018). For that, various frameworks for action can be considered, including global plans of action or regional and local approaches, which combine multiple levels and roles for effective outcomes.

Global frameworks for climate action and sustainability

According to O'Brien and Sygna (2013), the literature on transformation in a changing climate can have different approaches and be integrated and discussed through three spheres of transformation, as per Figure 2. The central sphere on practical issues includes specific actions that directly contribute to an outcome (e.g. installation of solar panels, infrastructure upgrade, promotion of sustainable transportation, new educational tools) (O'Brien, 2018). These are central since the results can be more easily monitored and can support actions in the other spheres. The political sphere refers to systems and structures which promote the development of norms, institutions and incentives. These resources are related to aspects that may either assist or hinder efforts to climate action, and contain also examples of cooperation towards a common objective. The external sphere refers to personal paradigms that can shape one's behaviours and actions towards climate change. This sphere also refers to "shared understandings and assumptions about the world, which influence perceptions, interpretations and constructions of reality" (O'Brien, 2018, p. 156).

The representation of the spheres in a concentric and embedded form intentionally reflects the relations between and impacts on one another, since the practical sphere is the core of transformation processes, the political sphere moderates the structures of society, between practical and personal actions, and the personal sphere is represented as the outermost for not being deterministic but having somehow an impact on the other spheres (O'Brien, 2018). Additionally,

Figure 2. The spheres of transformation on climate change (based on O'Brien, 2018)

PRACTICAL
Behaviours and Technical Responses

POLITICAL
Systems and Structures

PERSONAL
Beliefs, Values, Worldviews and Paradigms

it represents the different yet complementary roles of society in fighting climate change and responding to it through mitigation and adaptation measures. Although there are varied ways to approach strategies of climate action and transform society to a changing climate, these spheres are particularly interesting for organising actions and responsibilities to formally act towards a specific path.

These spheres may also be somehow related to triple-loop learning approach, in which the outcomes can improve practices, their assumptions and values and eventually norms and policies (Armitage, Marschke and Plummer, 2008; Horcea-Milcu et al., 2019). Educational efforts can act directly or indirectly towards all spheres, but probably more closely to the personal one. Different learning practices can lead to sustainability transformations, different behaviours and empowerment in climate change problems and solutions (Bentz and O'Brien, 2019). For Gupta (2016), learning can be associated with participation and outcomes in climate change governance, demanding multi-efforts for success.

International collaboration and shared responsibility have been recognised as important aspects to fight climate change (Miller, 2007) and actions towards sustainability and climate action demand involvement of several actors, such as states, companies, civil society organisations, communities and individuals. As per van den Bosch (2010), a perspective

on sustainability through multi-levels can be useful to analyse the needed transitions to address sustainable development challenges. Actors can be divided into micro, meso and macro levels, with each level included in the higher one that tends to be more resistant to change.

Molthan-Hill et al. (2020) clearly exemplify the roles and challenges of each level. At the macro-level, the SDGs are set up as an important framework for action and global agreements (e.g. the Kyoto Protocol) are signed to define guidelines for a specific purpose among nations. Following these international efforts, at the meso-level, national or regional initiatives can be implemented, such as laws to limit carbon emissions or to encourage energy efficiency and renewable energy. Both macro and meso actions can support and facilitate initiatives at the micro-level, where individuals can work as decision-makers or leaders in government bodies or companies, or influence others through education and communication, or just change their own views and attitudes (e.g. choosing more sustainable options for transportation, changing diet and consumption behaviour). All these lines of action are fundamental for practical and effective results towards a sustainable future, demanding partnerships from different levels.

A positive example of multi-level and multi-country alliance towards climate action is the European Green Deal. Set out as a plan of action to the

European Union and its citizens, it recognises the challenges of climate change and takes responsibility for acting to fight climate and environmental-related impacts (European Commission, 2019). Aiming for a sustainable economy and for the European Union to be climate neutral by 2050, the deal works towards efficient use of resources, circular economy, biodiversity restoration and pollution cuts providing a set of investments and financing tools. One of the strategies for such a ground-breaking set of goals include the development of the European Climate Law, which will turn the regional commitment into a legal obligation (European Commission, 2020) and require efforts by all sectors: for more investments in environmentally-friendly technologies and energy efficiency, industry innovation, and cleaner public transport, among others. Additionally, the efforts of the European Green Deal represent opportunities not solely for the climate, but also health of citizens (Haines and Scheelbeek, 2020).

National efforts should also be acknowledged. According to the data from the Climate Action Tracker (2019) and National Geographic (Mulvaney, 2019), Morroco and The Gambia are among the best-performing countries in meeting their self-set goals under the Paris Agreement. In Morocco, measures include increasing renewable energy to 52% of overall capacity by 2030, to create a National Commission on Climate Change and involve non-governmental organisations in decision-making. In The Gambia, the uptake of renewable energy and energy efficiency is the main strategy, complemented by efforts to restore forests, mangroves and savannas. National and local efforts are bolstered by leadership which strongly supports climate change adaptation measures (Vignola et al., 2017).

In contrast, some countries have committed fewer resources towards reducing their carbon emissions. Russia is a large emitter of greenhouse gases, has very weak emissions reduction targets and low efforts when it comes to new climate policies (Climate Action Tracker, 2019; Martus, 2019). The country is expected to meet the Paris Agreement targets but only because these targets are not ambitious. The status of the United States used to be worse, considering the previous decision to withdraw from the

Paris Agreement and relax climate change responses (Zhang et al., 2017). However, this status recently changed as the new government reentered the agreement (Bodansky, 2021). This decision impacts the world not only in terms of carbon emissions, but also in relation to international collaborations and partnerships.

Considering the 2030 Agenda, the goal on Climate Action (SDG 13) stands out in terms of research efforts worldwide (Salvia et al., 2019), probably due to the extension of the climate change impacts and the diversity of related areas. This SDG is also among those that are strongly interconnected with the others. According to Salvia et al. (n.d), the goals on Quality Education (SDG 4), Industry (SDG 9), Sustainable Cities (SDG 11), Responsible Consumption and Production (SDG 12) and Life on Land (SDG 15) are the ones which most affect the aims of Climate Action, especially due to their potential of change. Similarly, SDGs on Hunger (SDG 2), Health (SDG 3), Water and Sanitation (SDG 6), Energy (SDG 7) and Life Below Water (SDG 14) tend to be the ones most affected by climate change.

The IPCC (2018) relates climate change and the 1.5°C pathway to synergies and trade-offs with the SDGs. The strongest synergies are observed for SDGs 3, 7, 11, 12 and 14, due to the combined efforts and/or positive contributions towards health, energy efficiency and renewable energy, sustainable cities and assets, responsible production and consumption and protection of marine resources. Conversely, the most relevant trade-offs can be seen in SDGs 1, 2, 6 and 7, where if actions are not properly carried out, efforts towards poverty and hunger alleviation, access to quality water and energy efficiency may be hindered (IPCC, 2018).

The most recent report on the SDGs (United Nations, 2019) brought some interesting insights for climate action and corresponding frameworks. Global assessments indicate that climate-related financial flows increased, mostly dedicated to reducing carbon emissions, but much more needs to be done, especially concerning the share available to assist poorer countries to adapt to climate change and to overcome investments in fossil-fuels. A call for action

was made to increase contributions towards response efforts and Paris Agreement targets. Some positive outcomes have been observed in respect of increased number of national plans for climate change resilience and adaptation and strategies for disaster risk reduction, but more ambitious changes are needed to avoid the worst impacts of climate change (United Nations, 2019).

Climate change scepticism and the role of education

Though many climate literacy efforts attempt to communicate climate change as a risk and sustainable development as an important approach, scepticism and critiques exist around the world. Climate change literacy is understood as a combination of education competencies that can include (1) knowledge of climate system science, (2) understanding of the impacts and threats of climate change, (3) motivation to make informed decisions to implement mitigation and adaptive solutions to the climate crisis and (4) skill in systems thinking (Johnston, 2020). Leaders, educators, and journalists can inadvertently pass on misconceptions and faulty knowledge.

A common misunderstanding is that the Earth's climate has changed naturally in the past; therefore, anthropogenic actions would not be the cause of global warming. Maslin (2019) highlights additional climate change science misconceptions including the belief that changes are due to sunspots/galactic cosmic rays, carbon dioxide being a small part of the atmosphere and therefore not having the strength needed for a large heating effect, manipulation of data to show a warming trend and the use of climate models too sensitive to carbon dioxide.

Johnston (2020) presents arguments that climate change deniers do not necessarily misunderstand the science of climate change. Denial also depends on the cultural values, considering that people 'credit or dismiss scientific information on disputed issues based on whether the information strengthens or weakens their ties to others who share their values' (Kahan et al., 2012). The phenomenon of climate denial, that is, the active resistance to information on a collective level is also outlined by Norgaard (2011)

as the intersecting result of emotions, culture, social structure, and inequality in people's lived experience.

Evans and Feng (2013) consider that the

social determinants of believing climate scientists is subdivided into at least five categories: 1) acknowledging the existence of climate change; 2) accepting that humans have caused global warming; 3) believing scientists' claims that global warming is a serious problem; 4) believing that there is scientific consensus on the matter or in the certainty of climate change and the science behind it; and 5) believing scientists' proposals for the need to take ameliorative actions to mitigate the effects of climate change.

In this context, engaging in education and proper communication options may contribute to overcome scepticism on climate change (Sterman, 2011; Stevenson et al., 2014).

A survey in 2015 in 119 countries found that more than a third of the world's adults have never heard of climate change. The study says that education is the "single strongest predictor" of public awareness of climate change (McSweeney et al., 2015; Lee et al., 2015). Education can expand climate literacy efforts, increase climate change knowledge and change worldviews.

According to Lee et al. (2015), improving basic education, climate literacy and public understanding of local dimensions of climate change are vital to garner support for climate action. Nonetheless, increased knowledge and understanding of climate change must be associated with practical contributions, engagement and behaviour change. Abade (2019) highlights the importance of climate change education for children, since they have an effective role in creating change now and in the future. For Stevenson et al. (2013), education of adolescents is the best way to overcome climate change scepticism, because their worldviews are still forming. For Leal Filho et al. (2019b), curricular innovation and practices engaging undergraduate students are fundamental to reduce climate change scepticism. These efforts contribute also to the university role on supporting climate

change mitigation and adaptation (Leal Filho et al., 2018). In this sense, climate change literacy is a vital element for general public awareness and is necessary for developing policies and making effective decisions to combat climate change (Johnston, 2020).

In short, if citizens understand how climate works, how to distinguish facts from fiction, and how to talk about the climate in a meaningful way, society will benefit (Climate Literacy, 2016). Similarly, education for sustainable development has the potential to create knowledge in a way that engages people in changing behaviour, understanding their impact in the world and empower them to change (Rieckmann, 2018; UNESCO, n.d.). There is evidence that embedding education for sustainable development in educational approaches enhances students' attitudes towards sustainability (Vare and Scott, 2007).

Concluding remarks

This chapter has presented an overview of the interconnections between the concepts of climate change and sustainability, in addition to communicating the main frameworks to guide actions and overcome not only the impacts of climate change, but also scepticism. Addressing climate change and sustainability in tandem enables synergies, assists governance initiatives, and – by promoting education for sustainable development – can improve climate literacy.

Overcoming challenges associated with climate change and sustainable development will require individuals to be informed and concerned about the issue. Education and research are therefore essential in facing this challenge. In this context, the role of universities in pursuing and implementing sustainable development will be discussed in the next chapter.

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Chapter 3:
The role and impact of the university

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Introduction

Universities around the globe have committed to implement sustainable development through research, teaching and learning, outreach and campus operations (Lozano et al., 2013). These areas of activity are reflected in international, national and organisational sustainable development policies for higher education (Vargas et al., 2019a). The important role of education has also been highlighted through the UN Decade of Education for Sustainable Development (2005 – 2014) (United Nations, 2002).

This chapter takes an international and forward-thinking perspective to provide an overview of implementing sustainable development and climate action within higher education institutions (HEIs). The first section outlines the role played by universities in these efforts. The second section provides an overview of some of the initiatives in universities to evaluate and measure their progress towards sustainable development. The third section presents an overview of elements which hinder the implementation of sustainable development in higher education, as well as some of the drivers which have been successfully deployed. The fourth section outlines the role of leadership and organisational management for sustainable development in higher education.

Universities' role in the implementation of sustainable development and climate action

A literature review conducted by Findler et al. (2019) suggested that there are seven areas in which universities are contributing to sustainable development. Most papers published focus on what universities are doing in practice to contribute to sustainable development through *outreach activities*, *assessment and reporting,* and *research*. These are followed by papers focused on what universities are doing in practice through *education*, *campus operations* and *campus*

experiences. There are also a large number of *generalist* papers. However, sustainability in HEIs has mainly been implemented through compartmentalised approaches (Lozano et al., 2015). In many cases the focus has been bottom-up rather than strategic initiatives supported by senior leadership (Farinha, Caeiro and Azeiteiro, 2020). Therefore, university leaders have an important role to play in translating bottom-up work into strategic approaches.

In the academic literature there is more research on what universities are doing in practice to contribute to sustainable development in the Global North than in the Global South (Ulmer and Wydra, 2020). In countries such as Bangladesh research results suggest that environmental management practices are very limited (Hoque, Clarke and Sultana, 2017). Although examples may appear to show a lack of activity in the Global South, it is difficult to draw conclusions and understand differences due to the differences in volume of published research.

HEIs are in a unique position to support sustainable development through teaching and learning, research and outreach, and the development of social and technological innovations (Radinger-Peer and Pflitsch, 2017; Leal Filho et al., 2018b). A key contribution to transformative learning can include nurturing values, attitudes and behaviours towards a restorative and regenerative focus on the natural environment and society (Sonetti, Brown and Naboni, 2019). HEIs can also contribute to the local area acting as active stakeholders contributing to regional innovation and governance systems (Peer and Penker, 2016). Some examples of this in practice include providing consultancy services to regional governance networks, supporting communities to engage in regional governance, or by representing their own interests in fora that support regional governance. Finally, HEIs are located at the interface of theory and practice, and local and international arenas (Leal Filho et al., 2019b). This is a privileged position to nurture, support and drive community-based initiatives engaging local and international actors to advance towards sustainable development.

Universities are ideally located to reach a wide range of stakeholders. These include at the individual level

students, staff, members of the local community, industry partners, and political leaders. Universities also interact with several stakeholder organisations such as funding councils, governmental agencies and non-governmental organisations (Vargas et al., 2019b). Internal and external stakeholders can influence the process and speed at which universities implement sustainable development (Lozano and von Haartman, 2018). However, stakeholder networks need to be developed. In the case of the UK, higher education sustainable development policy frameworks include stakeholder organisations, but these frameworks lack crucial language related to issues such as funding and governance for the networks to work effectively (Vargas et al., 2019b). In Latin America, policy frameworks at national or organisational level are not a widespread phenomenon (Hernandez, Vargas and Paucar-Cáceres, 2018). Therefore, there is a need for universities in the Global South as well as in the Global North to develop and disseminate appropriate sustainable development policy frameworks for higher education both at

national and organisational level. This is an area that university leaders could help develop.

A holistic approach and responsibility for sustainable development is often missing in HEIs (Lozano et al., 2015; Farinha, Caeiro and Azeiteiro, 2020; Roos and Guenther, 2020; Roos et al., 2020). Furthermore, the literature shows that linking the social responsibility and sustainability agendas is problematic due to misconceptions and a lack of awareness around the two agendas (Leal Filho et al., 2019a), and HEIs can be inclined to make judgements based on economic rather than ethical factors. The integration of environmental, societal and economic issues in the sustainability agendas of universities is a key opportunity for university leaders.

Climate action at universities is receiving increasing attention. Given the importance of the educational sector in CO2 emissions (e.g. in China the education sector is responsible for approximately 40% of the total energy consumption in the public sector (Li, Tan

Table 1. Interventions to reduce carbon emissions from travel at universities

	Current intervention	Reference
1	Public transportation improvements and provision of incentives for use of public transport.	(Miralles-Guasch and Domene, 2010; Ribeiro et al., 2017)
2	Promotion of car-sharing and provision of car-sharing infrastructure and services.	(Miralles-Guasch and Domene, 2010; Gurrutxaga et al., 2017)
3	Increasing safety around walking and cycling to encourage the use of these transportation types.	(Miralles-Guasch and Domene, 2010; Nieuwenhuijsen and Khreis, 2016; Wilson et al., 2018)
4	Increasing the cost of parking whilst reducing the cost of public transportation.	(Miralles-Guasch and Domene, 2010)
5	Developing pedestrian-friendly biking transit.	(Miralles-Guasch and Domene, 2010)
6	Introduction of intelligent green transportation systems.	(Miralles-Guasch and Domene, 2010; Cuaresma, 2019)
7	Education and promotional talks to encourage the reduction of carbon emission from travel.	(Miralles-Guasch and Domene, 2010; Paradowska, 2019)
8	Introduction of telecommunication substitutions - allowing for distance learning/online learning and minimal on-campus work.	(Miralles-Guasch and Domene, 2010; Versteijlen et al., 2017)
9	Ensuring readily available charging stations for electrical vehicles promoting the use of this type of transport.	(Miceli and Viola, 2017)
10	Development of clean fuel vehicles to reduce CO2 emission.	(Shuqin et al., 2019)
11	Switching to online conferences and presentations to reduce air travel of academics and students.	(Glover, Strengers and Lewis, 2018; Janisch and Hilty, 2017)

and Rackes, 2015) many HEIs have been developing aggressive energy-reduction and climate change plans. These strategies usually require a set of targeted integrated changes to improve operational processes and technologies as well as the users' habits. In contrast, climate change education is not yet prioritised at most universities (Molthan-Hill et al, 2019).

Universities can make a direct contribution to address climate change through reducing carbon emissions of travel and energy usage interventions (e.g. renewable energy, waste-to-energy, energy efficiency). In terms of energy usage and environmental impacts, laboratory intensive buildings tend to have the highest energy usage and water consumption (Alghamdi et al., 2020). Therefore, careful consideration related to activities and carbon emission in these buildings is crucial for climate action. There is also a wide range of travel interventions that can help reduce carbon emissions (see Table 1).

Academia and NGOs tend to focus on influencing national climate change policy and regulatory frameworks (Bratman et al., 2016). The fossil fuel divestment movement has targeted the oil, gas and coal companies that are central to the fossil fuel economy, as well as the governments and organisations supporting these companies. One part of the movement is focused on encouraging universities to divest and is driven by student activism campaigns (Bratman et al., 2016). This movement has successfully encouraged HEIs as well as other organisations to divest nearly US$10 trillion (People and Planet, n.d.). If universities continue to rise to the divestment challenge they have the potential to become instrumental actors in the climate justice movement whilst supporting the environmental activism of one of their key stakeholders, the student body.

A study by Maina, Murray and McKenzie (2020) examines the extent of fossil fuel divestment campaigns at HEIs across Canada. The findings suggest that out of 220 HEIs, there are 38 active divestment campaigns; at present, six Canadian HEIs have agreed to either partial or total divestment, whereas two Canadian HEIs divested without external pressure. Table 2 summarises divestment actions at five universities; all were under pressure by groups composed of the

academic community and external stakeholders.

The circular economy (CE) is another area that could be developed to improve environmental sustainability and carbon emissions. The concept of CE is defined by Kirchherr, Reike and Hekkert (2017) "as an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production, distribution and consumption processes". Universities have developed teaching and research around CE, but they do not often engage in work related to CE on campus (Mendoza, Gallego-Schmid and Azapagic, 2019). It may be used to accomplish sustainable development and to support efforts among HEIs towards more carbon-friendly – if not carbon-neutral – operations.

Mendoza, Gallego-Schmid and Azapagic (2019) propose a framework to help universities to develop a CE strategy. It consists of measures aimed at improving resource efficiency and the environmental sustainability of their campus operations. The authors tested the framework at the University of Manchester and consider the CE approach as compatible with most sustainability management frameworks used in HEIs.

According to Leal Filho et al. (2018c):

as universities have proved to be leaders in, amongst other things, the space race and the war on cancer, they can potentially play a critical leadership role in this new era [of deep sustainability challenges]. In pursuing a more sustainable world through this new mission, universities have encountered climate change as one of the most significant challenges affecting the world today, and it is expected that they will play a key practical role in helping to solve the problems it will engender.

Initiatives to reduce the carbon footprint of HEIs should fulfil three requirements:

1. They should be part of a whole-institution framework, duly embedded into an institutional strategy;

Table 2. Summary of the actions taken by some universities to divest from fossil fuel

HEI		Description
1	University of Oxford	In April 2020 Oxford University passed a motion 'requiring its endowment fund to divest from all direct investments in fossil fuel companies, and end future investment in funds that primarily hold stock in fossil fuel companies. The motion further requires endowment managers to request evidence of plans to achieve net-zero carbon dioxide emissions from companies across Oxford's entire portfolio of investments' (Kayanja, 2020).
2	Yale University	According to the Yale Investments Office, investments in thermal coal and oil sands has declined to about 0.02 percent of the endowment's current market value since 2014. As of June 30, 2019 Yale's endowment was worth $30.3 billion. It was also considered that private investments take much longer to remove from the portfolio than public holdings, but the institution is making progress (Pavilonis, 2020).
3	University of California	Since 2014 the University of California started its divestment process. In September 2019, the University announced that it 'would divest not only its $13.4 billion endowment from fossil fuel companies but also its $70 billion pension fund. The UC system's commitment to complete divestment of its huge investment portfolio demonstrates that divestment is both feasible and financially sound' (Leddy 2019)
4	Münster University	In 2018 the University of Münster has pledged to become the first German University to divest from coal, petrol and gas investments. It is the first university in Germany to exclude investments in this sector (Dohle, 2018).
5	Cornell University	After a semester of protests and assembly votes, the Cornell University Board of Trustees voted to divest from fossil fuels. The Board's Investment Committee made a decision to implement a moratorium on new private investments focused on fossil fuels and to increase investments in alternative and renewable energy (Stamm, 2020).

2. They should be integrative, i.e. have the support and participation of members of staff and students;

3. They need to be continuous, i.e. not be delivered by means of short campaigns or actions over weeks or months, but as a long-term effort lasting decades.

Also, as stated by Sinha et al (2010), inventory databases may be deployed, as a means of keeping a record of emissions and measuring progress over a period of time.

In conclusion, universities are in a unique position to be leading organisations in climate action and sustainable development regionally and internationally. However, universities have focused mainly on compartmentalised rather than holistic approaches which are not conducive to their leadership in these areas. They need to focus on developing and implementing holistic approaches to implement sustainability in all areas of universities' activities, embedding climate change education in their curricula, developing and implementing carbon reduction strategies whilst working towards carbon neutrality, divesting from fossil fuels, and applying CE thinking, whilst supporting related research in and knowledge exchange between the Global South and the Global North. This requires the commitment and support of university leaders at an international level.

Initiatives that help measure and evaluate sustainable development implementation in HEIs

There is a wide range of initiatives that support the implementation of sustainable development (Table 3). Some are specific to higher education (e.g. STARS) whereas others can be used in other types of organisations (e.g. ISO 14001). Some initiatives are more comprehensive than others. Indeed, some only focus on environmental issues or social issues whereas others focus only on campus management or curricular activity. There are also some initiatives that are student-led. Some initiatives to measure and evaluate sustainable development implementation in

HEIs are significantly more time and resource intensive (e.g. the SAQ tool) than others which provide a quick overview of sustainability on campus (e.g. the Campus Sustainability Selected Indicators Snapshot). Some have more international relevance than others (e.g. Times Higher Impact Rankings).

Increasingly, HEIs are using environmental management systems to support the implementation of sustainable development in their activities (i.e. 14 HEIs across the world in Velazquez, et al., 2006; and 47 in Europe in Disterheft et al., 2012). Environmental management systems often follow a Plan-Do-Check-Act cycle that universities have been using mainly for campus and operations activities. This cycle supports a focus on improvement rather than solely on assessment, which is crucial to progress towards sustainable development (Roos and Guenther, 2020). ISO 14001 has been achieved by universities that include research and teaching and learning in their environmental management system (Manchester Metropolitan University, 2019) which shows its flexibility for assessing the whole range of universities' activities.

The two main international formal environmental standards for universities are the International Standardisation Organisation (ISO) 14001 and the Eco-Management and Audit Scheme (EMAS) (Disterheft et al., 2012). ISO 14001 is gained mainly after pursuing participatory approaches as well as top down approaches to environmental management systems, which suggests it is a more flexible standard than EMAS which is gained by participatory approaches (Disterheft et al., 2012).

The environmental management performance literature mainly focuses on European, North American, Australian and Asian cases, and a few cases from South America. The European cases are mainly from Spain, Portugal and the UK. Despite the increasing quantity of literature, there is no evidence of one specific standard to assess environmental management performance, with the literature presenting an array of different initiatives (e.g. tools, documents, rules, rankings). The literature has a particular focus on participatory approaches and stakeholder engagement (Roos and Guenther, 2020). Periodic performance appraisal is crucial in implementing continuous improvement actions and assisting decision makers (Berzosa, Bernaldo and Fernández-Sánchez, 2017).

The three most comprehensive sustainability assessment tools are the Pacific Sustainability Index (PSI), the Sustainability Tracking, Assessment and Rating System (STARS) (Bullock and Wilder, 2016), and Niedlich et al's (2020) Systemic Tool for Assessing Sustainability Governance. A common criticism is that tools do not tend to evaluate complexity which is inherent to a holistic implementation of sustainable development in higher education. Niedlich et al's (2020) tool addresses complexity whilst also accounting for governance structures, processes, instruments, and practices which tend to be more easily quantifiable. The tool is based on the results of case studies developed of 11 HEIs in Germany. The key dimensions are:

- *Politics—How is sustainability entrenched and legitimised in the HEI?*
- *Profession—How are different professional perspectives and competencies being connected?*
- *Organisation—How are cooperative work and task performance made possible?*
- *Knowledge—How is the necessary knowledge generated and used competently?*
- *The Public—How is awareness of the need for sustainable development achieved in the HEI?*

In conclusion, although there are a number of initiatives and tools that help evaluate and measure progress towards sustainable development implementation in higher education, there is no single international standard to holistically and systematically measure and evaluate the implementation of sustainable development in HEIs (Bullock and Wilder 2016). For instance, some initiatives take an environmental perspective rather than looking at the whole spectrum of sustainable development issues. Others focus on easy-to-measure issues and struggle to provide insights into the complex nature of sustainable development in higher education. The choice of tool will therefore depend on the characteristics and interests of each specific institution and its stakeholders. Universities may also choose to combine different initiatives to meet their sustainability ambitions.

Barriers and drivers for the implementation of sustainable development in higher education

Blanco-Portela et al. (2017) reviewed barriers and drivers for the implementation of sustainable development in higher education in 35 articles published between 2000 and 2016. Internal barriers included competitiveness between departments which hinders interdisciplinarity, challenges linking staff working on campus operations with academic staff, lack of incentives, lack of support from senior leaders, lack of staff training, low priority within heavy workloads, perceived lack of relevance by staff and students, lack of related institutional action plans and policies, lack of clarity in terms of institutional priorities, lack of implementation of policies and lack of financial and human resources. External barriers included a lack of societal pressure, a lack of government regulation and contested definition of sustainability.

Internal drivers included authentic learning scenarios, curriculum co-creation with students, integration of research and teaching, a focus on interdisciplinarity, flexible institutional management, mechanisms to monitor sustainable development implementation such as energy consumption and carbon emissions, commitment by staff, students and academic boards, leadership of sustainability champions, students and staff acting together as change agents, sustainable development integrated in universities' policy frameworks including strategic plans, support from senior leaders, appropriate funding and staff responsible for sustainable development implementation at the university. External drivers included external reputation, government incentives, pressure from peer institutions, assessment and certification by international experts, pressure from stakeholders, and external funding to support sustainable development implementation.

Stakeholder-related drivers and barriers are often mentioned in the literature, as these have the power to drive, but equally to hinder, sustainable development implementation, as supported by previous research (Velazquez, Munguia and Sanchez, 2005; Verhulst and Lambrechts, 2015). Therefore, understanding the role of stakeholders in sustainable development is key.

Other studies are focused in specific geographical areas. For instance, research in Portugal shows that universities face barriers such as lack of national policy frameworks to support their work, lack of financial resources, and lack of staff with relevant experience, resulting in a lack of holistic implementation (Farinha, Caeiro and Azeiteiro, 2020). Blanco-Portela, Benayas and Lozano's (2018) study focused on 45 universities based in 10 Latin American countries. Findings suggest that key drivers include international influence and standards, support from university leaders, institutionalisation of the environmental programme, commitment of department staff and networking. Key barriers include resistance by different groups, complex bureaucracy, lack of available resources, lack of leaders' support and a rigid and compartmentalised structure. Figure 1 presents some of the barriers in implementing sustainable development at universities.

The literature also offers some account of drivers and barriers from an outward looking approach. This is the case of a recent study which looks at universities' role and impact in community-based projects (Leal Filho et al., 2019b). One of the key barriers for community projects is that many local partners as well as other university stakeholders are not aware of the SDGs. There is also a lack of funding, a lack of formal support from national bodies, and a lack of relevant recognition of academic staff working on local collaborations for sustainable development. A more co-ordinated approach to policy development and implementation, increased participation from different stakeholders in the implementation of community-based initiatives for sustainability, as well as an increase in the dissemination of results and outcomes related to these initiatives would be beneficial to address gaps in current practice.

Other barriers and drivers are linked to policy frameworks. The UK has sustainable development policies that are not vertically integrated. Vertical integration means that policy issues (e.g. teaching and learning, outreach and research) are integrated at different levels of policy and this integration supports implementation (Vargas et al., 2019a). However,

Table 3. Sustainability initiatives for HEIs

Initiative	Characteristics	References
Assessment Instrument for Sustainability in Higher Education (AISHE)	Focused on priorities, goals and scaffolded approach. Specific to HEIs. Internationally recognised.	Yarime and Tanaka, 2012; Fischer, Jenssen and Tappeser, 2015; Berzosa, Bernaldo and Fernández-Sanches, 2017
Campus Ecology	Focused only on environmental aspects. One of the earlier assessment tools. Baseline for other tools. Specific to HEIs.	Yarime and Tanaka, 2012; Lozano, 2006
Campus Sustainability Assessment Framework	Focused on holistic sustainability assessment. High number of indicators. Student led. Focused on Canada and the United States. Provides sustainability profiles of a range of universities.	Yarime and Tanaka, 2012; Fischer, Jenssen and Tappeser, 2015
Campus Sustainability Selected Indicators Snapshot	Focused on environmental aspects and eco-efficiency. Quick assessment tool. Does not address processes or motivations. Specific to HEIs.	Yarime and Tanaka, 2012; Lozano, 2006
College Sustainability Report Card	Discontinued but used to develop other sustainability assessment tools such as the *Pacific Sustainability Index (PSI)*.	Yarime and Tanaka, 2012; Lauder et al., 2015; Bullock and Wilder, 2016.
Global Reporting Initiative (GRI)	Focused on reporting, most common tool amongst companies, not specific to HEIs, internationally recognised.	Yarime and Tanaka, 2012; Larrán, Andrades Peña and Herrera Madueño, 2019; Gamage and Sciulli, 2017
Graphical Assessment of Sustainability in Universities (GASU)	Adapted from the GRI. Specific to HEIs.	Lozano, 2006
Graz Model for Integrative Development	Focused on holistic nature of sustainable development and the links between universities' areas of work. Specific to HEIs.	Fischer, Jenssen and Tappeser, 2015; Mader, 2013
Green Plan	Focused on policy development and related objectives. Can be progressively implemented. Specific to higher education. Aligned with European Sustainable Development Strategy.	Fischer, Jenssen and Tappeser, 2015 ; EAUC n.d.
Higher Education 21's Sustainability Indicators	Focused processes. Challenging to measure. Specific to HEIs.	Lozano, 2006
ISO 14001	Focused on environmental management systems, not specific to HEIs, internationally recognised.	Disterheft et al., 2012; Setyorini et al., 2016; Vieira et al., 2018
ISO 26000	Focused on social responsibility, not specific to HEIs, internationally recognised.	Boer, 2013
National Union of Students (NUS) Responsible Futures	Focused on sustainability and social responsibility in the curriculum. Student led. Focused on the United Kingdom.	Cicmil, Gough and Hills, 2017
National Wildlife Federation's State of the Campus Environment	Focuses on eco-efficiency, barriers, drivers and motivations. Identifies processes. Uses small sample of data. Specific to HEIs.	Yarime and Tanaka, 2012; Lozano, 2006

Initiative	Characteristics	References
People and Planet	Specific to HEIs, focused on the United Kingdom. Student led. Provides profiles of all the HEIs in the United Kingdom. Ranks universities.	Fischer, Jenssen and Tappeser, 2015; Scarborough and Cantarello, 2018
Program Sustainability Assessment Tool (SustainTool)	Focused mainly on societal aspects and curriculum. Not suitable for assessment of the whole institution. Suitable for plans and programmes in specific parts of HEIs.	Berboza, Bernaldo and Fernández-Sanchez, 2017
Sustainability Assessment Questionnaire (SAQ tool)	Specific for HEIs. Focused on reflection to find out about weaknesses and goals. Challenging for large HEIs to complete. Time consuming.	Fischer, Jenssen and Tappeser, 2015 ; Berboza, Bernaldo and Fernández-Sanchez, 2017; Lozano, 2006
Sustainability Tracking, Assessment and Rating System (STARS)	Internationally recognised. Can be used for long term and short-term goals by institutions starting to implement sustainability or leading on sustainability. Specific to HEIs. Recognised as one of the most comprehensive sustainability assessment tools for HEIs.	Yarime and Tanaka, 2012.; Fischer, Jenssen and Tappeser, 2015 ; Caeiro et al., 2020; AASHE n.d.; Bullock and Wilder, 2016
Systemic Tool for Assessing Sustainability Governance	Specific for HEIs. Focused on governance.	Niedlich et al., 2020
The Eco-Management and Audit Scheme (EMAS)	Not specific to HEIs. Focused on environmental performance. Focused on progress.	Torregrosa López et al., 2016; Disterheft et al., 2012
The Pacific Sustainability Index (PSI)	Based on the College Sustainability Report Card, Focused on environmental and social aspects of sustainable development. Recognised as one of the most comprehensive sustainability assessment tools for HEIs.	Bullock and Wilder, 2016
Times Higher Impact Rankings	Focused on the SDGs, specific to higher education. Ranks universities. International relevance.	Paletta et al., 2020
UI Green Metric	Focused on ranking universities globally. Internationally recognised. Specific to HEIs.	Fischer, Jenssen and Tappeser, 2015; Caeiro et al., 2020; Lauder et al., 2015
Unit-based Sustainability Assessment Tool (USAT)	Focused on teaching and learning. Indicators are subjectively assessed and has no mechanisms for standardisation. Therefore, benchmarking is not possible.	Berboza, Bernaldo and Fernández-Sanchez, 2017

Figure 1. Some of the barriers in implementing sustainable development at universities
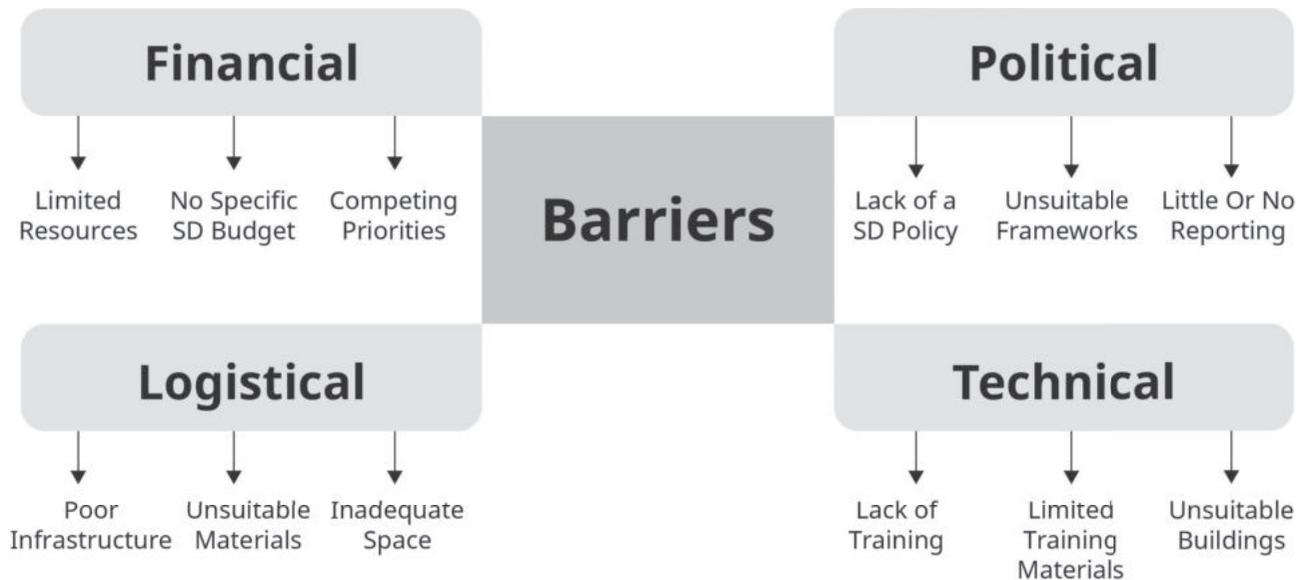
sustainable development activity at universities is not always driven by policy frameworks (Leal Filho et al., 2018a). Instead some universities have been leading sustainable development implementation through bottom-up approaches that result in policy development at national and international level.

The literature on sustainable development in higher education shows how complex barriers and drivers are but does not provide a systemic view of how barriers can be overcome and drivers can be used in different contexts (e.g. social and political at country level) while recognising organisational characteristics (e.g. universities' size, type, focus, location).

Leadership and organisational management of HEIs on sustainable development

Environmental sustainability is a dominant narrative in international university networks working towards the implementation of sustainable development, such as the Global Universities Partnership on Environment for Sustainability (GUPES), Global University Network for Innovation (GUNi), International Association of Universities (IAU), and Higher Education Sustainability Initiative (HESI) (GUNi, IAU and AAU, 2011; Ruiz-Mallén and Heras, 2020). In addition, there is a critical narrative which is focused on alternative views of the Agenda 2030 (Ruiz-Mallén and Heras, 2020).

Apart from aspects of curriculum and research, sustainable development is often promoted through declarations, and by means of partnerships between institutions (Kawabe et al., 2013; Qian, 2013; Lozano et al., 2015). One special feature of HEIs is that they have local and global connections, allowing them to work together towards broader objectives such as the SDGs (Findler et al., 2019). But such goals are more likely to be achieved through leadership that motivates staff, students, alumni and the surrounding community to participate (Trencher et al., 2014; Findler et al., 2019).

According to Leal Filho et al (2020), sustainability leadership:

> *entails the processes which leaders, policymakers, and academics undertake in order to implement sustainable development policies and other initiatives within their organisations. It encompasses approaches, methods, and systemic solutions to solve problems and drive institutional policy towards more sustainable organisations. (Leal Filho et al 2020)*

This definition takes into account that organisational management in universities is essentially geared towards implementing sustainable development at the institutional level (Aleixo, Leal and Azeiteiro, 2018). A study carried out by Mader et al. (2013)

highlights that management support is important in promoting leadership that is proactive, and which fosters clear forms of communication. This approach ensures integration of sustainability into all strategic interventions, ensuring the engagement of staff and students, and supporting longer-term sustainable development activities. This is an important detail, since lack of support from the leadership often means that sustainability-related activities are undertaken on an *ad hoc* basis, with little lasting impact. Table 4 outlines features of sustainability leadership in higher education.

But support from the leadership does not need to be rigid (i.e. being controlled from the top). Rather, this support can be offered with a requirement that units within an institution find the best way to implement their sustainability plans. Studies have demonstrated that flexible organisational structures encourage more effective sustainable development (Barth, 2013).

University leaders may choose to embrace or disregard sustainability (Grindsted, 2011; Aleixo et al., 2018). Institutions successfully promoting sustainable development have purposeful leadership and governance systems in place, allowing for a meaningful engagement and offer a fertile ground for innovative practices. The promotion of SDGs is not always easy for institutional leaders, as they may clash with other institutional goals (e.g. increases in student numbers).

An example of leadership that promote sustainability is the American College & University Presidents' Climate Commitment. This was created by multiple HEIs to promote climate neutrality and sustainability in their respective organisations. The members involved in the committee provide leadership-by-example with the aim of reducing greenhouse gas emissions and promoting sustainability (Dyer and Dyer, 2017). Another example is using sustainable development as a tool to increase an institution's competitiveness. As more universities engage in entrepreneurial activity, the implementation of sustainable development initiatives may add a competitive edge (Guerreto, Urbano and Fayolle, 2016). Sustainability practices not only help to reduce operational costs and decrease carbon footprint, but may also act as a marketing tool. A growing number of European universities have realised that, where leadership is strong, great advances in sustainable development may be made (Dlouhá, Glavič, and Barton, 2017). Therefore, some universities have successfully ensured that not only specific, institutional aims, but also broader goals – such as the SDGs – are pursued.

Conclusion

Whereas the growing importance of sustainable development constitutes a challenging trend for higher education, universities can master such a challenge by suitable study programmes, research and extracurricular activities which may help to prepare future generations of professionals – and political and social leaders – for tackling climate change. HEIs should

Table 4. Features of sustainability leadership in higher education

Leadership trait	Features
Promotes a wide perception about the scope of sustainability issues	Appreciation of the magnitude of changes at the institution
Fosters collaborative decision-making	Engagement of all stakeholders in decisions concerning the whole organisation
Develops organisational learning	Using the opportunities to learn under a sustainability perspective and adjust current practice
Seeks institutional synergies	Maximises the potential for interactions among internal stakeholders
Makes sense of complex circumstances	Helps to determine the best course of action
Advocates interconnections	Consolidates institutional stability

also endeavour to embed sustainability thinking as part of their institutional practices.

The research results summarised here have practical implications for HEIs, and may support the advancement of research, educational programmes and extension activities related to sustainable development. For instance, many tools are available, but their deployment needs to be aligned with institutional aims and targets. It is important that the leadership of HEIs is behind sustainability-driven efforts, and provides a framework against which staff see sustainability and climate change management as worthy goals. This may help to harmonise the efforts undertaken within HEIs as they endeavour towards a better future.

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Section II:

Country Cases

Chapter 4:
Brazil

Amanda Salvia and Luciana Brandli

Sustainability and Climate Action in the Higher Education System

Brazil is rich in natural resources and biodiversity. Given its large territory and hydrological conditions, a major share (83%) of the national electricity mix is considered renewable (with 64.9% represented by hydropower) (EPE, 2020), although more efforts are necessary to increase the use of other renewable energy sources. Economic activities demand extensive use of land and resources such as water and energy, and cause environmental degradation. Since 2019, Brazil has been receiving increased attention due to the political position of the incoming government towards environmental and sustainability issues. The country has a comprehensive framework of environmental protection and climate change policies, including the National Policy on Climate Change and a series of environmental laws, such as the National Environmental Policy, the Solid Waste Policy, the Water Resources Policy and the New Forest Code. Nevertheless, it lacks resources and governance measures for putting these in practice and having these monitored and supervised.

Brazil has a large higher education system and within it complex and diverse approaches to sustainability and climate change. The last Brazilian Higher Education Census (INEP, 2019) listed a total of 2,537 higher education institutions, of which 199 are designated universities. Although less than 11% of all institutions are public, the rate increases to 54% for universities. In addition to the regular public and private (including for- and non-profit) universities, Brazil has also a third group characterised by a community approach. Community universities can be seen as a hybrid model between public and private institutions: although fee-paying, these have a non-religious and non-profit private character, and strong commitment towards the development of their local communities through teaching, outreach and research activities (Fioreze and McCowan, 2018).

The sustainability practices of HEIs are usually adapted to the reality of local communities, through provision of social projects and health services for people that live around the campus, or by improving the surrounding environment. Practices aim to integrate the academic community with the environment around them and seek community involvement (Moura, Frankenberger, Tortato, 2019). Although some of these practices involve the whole academic community, many others tend to be practised by specific groups, as isolated and non-institutional efforts. In a study on environmental sustainability, Brandli et al. (2015) identified barriers that hinder efforts in Brazilian universities, such as the lack of mandatory institutional strategies to motivate the academic community to engage in sustainability and the belief that there is no space for implementing sustainability measures within the regular agenda of universities. These barriers relate to challenges to integrate sustainability in Latin American HEIs (Blanco-Portela et al. 2018), including lack of leaders' support and a rigid and compartmentalised organizational structure.

When climate change responses are concerned, similar challenges are observed. Some universities in Brazil do not yet attach importance to climate change and have isolated contributions from individual professors (Molthan-Hill et al., 2019). Climate change education is also weakly investigated in the country (da Rocha, Brandli and Kalil, 2020), and there is no official regulation to formalise education for sustainable development and climate change in Brazil. As per Pinsky, Gomes and Kruglianskas (2019), one of the major obstacles to an integrated research agenda on sustainability is the absence of demand from the public and private sectors. Therefore, the role of universities in relation to climate action should have an integrated and multidisciplinary teaching and research agenda, considering local and global challenges and government resources to foster a low-carbon economy enabled by a sustainable use of resources.

The 2030 Agenda and the SDGs emerged as a way to guide efforts towards sustainability and also to

support isolated initiatives observed in HEIs. In terms of corporate social responsibility, a broader commitment from HEIs to the SDGs is needed, as well as increased adaptation and change to support teaching, research and practice in relation to sustainability issues (Moon, 2019). In this sense, along with the development of the 2030 Agenda, the Brazilian network "Rede ODS Universidades" (Universities SDG Network) was created in 2017 as a partnership between the United Nations Development Programme and universities aiming at strengthening teaching, research and outreach activities to promote sustainable development in line with the goals (United Nations, 2017). Another network is the SDG Accord, which reinforces the commitment of universities and researchers to the 2030 Agenda as a collective response. Part of this Accord was the Climate Emergency Letter, an additional and specific commitment towards the attainment of SDG 4, related to Quality Education and SDG 13, on Climate Action. In Brazil, the University Centre of Brusque (UNIFEBE), the University of Southern Santa Catarina (Unisul) and the Federal University of Pará (UFPA) signed the letter and acknowledge the importance of sustainable development and climate change. There is also La Unión de Responsabilidad Social Universitaria Latinoamericana (the Union of Latin American University Social Responsibility) – URSULA, which is a space for critical discussion of the role of higher education in Latin America and is based on university social responsibility related to the SDGs (Vallaeys, 2019).

The Times Higher Education Impact Rankings is, to date, the only global performance table to assess universities against the SDGs. With more than 760 universities evaluated in 85 countries, Brazil is represented by 30 institutions. Among the first 100 in the ranking are University of São Paulo (14th) and Londrina State University (91st). The assessment shows the best outcomes in terms of practices in each university and their contributions to the SDGs, helping guide future efforts.

Another initiative is the creation of the Rede Clima (Climate Change Research Network) from the Ministry of Science, Technology and Innovation. This network includes universities and research centres in

Brazil focusing on topics from the physical bases of climate change to its impacts, vulnerability and adaptation. The Rede Clima includes a team of scholars of the most varied academic backgrounds working towards interdisciplinarity (integration and collaboration) in the climate change research field (Araujo, Ometto and Soares, 2019).

Education for sustainable development and climate change education are not yet consolidated in Brazil (Silva, Costa and Borba, 2016). Therefore, varied strategies can be found in Brazilian universities, from isolated actions to institutionalised initiatives. In terms of teaching, for example, Brazil tends to have a strictly discipline-focused curriculum in higher education, where initiatives of general modules for all undergraduate courses are not commonly applied. In general, waste management and renewable energy have great potential for implementation in campus operations (Avila et al., 2019; Moreira et al., 2018) by reducing environmental impacts and carbon emissions. Research covers a wide range of topics, which vary depending on the region and the environmental problems and climate change impacts observed; nonetheless, there is a lack of practical implementation of this research, especially on environmental sustainability (Santos, 2018).

The following section provides two case studies to illustrate sustainability and climate change responses in Brazilian higher education institutions.

Institutional Case Studies

University of São Paulo

The University of São Paulo (USP) is one of the biggest public higher education institutions in Brazil and is considered the best university in the country, according to the Times Higher Education ranking of 2020. Founded in 1934, USP has around 100,000 students, 5,000 professors and 13,000 staff members. The university has campuses in eight locations in the state of São Paulo.

The university has a number of offices affiliated to the rectory to manage issues such as social work and communication, institutional relations and health. There is also a Superintendence of Environmental

Management (SGA, in Portuguese), which has the important role of incorporating the environmental dimension of sustainability in all policies, plans and activities of the university. USP also has the Interdisciplinary Climate Investigation Centre (INCLINE) which encompasses projects and researchers of several different areas within the university, with the aim of linking groups that work on climate change. There is also the offer of interdisciplinary subjects within all courses and workshops for all the academic community.

USP started to develop independent actions related to sustainability after the United Nations Conference on Environment and Development, also known as Rio 92, when awareness of the importance of sustainable development and environmental preservation increased. In the following years, programmes related to recycling ("USP Recicla") and water and energy savings ("PURE" and "PURA") were implemented. After some years of environmental issues being coordinated by a working group, the Superintendence of Environmental Management was created in 2012 and USP started to have a more institutional view of sustainability and environmental preservation actions, leading to the creation of the USP Environmental Policy in 2018. This policy indicates what should be done within the university to support environmental sustainability, including the development of environmental master plans for all campuses, environmental programmes related to ecological reserves and pilot projects, environmental inventories, a corporate data information system, environmental monitoring within the campuses, and environmental education. The policy and its sustainability actions are aligned with the university mission and motivation, as commented in the interview with Prof. Dr. Tercio Ambrizzi[1] of the Department of Atmospheric Sciences:

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1   Prof. Dr. Tercio Ambrizzi is Full Professor of the Department of Atmospheric Sciences at IAG / USP. He works in the area of Atmospheric Sciences, with an emphasis on dynamic meteorology, numerical modeling of the atmosphere and climatology. He is General Coordinator of INCLINE and Superintendent of Environmental Office at USP, and, a member of the Governor's Council for Environmental Matters and member of the Brazilian Academy of Sciences.

The university's mission is to educate and generate research. When thinking about this in terms of actions to mitigate carbon emissions - and therefore minimise the impacts of climate change – and of sustainable and environmental preservation, I think the basic motivation of the university is to effectively serve as an example for society and to act in terms of increasing scientific knowledge. I think this is the biggest motivation that the university should have – searching for innovation in all these actions and transferring this to society.

Although there is no policy related to climate change, INCLINE has the role of connecting the different efforts of the university and representing USP in international networks related to climate action. Additionally, the university has several initiatives to reduce carbon emissions, such as a reduction in the use of official vehicles, and virtual thesis defences. For the latter, the USP digital system reports the carbon footprint saved whenever an online event of this kind is held. Efforts to increase the use of renewable energy on campus have also been made, in partnership with the university's Institute of Energy and Environment. In order to contribute to these initiatives, the Superintendence of Environmental Management has been gradually implementing the use of shared bicycles on all campuses; plastic cups are no longer offered in restaurants; and there are also community gardens and compost bins in some faculties. Prof. Dr. Ambrizzi continued:

The role of the university is normally seen as a tripod (teaching, research and extension), but in fact we can say that there is one more item: sustainability. We cannot have any of them properly functioning if we do not involve sustainability.

The university has also been working towards the SDGs. The Pro-Rectory of Culture and Outreach has launched a project call on "Promotion of culture and outreach initiatives linked to the SDG-UN". The rector's office will provide funding of around US$ 90,000 for several projects connected to the SDGs. Projects are required to involve students and professors, contributing to greater academic community participation. The SGA also receives a share of budget from university management and as climate

change and sustainability are among its core actions, these resources are used as seed money for projects in this area. Additional financial support is pursued from other funding bodies, such as FAPESP and CNPq (state and national research funding agencies).

The SGA is currently developing a specific course on the SDGs, sustainability and environmental education. Students will learn more about sustainability, its importance and history, and climate change. The university is also working on the possibility of students pursuing this module outside their mandatory curricula. The university management believes this is a better approach rather than making the course mandatory for all students, which could be considered an excessive imposition. Additionally, the Superintendence supports a process called "people who learn by participating" (PAP). This process works as a socioenvironmental education programme for staff members and aims to include sustainability in university management decisions and promote sustainable actions within the institution (Sudan et al., 2015).

USP is one of the few Brazilian members of the International Sustainable Campus Network – ISCN. This network aims at sharing best practices for sustainable campus operations and for the integration of sustainability topics in teaching and research. In 2016 the university was awarded in the aspect of Excellence in Campus, due to its efforts and outcomes in environmental planning and policy development. The recognition of these efforts is seen also in the position of the university in important international rankings. USP is the 14th most sustainable university in the world, according to the UI GreenMetric World University Ranking 2020, and occupies the first position in Latin America. The ranking evaluates aspects of infrastructure, education, research, energy and climate change, waste and water. Additionally, the university ranked 14th in the Times Higher Education (THE) University Impact. This ranking assessed how universities have been contributing to the SDGs through stewardship, research and outreach. USP was among the three best institutions (of a total of 768 worldwide) in fighting poverty and providing clean energy. These results are due to the support given to low-income students and to the investments in renewable energy (especially solar) on campus.

One of the main challenges to sustainability and climate change efforts is to encourage academic units to communicate more about ongoing projects and make these efforts institutional rather than individual. The more institutionalised these projects are, the greater the chance they will last longer and be more successful. Communication outside academia is another challenge. Making society and decision-makers aware of the university contribution to different sustainability or climate approaches is fundamental for not only being recognised as important institutions in this agenda, but also to understand the need for human and financial resources. Furthermore, the association between university and decision makers needs to be strengthened, especially for further advancements in the area of science and technology for sustainability purposes.

On the other hand, driving forces to promote sustainability and climate action at USP include being an example to society, increasing knowledge availability and innovation, and passing on the sustainable practices to the community. As a public university, it is important to show society that invested resources (funded by public taxes) are well used and benefit the community. One means of ensuring this is the participation of university researchers in the events of the Legislative Assembly of the State of São Paulo. In these events, the outcomes and importance of research are presented, raising awareness of university efforts and securing budgets for research, teaching and outreach.

Although some of USP's efforts may be similar to universities that have been investing in sustainability for longer periods, in Brazil USP is a role model. In addition to governance that supports sustainability, the availability of resources and the volume of academic, research and outreach units also account for this role model status.

University of Southern Santa Catarina
The University of Southern Santa Catarina (UNISUL) is a community university guided by efforts of social responsibility and innovation, committed to integrating teaching, research and outreach for community development. UNISUL was founded in 1964 and is located in the southern state of Santa Catarina, with

campuses distributed across six cities. It has around 20,000 students, 230 undergraduate and graduate courses, and more than 300 research projects.

In addition to the mission of promoting education, developing science, technology and innovation, and improving life in society, UNISUL also contributes to sustainable development. As mentioned by the Rector Prof. Dr. Mauri Luiz Heerdt[2], universities must adapt in order to be integrated with the community. They must be concerned about problems experienced by society, and be deeply involved with promoting solutions:

> *Today universities are more committed to act together to avoid certain impacts and to promote sustainable actions that offer continuity for the future. In short, this is the university's mission. There was a time when the university did this from above, as on a "pedestal", but today it has to integrate with so many other entities and become deeply involved. It has to be completely involved with people and their needs to make a transformation. This social movement can make life better.*

UNISUL is member of a regional social movement for the Global Goals and leads local efforts related to the 2030 Agenda and sustainable development. A next step is an institutional report to be presented in accordance with each SDG, communicating how each member of the academic community has been contributing (or can contribute) to these goals.

The university does not have a specific position, sector or budget for sustainability and climate change-related activities, since it is considered that these efforts should be universal in the whole institution and in all approaches, especially teaching, research and outreach. Each one of these areas has their specific budgets and, as sustainability is included

in the Institutional Development Plan, they should focus as much as possible in this topic, with climate change included.

To ensure the promotion of professors' learning and awareness, comprehensive training on environmental education is given to all professors twice a year so that they can include sustainability in their classes and promote actions and reflections on the topic. This initiative supports the university's attitude towards sustainable development and provides education to raise awareness and promote behaviour change.

The university has encouraged various research groups to be created. With particular importance for UNISUL is the Research Centre for Energy Efficiency and Sustainability (Greens), a group that has been developing several studies on sustainable development, both locally and internationally. The group was founded in 2014 and aims at transforming lives through research. It includes more than 30 researchers in the water-energy-food nexus, climate change mitigation strategies, sustainable development and the SDGs, environmental education, green campuses and living labs, sustainable cities, environmental justice and refugees, and empowerment of girls and women. Greens also coordinates the project BRIDGE (Building Resilience in a Dynamic Global Economy) in Brazil, an international partnership the led by the University of Cambridge and funded by the Newton Fund. One of the most important outcomes of this partnership was the implementation of a solar hydroponic greenhouse at the university, which has reduced water consumption by almost 90%, reducing the use of chemicals in food production and increasing the use of renewable energy. In addition to producing vegetables (to be used both within the university and donated to schools, churches and nursing homes), the greenhouse is also a learning environment for students.

UNISUL has also developed a graduate programme in environmental sciences, covering challenges related to sustainable development with an interdisciplinary approach, connecting research and education in the main areas of technology, environment and society.

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2   Dr. Mauri Luiz Heerdt graduated in Philosophy with Specialization in Strategic Management of Higher Education Institutions and has a PhD from the University of Cambridge. He has held many university management positions in recent years, and is currently Rector of the University of Southern Santa Catarina.

An important aspect related to both teaching and outreach at UNISUL is the Environmental Education Programme. It follows the institution's environmental education policy, which envisioned, among other things, the provision of at least one learning course with an environmental education approach in undergraduate courses, the integration of environmental education in research and outreach initiatives and the offer of environmental education training to teaching staff. Although integrated, the efforts of this programme are decentralised within the scope of teaching, research and outreach management, in order to make the environmental issues transversal in the university. The programme has a variety of actions, from simple initiatives (such as campaigns to raise awareness about the correct disposal of cigarette butts, and movements to stop the use of plastic cups, among others[3]) to more elaborate ones such as the "Green June" initiative and mandatory teaching training. The "Green June" initiative offers workshops, debates and activities to raise awareness and promote actions to contribute to sustainable development for students, staff and the local community. UNISUL also coordinates the Water Resources Plan for some water basins in the state and partners with CELESC (the state energy company) to support the installation of photovoltaic solar panels in campuses.

Aspects that hinder the implementation of climate change and sustainability efforts at UNISUL are a lack of understanding about finite resources, and

consequently, the lack of appreciation of actions taken. It reinforces the need for having climate change included in everyday conversations and actions, since its impacts can be experienced by and discussed with everyone – researchers, leaders, families and societies in general. The importance of changing this view was highlighted by the Rector of UNISUL:

> *We still lack a perspective in the future where everyone can fit, and not to act arrogantly, in an authoritarian and predatory way, in relation to the environment, which will cause profound damage to the environment.*

UNISUL calls for attention to be paid to the natural resources and social and economic injustice, and has taken on the mission and responsibility to communicate, teach and inform sustainable action for a better future. In doing so, the institution needs to be directly and deeply involved with the community, promoting transformation and integration with sustainability practices.

Challenges and Opportunities: The Way Forward

The literature presents some challenges that can be experienced when climate action and sustainability efforts are to be applied in higher education institutions (Leal Filho et al., 2018a, 2018b). These include lack of funding, lack of interest from the academic community and lack of support from top administration. The case studies presented in this chapter demonstrate that although some challenges are indeed general – such as the need for resources to make major investments and for governance that supports sustainability and climate action – other challenges depend strongly on the context, type and magnitude of each university. For both universities, the process of communication is a key challenge, and is connected to strengthening academic efforts and having support from the local community. Effective communication ensures that university efforts are disseminated, that its role is valued and the provision of resources is justified.

The different approaches presented by the case studies demonstrate how decisions need to be made in

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3   Other examples of initiatives include a) Ecological disposal of batteries: with a local school and energy and waste companies, the university organised this project to collect old batteries and correctly dispose of them; b) Selective collection and recycling: developed by the university library and the Internal Commission on Accident Prevention, this project focused on plastic and paper waste, encouraging students and the local community to take these materials to collection points for recycling. The funds raised are then used for library reading projects, representing positive environmental and social outcomes of this initiative; c) Less paper and more preservation: promoted by the Pro-Rectory of Administration and Academic Services, this campaign aimed at making the academic community aware of the impacts of wasting paper, encouraging behaviour change regarding its use and whenever possible, changing to digital resources.

accordance with contexts and sizes. While UNISUL is able to implement sustainability institutionally and within each area of the university, USP is a much bigger institution which demands a specific unit for handling these issues. With so many academic members and units, the university management needs to support a team to collect information, understand and connect the different efforts and integrate the community. Regardless of the university size and category, though, leaders realise that sustainability and climate efforts need to be developed together, otherwise the academic community does not relate individual efforts to these bigger aims. Each small action adds up and gradually contributes to reduced environmental impacts and a reduced carbon footprint within and around the university. However, actions need to be implemented carefully and not authoritatively or harshly to avoid alienating the community.

For both universities the major driver to focus on sustainability is the university role and commitment to society: as a public and a community university, the institutions are expected to contribute to the community and improve life in society. The distinctive practice of University of São Paulo and University of Southern Santa Catarina in terms of sustainability and climate change might be associated to their classification and also to an adequate combination of availability of resources – through national and international funding – and of governance that supports these issues – through specific sectors or with shared responsibility among teaching, research and outreach. Brazilian university leaders should see these challenges and drivers as opportunities to frame the way forward, deciding on specific approaches to follow based on their context. As HEIs in Brazil are particularly diverse, strengthening networks such as URSULA, the Universities SDG Network and the SDG Accord could help overcome challenges. These networks encourage the creation of an institutional culture, articulate interinstitutional activities, promote actions for socialisation and the exchange of experiences, disseminate these actions through various communication channels, and act as a point of consultation and support for institutions.

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Chapter 5: Germany

Walter Leal Filho

Sustainable development in Germany

The pursuit of sustainable development has a long tradition in Germany. For many years the country has defined various goals and indicators and has developed a variety of initiatives to achieve sustainability (Scholz, Keijzer and Richerzhagen, 2016). There is widespread belief that a good life for all can only exist in the long term if political decisions are based on the guiding principles of sustainable development. Therefore, the Federal Government is committed to an ever stronger emphasis on sustainability principles, taking them into account as part of the decision-making at all levels (national, regional, local) and by involving all relevant actors. As a demonstration of commitment to sustainable development, the German government approved a Strategy for Sustainable Development (Strategie für Nachhaltigkeit) in 2009. Since 2016, the strategy has been geared to the goals of the United Nations' Agenda 2030 for sustainable development. It is now being revised, and a new version is expected to be approved in mid-2021.

Sustainability efforts in Germany also count on the support of the German Council for Sustainable Development (Rat für Nachhaltigkeit) or RNE, which was created in 2001. RNE advises the German Federal Government on sustainability issues and is intended to help develop and implement the Strategy for Sustainable Development with advice and specific projects. A further task of the RNE is to strengthen the perception of sustainable development among the population and to make sustainability an important public concern. The Council is made up of 15 personalities from the fields of business, environmental protection, agriculture, social policy, science and development cooperation, as well as representatives of trade unions and churches, who are appointed by the Federal Chancellor for a three-year term of office.

To promote and achieve the 2030 Sustainable Development Agenda, the German government developed a framework which includes the contribution of education for sustainable development (ESD). In Germany ESD is implemented across different levels including national, federal-state and the local levels. This allows for sustainable development efforts to be deployed and progress to be achieved at different stages and levels (Bormann and Nikel, 2017).

Aside from educational programmes, Germany has invested in a variety of political initiatives that focus on sustainability. There are six key areas (Domröse et al., 2019):

1. mobility and transport
2. clothing and textiles
3. food
4. consumption at home
5. leisure and tourism
6. sustainability at the workplace

Significant efforts have also been made in the field of energy – especially in renewable energy production – aimed at reducing CO_2 emissions, which are complemented by measures such as the promotion of travel by public transport, and fiscal incentives to encourage electric mobility. These have been largely successful as Germany today has one of the highest levels of renewable energy generation in the European Union from around 6% in 2000 to around 42% in 2019, thus exceeding the target of 35% for 2020 ahead of schedule (Federal Environment Office, 2020). Also, it has a new fleet of public buses powered by renewable energy or electric engines, and has substantially extended the number of cycle paths, which is now nearly 12,000 km long (European Cyclists' Federation, 2020).

Sustainability and climate action in the higher education system

As an example of efforts at university level, the project "HOCH-N", launched in 2016 and funded by the German Federal Ministry of Education and Research (BMBF), promoted sustainable development in line with the SDGs at German higher education institutions. It conducted research in the fields of governance, sustainability reporting, teaching, research,

transfer and operations. This has resulted in six action guidelines that can be used by other universities for a "low-threshold entry" into sustainable-related work at universities[1].

The current policy on sustainable development in universities has been recently reviewed by Singer-Brodowski et al. (2019). At the federal level, six of the 16 states have so introduced sustainability in their university development plans, as a sign of a greater awareness about the relevance of the topic. Moreover, many universities have agreements ("Hochschulverträge") with the responsible Ministry of Higher Education and Research, which requires universities to implement sustainability and climate change projects and research in their institution (e.g. FU Berlin). The German Rectors´ Conference has issued 71 resolutions and recommendations. So far, 8 of them refer to sustainable development. At the federal level the regional rectors´ conference of North-Rhine Westphalia includes sustainable development in the innovation strategy and higher education act. According to Singer-Brodowski et al. (2019), only six of the 15 surveyed universities have a mission statement on sustainable development with varying scope. Furthermore, universities which follow a whole-institution approach (e.g. HNEE) are still rare.

However, several universities have committed to becoming carbon neutral in addition to GHG management and reporting (Button, 2009; Udas, Wölk and Wilmking, 2018). These include the Umweltcampus Birkenfeld of the University of Applied Sciences in Trier, Leuphana University Lüneburg, the Hochschule für Nachhaltige Entwicklung Eberswald (HNEE), Greifswald University and the Freie Universität Berlin.

Education (Teaching and Training)
Despite efforts to include sustainability and climate action in policies and charters, sustainable development has not reached a full scale application in teaching and research in Germany. Part of the problem is integrating sustainability into the university curricula and fully involving teaching staff (Barth and Rieckmann, 2012). Resources to support sustainability teaching are often limited, and initiated activities are often *ad hoc*.
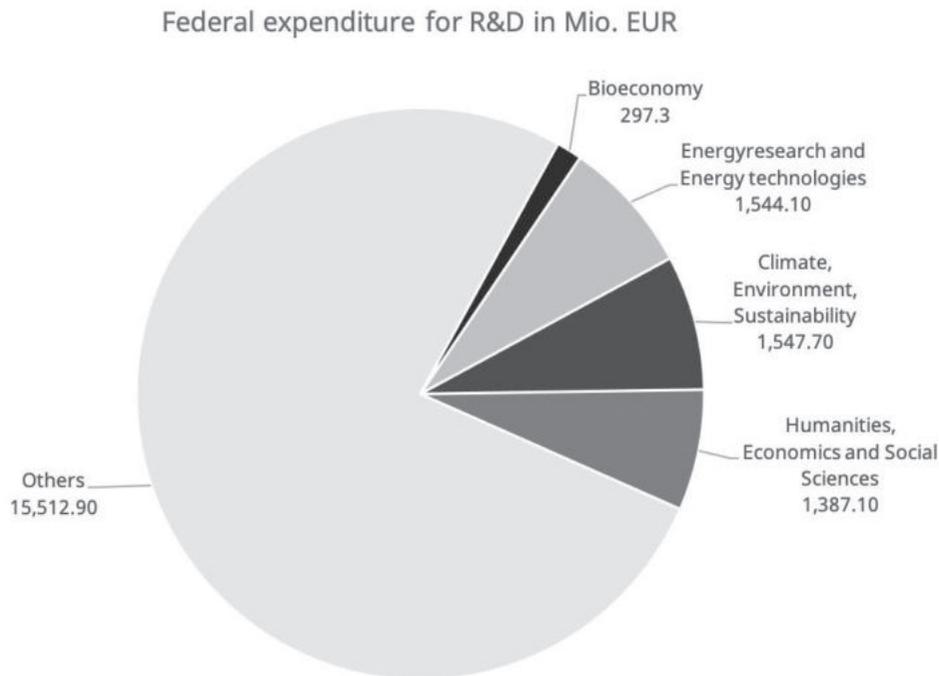
Universities which have translated policy into action should serve as an example for other institutions (Müller-Christ et al., 2014). According to the platform "Hochschulkompass" of the German Rectors' Conference, which details all study courses offered in Germany, only 223 of 20,462 higher education courses explicitly stated *sustainability* or *sustainable* in the course description (HRK, n.d.). A query on the webportal *www.studieren.de* revealed that 29 study programmes at 17 universities with the keyword "Klimaschutz" (xStudy SE, n.d.). Nevertheless, other courses and study programmes might include single modules related to sustainability or cover sustainable development as part of a general skills course, which is available for all students (e.g. at FU Berlin, Hochschule Zittau-Görlitz, or include sustainability as a mandatory introductory lesson for the first semester student (e.g. at HNEE and Leuphana).

Climate-related Research
Investment in climate research is essential for a credible climate policy. The German Government supports research, innovation and education in order to achieve the goals of the Paris Agreement as well as European policy (the EU New Green Deal) and the national climate mitigation targets (e.g. Klimaschutzplan 2050 und Klimaschutzprogramm 2030, Deutsche Anpassungsstrategie (DAS)). The term "climate research" can be defined broadly. There is, for example, a broad research portfolio including research policy input into the climate protection plan, climate system research, the provision of climate-related information to support decision-making as well as research on mitigation and GHG emissions. German climate research holds a leading position worldwide and is embedded in European and international research policy and international agreements on scientific and technological cooperation. German universities often exploit opportunities for "third-party-funded" projects (Drittmittel). These are funding streams outside of a university's annual budget, which is usually obtained in responses to "Calls for Proposals" issued by various funding bodies. An important funding body for basic research, is the German Research

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[1]   https://www.hochn.uni-hamburg.de/en.html

Figure 1. Federal expenditure on R&D for sustainability topics

Source: Author, based on https://www.datenportal.bmbf.de/portal/de/Tabelle-1.1.5.html

Foundation (DFG), while another funding both basic and applied research, is the BMBF.

Some of the most important research funding programmes and initiatives supported by the BMBF are:

- Earth System and Climate System Research (climate models, clouds and precipitation, extreme weather/natural hazards, carbon cycle and simulation of detection sources and sinks and fate of trace-gases).
- BMBF framework programme "Research for Sustainable Development" (Forschung für Nachhaltige Entwicklung, FONA). Funding ranges from basic research to ready-to-use applications to combat challenges of climate change and support decision-making for future-oriented action for business, politics and administration.
- Applied research: inter- and transdisciplinary research and development projects, for example on climate resilience through action in cities and regions.
- Climate adaptation in Africa: the Southern African Science Service Centre for Climate Change and Adaptive Land Management (SASSCAL), and

the African Science Service Centre on Climate Change and Adapted Land Use (WASCAL). These climate initiatives are illustrative of efforts towards international cooperation on matters related to climate change, with a special emphasis on adaptation.

Institutional Case Studies

Freie Universität Berlin (FU Berlin)
Freie Universität Berlin (Free University of Berlin) is a large university with a broad spectrum of disciplines founded in 1948. Professor Günter M. Ziegler leads the university and has been actively involved in advising projects and collaborations concerning climate change, in particular a large consortium with a special focus on water distribution and management.

Freie Universität Berlin considers sustainability and climate change as central topics for two reasons. First, as an institution with around 45,000 students, it is large enough that its strategic decisions, its campus development, and the actions of its members can have a significant impact. Second, it acknowledges that

both topics are global urgent issues with long-term effects on teaching and research at the university.

According to the university's President:

> *Perhaps, just to illustrate that we believe this is central: after the Fridays for Future discussions last year, last December Freie Universität declared [...] a state of "climate emergency". [...] That basically means that everything that we do in the years to come will always have these question on the front page: How do our actions relate to climate issues sustainability, do they contribute? Is there a problem? Do we increase or decrease our carbon footprint with this?*

Since 2016, Freie Universität Berlin has had a sustainability mission statement, developed with the expertise of the dedicated department of sustainability and energy (Stabsstelle Nachhaltigkeit und Energie) and approved by the academic senate. The climate protection management started in the year 2000. Since 2011, the university has had a climate protection agreement with the state of Berlin, which has lead to close collaboration and concentrated efforts.

In December 2019, Freie Universität Berlin set the target of a climate neutral campus by 2025. Since 2000, Freie Universität Berlin has reduced its carbon dioxide emissions by 80%. The system boundaries consider not only the buildings but also business travel as well as the emissions of the vehicle fleet, and the university does not compensate residual emissions with carbon offsets.

According to the President:

> *If this topic was new to us, it would be rather ambitious at the time to say that in 2025, we want to have the campus climate neutral. Note that this is quite a bit faster than the goals set by others, and it is ambitious, but again it is the role of Freie Universität to be ambitious in things that are important. [...] As I already mentioned in this state of climate emergency, we decided that we want to have the university climate neutral by 2025, which is in five years. This involves quite a lot of things connected to that, it is not only saving*

> *energy or burning less fuel, but the ambition is to have climate neutrality and sustainability visible in research, in teaching, in transfer [...].We will compensate that not by paying into external funds, but by doing green things on campus: at the heart of the strategy will be an ideas and innovation management system that is intended to become a driving force for new ideas and projects.*

Sustainability and climate change are understood as grand challenges, which are addressed through teaching, studying and research. Freie Universität Berlin see its campus as a living lab, which they develop and study also in order to understand the interaction between urban and natural systems in the context of sustainability and climate change. This includes, for example, a social cohesion project as well as photovoltaic systems and bee hives on the roof, renaturation of green spaces to attract insects, the implementation of a negative CO_2 emission technology (plant coal) that was developed by the university's researchers, as well as mobility initiatives such as rental bikes.

The President stated:

> *The approach for the Freie Universität itself is that we do not only look at energy consumption and what we can do in research or teaching. But we see the campus of Freie Universität which we describe as a green campus, [...] as a living land and so the questions of energy consumption, carbon footprint, sustainability, and effects between buildings and environment and so on. All of this is studied and treated and part of the policy at Freie Universität [...].*

The provost (Kanzlerin) of Freie Universität oversees all activities concerning sustainability and climate change. She is advised by the unit for sustainability and energy (Stabstelle Nachhaltigkeit und Energie), which coordinates all activities. The unit currently has eleven employees and five student assistants, and it is growing. The Vice President for International Affairs is in charge of sustainability in research and teaching. Moreover, the Executive Board (Präsidium) and the academic senate founded a steering committee for sustainability and climate protection. This committee

consists of representatives of all stakeholder groups including students and employees. In a recent evaluation of the curricula, Freie Universität Berlin found that all seventeen SDGs are addressed in teaching. In 2019, 1796 projects were conducted at the university, of which 665 (37 percent) treated sustainability issues directly.

Freie Universität Berlin is part of the Berlin University Alliance, a consortium of three universities and one hospital in Berlin (along with the Humboldt University of Berlin, the Technical University of Berlin, and the Charité - Berlin University of Medicine), which funds research and collaboration projects. In this university alliance, a major research project is being prepared on the effect of climate change on water in the Berlin-Brandenburg region. The university is also part of the International Sustainable Campus Network (ISCN). It co-founded the UNICA university network, and it is a member of the green working group within this network. Other participations include the *Una Europa* network, which is a university network in the "European Universities" programme, also known as the Macron Initiative. It is also a founding member of the U7+ network, founded in 2019 in connection with the G7 summit in Paris. The network also has members from African universities and, addresses climate change in addition to other issues. Additionally, Freie Universität Berlin co-founded the University Alliance for Sustainability in 2015: partner universities from Vancouver, Petersburg, Beijing and Jerusalem use this platform to discuss sustainability topics and find solutions across continents. As emphasised by the President:

> *We are actively involved in the UNA Europa network [...] and so sustainability issues are very important in this network - in particular again in teaching because this was started as a network focusing on teaching, but there is a focus area for that network on sustainable development and Freie Universität took the lead on that project. [...] one of the very strong things in particular in this network is the peer to peer consulting. We do learn from each other [...].*

Freie Universität Berlin wants to have a climate neutral campus by 2025. The university did not mention a dedicated risk management plan, but climate adaptation activities are part of the integrated climate protection concept.

There is currently no short-term research funding for climate change. Within the Berlin university alliance, resources are project based. However, Freie Universität Berlin will establish an ideas and innovation management system on the campus, which will have a dedicated budget for projects. Biodiversity research is undertaken by the biology, chemistry, and pharmacy department together with the Botanical Garden and Botanical Museum of Berlin, which are part of Freie Universität. To incentivize students and research in green chemistry, the university will establish a new start-up campus called FUBIC with lab spaces and more.

In the last winter semester, 16% (42) of all offered courses focused specifically on a topic related to sustainability. Moreover, since 2018, Freie Universität Berlin has offered sustainable development courses for all undergraduate students. The series consists of 9 seminars and is attended by around 200-300 students. The topics cover managing, communicating, designing and researching sustainability. Freie Universität Berlin also develops a digital sustainability toolbox, which provides teaching and learning material, and is available for all partners in the University Alliance for sustainability.

Since 2009, Freie Universität Berlin has worked closely together with schools of all districts of Berlin in a project called "schools at university for sustainability and climate protection". The project has reached around 3000 pupils of the fifth and sixth grades as well as 300 teachers annually. Furthermore, the university is currently working on an investment policy to support its climate neutrality goal. The development was triggered by students and the city of Berlin. Since 2016, the committee of new energy of the city of Berlin, works on turning the city into a divestment capital for ecological sustainable financial assets. Other external drivers are the Hochschulverträge (University Agreements with the state of Berlin), which include climate protection activities, and in particular the Climate Protection Agreement (Klimaschutzvereinbarung) with the City of Berlin,

which document the goals until 2027. In 2011, Freie Universität was the first university in Berlin – and the only one, for five years – with such a Climate Protection Agreement.

The President commented:

> *And last year it has become visible that that is not only the faculty but also the students who are active and it is not exterior things that the Hochschulverträge would require us to do something with climate. [...] The exciting thing about these Fridays-for-future students was that they were very informed from the beginning, and they had been reading and they knew what they were talking about. And they also knew where Freie Universität stood, and they knew what we have been doing since 2001. And they also acknowledged that Freie Universität is way ahead of others in these things. And then nevertheless, they wanted more and that is a good basis for talking.*

A main barrier with respect to additional efforts is a lack of financial and human resources. The university is publicly funded and operates under tight financial conditions. For example, it has been determined in 2018 that 1.3 billion Euros would be needed to refurbish and modernize all campus buildings. The related energy efficiency gains would substantially support the achievement of climate neutrality. Although staff and students agree with the sustainability efforts, the university acknowledges that the scientific world and its messages might not find acceptance in all groups of society.

According to the President:

> *I think that basically it is always a question of resources. Resources means on the one hand money, and on the other hand people, and this is if you run a university under tight financial conditions - and we are doing that and we will have to probably do that even more in coming years - then it is not that easy to move ahead and say everything that is important, we will also make possible.*

Freie Universität Berlin sees its comprehensive and

integrated approach as distinctive. According to the university, they have been most successful in energy efficiency and carbon neutrality. These activities, together with the procurement of carbon dioxide free electricity since 2010, have led to an 80% decrease in CO_2-emissions over the last 20 years. The work performed to date suggests that Freie Universität Berlin is continuously seeking to identify improvement options – in addition to more teaching and research – in order to further develop a whole-institution approach towards sustainability and climate protection policies and goals.

Hochschule für Nachhaltige Entwicklung Eberswalde (HNEE)

Hochschule für Nachhaltige Entwicklung Eberswalde (University for Sustainable Development Eberswalde) is a university of applied science in the vicinity of Berlin with a focus on sustainable development. Vice-President Prof. Dr. Heike Walk is a Professor for Transformation Governance focused on sustainability. In addition to being part of the management of the university, she teaches and conducts research on sustainability transformation and participation as well as climate change. She stated:

> *Well, from my point of view, and with regard to the mission of the Eberswalde University, sustainability and climate change are central issues, and we strive that the whole institution integrates sustainability in every study programme and in the work of every department and of every research project.*

HNEE follows an integrated sustainability concept, aligned with the SDGs. HNEE developed its sustainability framework in 2016, and ecosystems and society are seen as interrelated and interdependent. Thus, HNEE aims to keep these systems working and build resilience. According to the Vice-President:

> *We developed this framework in a very participative process. We have a so-called round table on sustainability where many employees from the different stakeholder groups, yes, students, professors, teaching staff, and also employees from the different departments, come together, discuss together, and discuss certain problems together.*

So, they started this, I would say, bottom-up process or this dialogue process, yes, within these different stakeholder groups. And I don't know how long, but I think it took more than a year, many years, to work out, to elaborate, these principles of sustainability.

Since 2007, HNEE has a certified EMAS environmental management system to evaluate, report and improve the environmental performance of all activities. Climate-related risks are assessed within the overall risk assessment of the EMAS system. Since 2014, HNEE has a dedicated climate protection team, which developed a climate protection concept in 2015. The target is a 40 percent reduction in emissions relative to 2013. It is not connected to national or international targets. Since 2014, HNEE compensates unavoidable emissions with carbon offsets and is therefore climate-neutral. Carbon offsets are in part generated by a project run by an NGO, which was funded by alumni of the university. HNEE supports the protection of the Kakamega Rainforest in Kenya by installing energy-efficient clay stoves. HNEE gives students the possibility to engage in this project and thus integrates teaching and research with emission reduction activities. The goal is to reduce compensation through declining emissions in the future.

HNEE employs a dedicated climate protection officer and an advisor for sustainability at the university, Mr Henning Golüke. Both positions are in the presidential department as a "Stabsstelle" (Operational Office). Facilities management is responsible of the operation of the energy system and executes planned changes or maintenance.

HNEE is part of the Hoch N network and of the Brandenburg Council for Sustainability. As part of the university network "Bildung durch Verantwortung" (Education through Responsibility), HNEE acts as a pilot project for service learning across all departments and officially supports other Brandenburg universities in their development of sustainability. Service learning puts civil engagement at the core of teaching and can be integrated in the environmental, business or cultural sectors. According to the Vice-President:

Service learning is a kind of showing or of putting civil engagement of our students in the centre of teaching, to show that if your students take responsibility for society with their work in NGOs or in associations, we -, in taking this engagement in our education programme, that means in teaching and doing research about this civic engagement, we try to support our students and to show that civic engagement, yes, is important for university education.

HNEE does not have a specific budget for climate change research. However, it supports a number of research areas on sustainable development, for instance sustainable rural development, sustainable production and use of natural products and sustainable management of limited resources. HNEE has published many research articles in high impact factor journals, including a book named "Humans in the Global Ecosystem". The Vice-President stated:

We do a lot of climate change research, for example, with regard to forest management, to agro-forestry, or, for example, renaturation as measures for entrenched swamps. And we established, for example, last year, a research institute for sustainability transformation which should support and promote sustainability research. [...] So even those fields, climate change, all those fields, and also in the new established institute, climate change is central [...].

An internal review of the current curricula at HNEE showed that sustainability education has been embedded in all study programmes. Every first semester student gets an introduction lecture on sustainability development.

Moreover, HNEE conducts a monthly meeting with the climate protection manager from the municipality and the district as well as managers of local and regional biosphere reserves, to update each other on current actions and developments. HNEE takes part in an electrical car-sharing project initiated by the district. To engage with the local community, HNEE also organises a future week every year with the help of the district and the city of Eberswalde. Completed sustainability projects include a reusable coffee-to-go

cup deposit system across the city of Eberswalde and, since 2017, a climate neutral semester ticket which offers free access to public transport. For HNEE, environmental awareness and ecosystem protection are the main drivers of the work of employees and students.

However, HNEE has identified various barriers. According to the Vice-President:

> *The general barriers [...] are profit interests and maybe the calculation of costs of a climate project without integrating future savings. [...] For example, not all of our cooperation partners are motivated by sustainability ideas. [...] A barrier is really that we have to keep our cooperations running [...] and to find a way for pushing sustainability topics forward but not putting off our cooperation partners at the same time. [...] I believe another main barrier is actually that we are a state institution. We have some very official requirements that come, for example, to procurement. We cannot just say we want to get our electricity from Greenpeace Energy because it's a good company. So, this makes it sometimes very difficult to act sustainably [...].*

The key characteristic of HNEE is its holistic sustainability approach, which includes all curricula, departments, and research projects. All staff support the commitment towards the SDGs. HNEE has not only specialised on sustainability topics from a technical perspective but also on the transfer of sustainability into society. Furthermore, according to the Vice-President:

> *I would say many students enrol because of our strong orientation or alignment toward sustainability, and that is very distinctive to other universities. [...] One thing I would add would be also a transfer strategy. Usually universities try to transfer technologies, but we really have the aim to transfer the idea of sustainable development into the society [like] Values, knowledge, solutions. That's also very distinctive.*

In conclusion, HNEE – as one of the few universities in the world which have embraced sustainability as a central part of their activities – has been successful in adopting an integrated approach to sustainable development in teaching and research. As to the future, HNEE intends to improve aspects related to social sustainability, which may also include measures towards behaviour change in terms of energy and resource use.

Challenges and Opportunities

The current challenges to implement sustainable development in universities are the lack of financial, material, and personal resources as well as social-orientated problems such as no interest of staff or no administrative support (Leal Filho et al., 2020a, 2020b). However, the main barrier to initiating more efforts in sustainable development is the lack of or restricted access to (public) funding and resources. This and the lack of legal requirements explains the fact that only 5 percent of German HEIs currently report on sustainability on a regular basis (Azizi, Bien and Sassen, 2018). Universities are usually publicly funded and operate under tight financial conditions. The related energy efficiency gains of retrofitting university campuses, for example, would substantially support efforts related to climate action.

Many universities feel that public and private funding often focuses on short term profitability and current cost calculations and do not take future social or environmental savings resulting from climate or sustainability actions into account. The indirect impacts (e.g. research findings diffusing into business practice) of university-initiated sustainable development is a long-term process (Findler et al., 2019), which needs continuous and secure access to resources to achieve sustainable development (Adomssent and Michelsen, 2006).

The administrative and management processes of universities also pose significant obstacles for sustainable development (Leal Filho et al., 2017). The bureaucracy of a state-run public institution leads to restrictions, which might lead into conflicts with ideas of sustainability and climate change. For example, universities' procurement policies focus on a cost-effective use of public money and thus hinder the purchase of regionally or locally generated renewable

power, which might come at a higher price. However, sustainable procurement policies (Leal Filho et al., 2020a) in combination with optimised planning activities (Leal Filho et al., 2019) and institutional support (Leal Filho et al., 2018) are needed for effective sustainable development within universities.

The above problems are also paralleled by the difficulties in integrating sustainability into the university curricula, and to achieve full involvement of teaching staff. Here, action is also urgently needed. Moreover, social challenges may be harder to overcome than financial ones. The translation of sustainability research into action to transform society is a particular challenge (Leal Filho, Shiel and Paço, 2015). Universities in rural areas might face a reluctance from local partners towards climate action. Consequently, balancing the profit-orientated interests of cooperation partners with sustainability or climate protection is difficult. The scientific world and its messages might not always find acceptance across society. It might be the responsibility of universities to address and overcome these doubts and anxieties. Thus, the engagement of staff and students to promote and deliver knowledge into society is crucial.

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Chapter 6:
India

Golda Edwin and Nandhivarman Muthu

Sustainability and climate action in the higher education system

Post-secondary education in India is among the largest in the world with around 965 degree-awarding universities or institutions, 42,000 colleges and over 35 million students. The universities are broadly classified as Central (54), State (417), Private (369) and Deemed to be Universities (125) (UGC, 2020). Central Universities along with multiple Institutions of National Importance such as the Indian Institute of Technology, the Indian Institute of Science, and the All India Institute of Medical Sciences are established under the Central Act and sponsored by the Central (Federal) Government, while the State Universities are funded by the State legislatures or through private funds (MoE, 2020). The All India Council for Technical Education (AICTE) was founded in November 1945 to support country-wide technical education. Following this, the University Grants Commission (UGC) was founded in 1956 to maintain the quality of education and also to be responsible for establishing standards at both the Central and State level. It also provides the qualifying colleges with financial assistance and governs the associated universities. Universities associated with UGC have full freedom to introduce new courses that they think are important and suitable for national needs. Under Section 3 of the UGC Act, 'Deemed to be University' status is granted. They usually follow a smaller range of degrees and specialisations and are not currently able to obtain grants from the Centre or State. Besides, The National Assessment and Accreditation Council (NAAC) an autonomous body funded by the UGC was founded in 1994, to assesses and accredit higher education institutions (HEIs) in India (NAAC, 2020).

More recently, the Union Cabinet of India approved the National Education Policy 2020, thus ushering in a new era of school and higher education in India by setting up a 'single overarching umbrella body

for the entire higher education' – the Higher Education Commission of India (HECI) – with distinct and independent bodies which will assume separate functions like accreditation, funding, and academic standard setting. The UGC, AICTE and the National Assessment and Accreditation Council (NAAC) are expected to be merged under this policy from 2021 (Kumari, 2020).

Research funding to the universities is mainly through India-centric research funds that include various government departments such as the Council of Scientific & Industrial Research (CSIR), Defence Research & Development Organisation (DRDO), Department of Electronics and Information Technology, Indian Council of Agricultural Research (ICAR), and the Indian Council of Medical Research (ICMR). Other sources include international collaboration funds such as the India-Republic of Korea Joint Applied R&D Programme Funding, Deutsche Forschungsgemeinschaft (DFG – German Research Foundation), Indo French Centre for the Promotion of Advanced Research (IFCPAR), Indo-US Science & Technology Forum, UK India Education and Research Initiative (UKIERI), and the Global Innovation Technology Alliance. Universities usually find it challenging to secure research funding from government schemes due to complicated processes and red tape. To mitigate this, a new National Research Foundation (NRF) has been proposed as an independent body to boost research in science, technology, humanities, and social sciences at universities in India and will be allocated one percent of the national budget.

Traditionally the Central Universities and Institutions of National Importance contribute to the bulk of research and development at the tertiary level. However, a recent study observed that private universities show significant growth in research output during recent years. Private universities also tend to have relatively more international research collaborations (Banshal, Singh and Shankar, 2019).

The Government of India has also initiated several National Missions to ensure the wellbeing of its citizens. The missions spread across sectors such as Agriculture, Education, Electricity, Healthcare, Urban

Planning, and Rural Development. The National Mission for Education includes missions such as Sarva Shiksha Abhiyan (to universalise elementary education), National Translation Mission (to make knowledge accessible in all Indian languages), and the National Mission for Manuscripts (to conserve manuscripts of historical significance).

India is among the few countries which have enshrined a commitment to environmental protection and improvement in the constitution through Art.51-A (g) - 'the fundamental duty of every citizen to protect and improve the natural environment including forests, lakes, rivers and wildlife and to have compassion for living creatures'. When it comes to environmental education, the Ministry of Environment, Forest and Climate Change (MoEFCC) and The Ministry of Education (MoE), formerly the Ministry of Human Resource Development (MHRD) play a major role, with the former dealing with the informal education sector and the latter handling the formal education sector (Muppudathi, 2012). On one hand, the Environment Education (EE) Division of the MoEFCC has produced several modules as part of its Environmental Education Awareness and Training Scheme programmes. These initiatives were enforced through two main programmes – National Nature Camping Programme (NNCP) and National Green Corps (NGC) (Rathore, Khanna and Puri, 2015). On the other hand, the Higher Education division of the MoE has initiated "Jal Shakti Campus and Jal Shakti Gram", a set of strategies and guidelines proposed to bring water sustainability to villages and campuses of the Indian HEIs.

Following the historic conference on Human Environment held in Stockholm in 1972, the National Committee of Environmental Planning and Coordination was established. With the Environment (Protection) Act, 1986, the National Policy on Education in 1986 brought about the introduction of environmental education into the formal education system at all levels (Nandhivarman, 2017; Goel, 2018). The universalisation of environment education was mandated and made compulsory by Supreme Court Orders in 1991 and 2003 respectively. This encouraged India's leading schools to offer environmental management courses as elective courses in

their postgraduate degrees. The National Curricular Framework of 2005 was another landmark initiative that emphasised an integrated approach to environment education (Nandhivarman, 2017). Since then many more HEIs have incorporated courses on environmental management in their curriculum. Such steps were also heavily affected by the directives of the regulatory agencies in higher education and the judiciary (Bantanur, Mukherjee and Shankar, 2009). The 2005 National Curriculum Structure further stressed environmental sustainability and suggested project-based learning. The UGC launched a compulsory six-month course on environmental studies for undergraduates from all backgrounds in 2016. The Indian Institute of Science Education and Research, Pune, was tasked with establishing a pedagogy for climate change education in undergraduate education (Goel, 2018). One of the most important developments has been the UGC declaration of 2019, which made environmental studies a compulsory subject, by introducing the module syllabus for environmental studies for undergraduate courses of all branches (Abhinav, 2020; Bharucha, 2005).

More recently, the AICTE released its Environment Policy 2020 (AICTE, 2020). The policy aims to educate and engage students and employees on environmental concerns and sustainability, to make institutes carbon-negative, to incorporate environment concerns in planning and decision making, and to encourage collaboration. The Government of India has tabled a new National Education Policy proposing a holistic and multidisciplinary education through value-based environmental education, encompassing areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living (Government of India, 2020).

None of India's elite HEIs such as IITs, IIMs, NITs and central universities are featured in the Times Higher Education (THE) University Impact rankings 2019. This raises doubts as to whether India's leading institutes are also responsible campuses that foster equity and sustainability in educational delivery, and illustrates a critical feature of internal sustainability

initiatives that most HEIs in India refuse to stick to. HEIs need to take the lead in maintaining India's art and history, with their nuanced skills and wise use of emerging technologies while being sustainable in approach (Sengupta, 2019). Parvez and Agrawal's (2019) qualitative assessment of nine Indian HEIs based on the framework provided by the Sustainability Tracking, Assessment and Rating System (STARS), and the University of Indonesia (UI) GreenMetric World University Ranking (UI GreenMetric WUR) shows that, though Indian campuses are adopting sustainable development initiatives, over 50 percent of the criteria are not being met. There was a lack of regulation, tracking, and reporting systems.

The research work of Bantanur, Mukherjee and Shankar (2015) shows that the vision statements of Indian HEIs tend to be more focused on curriculum reforms, networking and information, special grants, scholarship to students, information and communication technology while ignoring the importance of sustainability practice in their objectives. A few HEIs practice aspects of sustainability like rainwater harvesting, solid waste management, wastewater management, sustainable transportation, biodiversity, and renewable resources, etc, with still a long way to integrate these practices into the culture and vision and mission statements.

Several Indian universities have set up climate change study centres. Some of the prominent ones include:

• The Divecha Centre for Climate Change was founded by the Indian Institute of Science (IISc), Bangalore, India. The centre's primary aim is to measure climate change and its environmental effects and identify solutions that can help offset climate change. The IISc is also part of the Indo French Cell for Water Sciences (IFCWS), a bi-national collaboration organisation. Its aims include comprehensive water and soil studies in India, ranging from local (soil-plant profile) to subcontinent scales. The partnership takes place in such fields as hydrology, geochemistry, remote sensing, agronomy, oceanography, geophysics, soil science, and climate change. There are also collaborations with countries in Southeast Asia and Africa (Ray, 2020).

• Indian Institute of Science, Education and Research (IISER) Pune, named by the Government of India as the National Resource Centre on Climate Change, has launched an online course offering instruction for teachers in all disciplines on the use of modern pedagogical approaches to incorporate climate change based materials. Academics at IISER Pune are pursuing studies on Himalayan glaciers, climate cycles, monsoons, and tropical seas. The latest research publications include emissions (of greenhouse gases, non-methane volatile organic compounds and particulate matter) from open urban waste burning in India. Researchers in the Earth Sciences Department at IISER Kolkata work on paleobiology, river reactions to climate change, atmospheric black carbon and other optically active aerosol organisms.

Indian campuses have a huge opportunity to expand on their sustainability programmes. Analyses and reviews need to be in place to guide their efforts, along with adequate funding for collaborative research.

Institutional Case Studies

Indian Institute of Technology, Gandhinagar
The Indian Institute of Technology, Gandhinagar (IITGN), founded in 2008, is a public engineering institution located in Gandhinagar, Gujarat, India. IITGN is spread across an area of 400 acres, with 1085 students and 120 staff. The operating budget of the campus includes a capital expenditure of US$3.3 million and an operational expenditure of US$12.8 million. Among engineering colleges, IITGN was ranked 14th by India Today in 2018 (IITGN, n.d.).

According to the IITGN Director, Prof Sudhir K Jain:

Sustainability and climate change are central to IITGN. We have emphasised sustainability across the campus, which includes water conservation, purification, recycling, comprehensive waste management, compost production and solar energy generation. The IITGN community is also actively engaged in promoting sustainability in all its operations by developing a system

for monitoring in real-time the carbon and water footprint of the campus.

Sustainable design elements have been widely incorporated across the IITGN campus, for example, low energy and resource consumption are among the guiding principles of campus development. The masterplan paid particular attention to preserving natural water bodies, natural landscape and drainage channels. IITGN became the first campus in India to be awarded a 5-star rating by Green Rating for Integrated Habitat Assessment for Large Developments. Sustainable campus operation practices include waste segregation at source, conversion of organic waste to manure, zero discharge campus (in-house STP), recycling paper and thermocol waste are amongst others. IITGN has developed strategies for carbon reduction plans, although these lack any specific targets and timeframes. The entire administration, faculty and students were involved in a consultative and participatory process.

To reduce its carbon footprint, IITGN adapted the system of Passive Downdraft Evaporative Cooling (PDEC) in the student dining area for air-conditioning so to minimise the energy consumption rate. There is a 500kW capacity solar energy harvesting plant, and a one metric ton installed biogas plant for generating 90-120 kW of electric power and offering a public mode of transportation and conserving native species in the campus for mitigating the carbon footprint at the campus level. Energy efficiency and solar power generation are aligned with the National Solar Mission, an initiative of the Government of India and State Governments to promote solar power. The mission is one of the several policies of the National Action Plan on Climate Change.

Understanding sustainability as a basis for campus development, several steps were taken to improve sustainable development without compromising other goals. The core goal of climate action and sustainability can be seen through activities such as involvement in the development of the State Action Plan on Climate Change (SAPCC) for Gujarat State, and by playing a lead role in National Communications developed by the MoEFCC. IITGN constituted a dedicated Green Office concerning sustainability and climate change in campus development with the support of the Dean, Campus Development and Advisor, Institute Works Department and Kiran C Patel Centre for Sustainable Development in promoting policies and practices and supporting research related to sustainability. The Green Office comprises a team of faculty, staff and students who work to create better awareness and implement activities on campus and in neighbouring villages, focusing in particular on waste management, compost production, and awareness programmes. It aids in steering sustainable development practices and inculcating behavioural changes.

According to the Director:

The Kiran C Patel Center for Sustainable Development was established to focus on water, pollution and waste management, energy, climate change and natural resources, wildlife and ecosystems. We aim to develop a strong outreach programme of training, education, awareness and community engagement on sustainable development and promote networking and collaboration among scholars, policymakers, industry, non-profit organisations and other stakeholders.

The Centre conducts an annual Sustainability Fair and a regular Sustainability Seminar Series to encourage active collaboration and networking amongst a broad range of stakeholders. The institute has been taking steps to address all of the SDGs and aspires to be an exemplary model for the country.

IITGN faculties are involved in several national and international networks on sustainability and climate change. Outcomes include the Housing and Urban Development Corporation Limited (HUDCO) Best Practice Award to Improve the Living Environment 2013-14, HUDCO Design Award for Cost-Effective Disaster Resistant Housing 2015, HUDCO Design Award for Green Buildings 2016, Rank 4th in Swachhata Ranking 2019, Yes Bank Natural Capital Award 2018 under the Eco-Campus category, and a 5-star Green Rating for Integrated Habitat Assessment (GRIHA) Large Development (LD) rating for implementation of Phase 1A constructions in 2018.

Policies relating to becoming carbon neutral by 2050 may not yet be finalised, but an effort towards carbon neutrality can be seen in their implemented plan to measure water and carbon footprints, energy efficiency and energy generation and zero discharge of wastewater to reduce carbon footprints at the campus level. Since it is a relatively new campus, the risk management plan to mitigate climate impacts has been integrated into the campus development master plan and design.

The institute offers several courses in the areas of environment and sustainability, covering such subjects as energy efficiency, environment and society, water quality, and biodiversity conservation, which are offered in the disciplines of Earth Sciences, Humanities and Social Sciences (including Archaeology), Mechanical Engineering and Civil Engineering. A minor in sustainability is proposed. The institute also conducts workshops and short courses focused on sustainability. These are aimed at providing a knowledge-sharing platform to initiate and strengthen research networking as well as explore the possibility of joint research projects and training in the area to help society with sustainable solutions.

Community outreach and engagement are important facets of IITGN policy. Many of its outreach programmes are undertaken by Nurture & Empower Entrepreneurial Ventures (NEEV) and Nyasa (meaning 'trust' in Sanskrit) on the campus. NEEV also provided product-specific training, and then facilitated livelihood opportunities through bulk orders for products such as cloth bags, curtains, stoles and laptop bags. Between April-July 2020, 18 women have been trained and mentored to make reusable cloth masks. Nyasa instituted a community teaching programme, called Chetana, under which the faculty, staff, and students of IITGN came together to conduct regular teaching sessions for construction worker's children. Efforts are taken to spread awareness among young minds on environmental issues by celebrating World Environment Day through - tree plantation drive. Under the Nyasa Challenge, groups of students cleaned areas within and nearby IITGN.

The Kiran C Patel Centre for Sustainable Development has the single largest faculty research cluster

at IITGN. During the past two years, IITGN faculty have published nearly 100 papers and undertaken 40 projects, including sponsored research projects, consultancy and internally funded projects, related to the field of sustainability and climate change. Some of the research labs at IITGN including the Machine Intelligence and Resilience Laboratory and Water Energetics Lab that are researching in the field of sustainability and climate change. The Machine Intelligence and Resilience Laboratory is an interdisciplinary lab working on the various aspects of climate change and variability, climate extremes, and resilience of built and natural systems. The Water Energetics Lab focuses on modelling and experimental testing of energy-efficient desalination and water treatment technologies towards drinking water production and industrial effluent recycling.

The Director emphasized that:

The major drivers for investing in climate change and sustainability at IITGN are the increasing awareness of the disruptive consequences and threats posed to civilization by climate and the desire to preserve the earth for the benefit of future generations. At IITGN, a sense of ownership of the institute and involvement of the community in conceptualising, introducing and executing sustainability initiatives has been impactful. As a result, we have an emotional investment in the successful implementation of sustainability initiatives. Besides, the various government policies, reforms and incentives are also a major driver to invest in climate action and sustainability.

Although universities around the world are aiming to reduce carbon footprints through investment and divestment policies, IITGN has not yet taken any action in this area.

The Director also stated that:

Some of the main barriers that hinder efforts are lack of awareness, reluctance to face the severity of the environmental crisis, a lack of realisation of the radical lifestyle changes required to mitigate the crisis, and an implicit faith that technology is the best way to undo the damages that

technology has wrought.

At IITGN, during the campus design and development process, minimal barriers were encountered in implementing climate action and sustainability initiatives. However, a few restrictions, for instance, the regulation by Gujarat State Electricity Regulatory Commission related to solar energy that the maximum rooftop solar PV system capacity to be installed at any eligible consumer's premises shall be up to a maximum of 50% of consumer's sanctioned load/contract demand limited the targets set by the Institute (GERC, 2016).

The topography of the land is also an important factor. For example, IITGN faced limitations (in terms of land available, and the type of suitable construction) at the conceptualisation stage of the master plan as the site is located near the riverbank. The riverbank and ravine landscape were protected and conserved as an inseparable part of the development process. The climate change and sustainability strengths of the Institute are grounded in the success of the campus master plan.

Pondicherry University (PU)
Pondicherry University (PU) is a public Central University spread across an area of 780 acres facing the Bay of Bengal. PU is accredited with 'A' Grade by NAAC, and first in the country to implement a 'Choice-Based Credit System' (CBCS) which is now being followed by many other universities. The university has 15 Schools, 38 Departments, 12 Centres and 1 Chair offering over 144 PG, PG-Diploma/ certificate and research programmes with a student strength of over 6557 including foreign students. With around 328 teaching and 487 non-teaching staff, currently, the university has more than 125 funded research projects including SAP & FIST Projects from various agencies like UGC, DST, CSIR and DBT (PU, n.d.). The Internal Quality Assurance Cell (IQAC) of Pondicherry University was established in the year 1996 to promote quality enhancement of all aspects of university functioning.

The university also has two off-campuses, one located in Port Blair (Andamans) with two departments viz., Ocean Studies & Marine Biology, and Coastal

Disaster Management and another Post-Graduate Centre at Karaikal. The Directorate of Distance Education focuses on making quality education accessible to all, by adopting information and communication technology to reach the larger segment of people who could not pursue the on-campus model. At present, 93 colleges offering various courses in Arts & Science, Education, Law, Dental, Medical & Para-Medical, Veterinary and Engineering are affiliated to Pondicherry University.

The university recently signed MoUs with prestigious institutions like National Chin-Yi University, Taiwan; National Chung Cheng University, Taiwan; Chungbuk National University, Korea; University of Toulon, France; Zhaw Zurich University of Applied Sciences, Switzerland and University of East Paris, France. PU ranked 9th in the NIRF Central University Ranking 2020 and 58th in the Top universities ranking in India 2020. Besides, PU ascended to the 101-200 rank category, for multiple SDGs by the Times Higher Education University Impact Ranking 2018 & 2019.

According to the Vice-Chancellor:

Sustainability and climate change are considered very important to the university's work, as it aims to shape future leaders by inculcating an environmental consciousness in the context of policies, values and practices. One of the first developments that we undertook at PU towards sustainability was the onset of the Green Campus concept for the development of sustainable action-oriented policies.

Sustainable strategies adopted at PU include preparation of a detailed report on the conversion of the PU Silver Jubilee campus into a solar campus (2012), installation of solar street lights, installation of solar water heaters in hostels and kitchens for steam cooking, free bicycles for students and battery-powered public transportation, installation of photovoltaic panels, installation of a water treatment system integrated with constructed wetlands, afforestation, setting up multiple rainwater recharge pits and initiating online administrative and student-centric activities to reduce the carbon and ecological footprints.

As a symbolic commitment to inspire and develop sustainability-related skills among students and scholars, Pondicherry University has:

- signed the 'Talloires Declaration', and developed multilevel strategies to fulfil the Declaration's 'ten-point action plan' in association with ULSF, USA.
- set up rainwater recharge pits without disturbing the natural rainwater drainage channels.
- signed an MOU with the CSIR-Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore, India for setting up a CO_2 monitoring station.
- Registered for 'Sustainability Literacy Test' to test the level of sustainability awareness, with SuliTestOrg, France.

The Vice-Chancellor stated that:

Pondicherry University faculties are involved in several national and international networks on sustainability and climate change. They have also actively participated in several programmes initiated by the Government of India and Regional Government and has received several recognitions and awards in the area of sustainability.

In association with multiple reputed organizations and NGO, the university plays an active role with the recently launched climate change adaptation programs: 'Fauna Protection and Conservation Network' (UN Decade on Biodiversity - 2020), 'Pollution Prevention, Topsoil Ecology & Ecosystem Restoration, for Soil Sustenance and Organic Food Production networks' (UN FAO - Global Soil Partnership), 'Green Campus Initiative' (Top-Down Approach); Lab-to-land environment education and action research (Attitude change - Transformation); International Cooperation for Wetlands Restoration and Conservation; Schools and Villages adoption program; and periodical Coastal Clean-ups.

According to the Vice-Chancellor:

The PU's role in the development of the region's first climate change policy document – 'Comprehensive Green Protocol', as a set of

non-negotiable and/or standard operating procedures where environmentally responsible practices, education and research go hand in hand, resulted in creating a healthy environment not only for the university but also for the affiliated institutions and the communities as a whole.

The protocol provides guidelines on the sustainable management of water resources; soil conservation and sustainable food production; clean air; energy conservation; sustainable use of natural resources; sustainable management of waste resources; and collaboration for sustainability (CGP, 2018). It is also deeply rooted with the missions stated in the National and State Action Plan on Climate Change.

To engage the student community and to involve the campus communities, the university initiated a volunteer drive programme to implement a holistic and student-centred on-campus outreach programme related to climate change and sustainable development (Muthu et al., 2015). This includes projects such as implementing an integrated organic kitchen waste management for campus sustainability (Nandhivarman et al., 2012), implementing an energy recovering strategy from food wastes (Nandhivarman et al., 2015), building constructed wetlands for the treatment of greywater in campus premises (Edwin et al., 2015), developing Pondicherry University silver jubilee campus as a 'solar campus' (Boruah et al., 2015), implementing an end to end solid waste management, adopting efficient water management and reuse strategies (Edwin et al., 2012), and organizing a green business ideas pitch and bootcamp (Climate-Launchpad, 2019).

Different wings of the university administration are responsible for campus operations related to sustainability. Fostering the guidelines of government agencies, state compliances, national missions and international targets, the Office of Green Campus (OGC) was set up with the efforts of university leaders and alumni of the Department of Ecology and Environmental Sciences. The OGC establishes policies and control methods as per the Green Protocol, the State and Central Governments Alerts, and the University Grants Commission Recommendations. It also offers advice and strategic assistance to the different sectors

to streamline and implement sustainable policies. Furthermore, it advises the university on all environment-related legal proceedings. Recent outcomes of OGC include community outreach through awareness programmes and capacity building, guidance on sanitary waste wrapping and disposal, call for volunteers, student-centered cotton carry bags drive and more. With the assistance of the administrative, research, and institutional wings and the OGC, the university has aligned its current work and other programmes with the Sustainable Development Goals (SDGs). According to the THE University Impact Ranking, PU has done relatively well on the SDGs: Goal 5 (Gender equality), Goal 12 (Responsible production and consumption), Goal 13 (Climate Action) and Goal 17 (Partnerships for Goals) with an ascension to 101-200 ranking category (2018 & 2019).

Moreover, the ongoing initiatives such as the installation of photovoltaic on roof tops for electricity to feed the main campus without using the national electricity grid, energy projects to generate biogas/renewable energy from campus organic waste, water treatment plants integrated with constructed wetlands, and a mass green cover drive to act as a campus carbon sink are expected to foster the carbon neutrality 2050 agenda.

The curriculum on environmental studies is mandated for the students, and the choice-based credits systems of the university offer multidisciplinary courses on environmental sciences, where a special emphasis is given to climate change and sustainable development.

On the major drivers and barriers faced by the PU, the Vice-Chancellor stated:

The main drivers at the campus to invest in climate action and sustainability initiatives include international and national rankings, awards, influences, standards, environmental certification, marketing of good practices, consistent local and national legislations and associated penalties, the initiatives of the academic faculties and administrative staff, and more importantly support from the university leaders, collaboration and partnerships. On the other hand, barriers include

a lack of awareness and motivation, academic load, time constraints, lack of funding and lack of collaborative spirit between faculties and the departments.

When compared to other institutions in India, the Vice-Chancellor also stressed that:

Pondicherry University was one of the first in the country to introduce the "Choice-Based Credit System" (CBCS), which is now being followed by many other Universities.

PU also integrated environmental science-related courses in Humanities and the Sciences and promoted interdisciplinary studies and research in the field of climate change and sustainability. While PU strives to be financially able to put in place effective measures for climate change adaptation and includes sustainable development in the vision and mission statement of the university, the institution has been one of the most successful in the region for the establishment of the Office of Green Campus, green cover development, and sustainable waste management practises in compliance with notifications/rules/acts of the government and global goals. The challenges faced by the university in realising its goals are not only financial but also include: frequent weather events in the region such as storms, flooding, saltwater intrusion and drought that are increasing in magnitude and frequency.

Challenges and Opportunities: The Way Forward

While sustainability and climate change are deemed central to both PU and IITGN, the two campuses have different viewpoints on the grand challenges of climate change and sustainability. IITGN, on one hand, has emphasised sustainability across the campus with a special focus on water conservation, purification, recycling, comprehensive waste management, compost production, low energy and resource consumption and solar energy generation with internal targets towards becoming a carbon-neutral, zero discharge campus. PU on the other hand stressed its commitment to the Comprehensive Green Protocol adopted by the University with specific carbon

reduction targets directly through solar power generation, water resource management, soil conservation, clean air through a plantation drive and indirectly through waste resource management, sustainable use of natural resources, and procurement. Besides, PU significantly partnered with national/ international organizations, NGOs and industries to further its climate commitment.

Both institutes have a dedicated Green Office to oversee and coordinate tasks related to climate change and sustainability. However, as IITGN is one of the premier institutes in the country, it is better placed when it comes to securing funds and allocating budgets for tackling climate and sustainability issues and undertaking community outreach and engagement through tailored programmes.

It was also observed that PU had better gender equality (around 42% women) among the students enrolled compared to IITGN (around 20%). Gender inequality is a common phenomenon especially with the core technical institutions such as the IITs. This ratio at IIT has improved compared to the recent past when it was around 8-10% and this was possible mainly because of the enforcement of a reservation through the addition of supernumerary seats for women. With gender equality being one of the 17 SDGs (Goal 5), empowering women and promoting gender equality is not only a basic human right but also crucial in ensuring an all-around sustainable development, ending all forms of discrimination against certain sections of the society.

The major drivers for investing in climate change and sustainability at IITGN were the government policies, reforms, incentives and most importantly the emotional involvement of the campus community and increasing awareness of the disruptive consequences of climate change and the desire to preserve the earth for the benefit of future generations. On the other hand, the drivers for PU include international and national rankings, awards, standards, environmental certification, marketing of good practices, consistent local and national legislations and associated penalties, the initiatives of the academic faculties and administrative staff, support from the university leaders, collaboration and partnerships.

The main barriers that hinder the efforts at IITGN are a lack of awareness, reluctance to face the severity of the environmental crisis, a lack of realisation of the need for a paradigm shift in lifestyle changes, an implicit faith that technology is the best way to undo the damages that technology has wrought and some hurdles posed by the nature of the topology being on the riverbank and restricting regulations on adopting solar. The barriers for PU include a lack of awareness and motivation, academic load, time constraints, lack of funding and lack of collaborative spirit between faculties and the departments.

Some of the unique facets of IITGN have been its efficient operational monitoring that measures the impact of policies and actions taken, a consultative and participatory process with all stakeholders and its annual fair and seminar dedicated to sustainability. PU was one of the first HEIs in the country to introduce the 'Choice-Based Credit System' (CBCS) and to launch a 'comprehensive green protocol' (climate change policy), which is now adopted by many other universities, and also it has a notable commitment to interdisciplinary research on sustainability. IITGN is on the riverbank and PU is on the coast of Bay of Bengal, and so both have their inevitable challenges with respect to maintaining the sensitive ecosystem surrounding their campuses.

International pressure to participate and show climate action has been a key factor in encouraging climate action worldwide. Many nations are creating climate action plans as part of these wider mitigation initiatives to consider how to reduce their greenhouse gas emissions. India carried out national climate change plans in preparation for the Copenhagen COP, which encompassed both climate protection and adaptation (Dubash, 2020). In almost all cases, these pressures were mediated by national politics, which involved the creation of coherent national narratives. In India, the construction of a co-benefit narrative proved politically important to unlock what had previously been an equity-only construction of climate politics. The higher education community is showing ever more commitment to climate action because of the national action plans, and HEI leaders are committed to teaching and encouraging, engaging and reporting information on climate action at the campus level.

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Chapter 7:
Japan

Jing Liu

Sustainability and climate action in the higher education system

The population in Japan has decreased over the past decade, while also becoming a rapidly aging society with a long overall life expectancy and a decrease in the birth rate. In 2019, about 28.4% of the total population was over 65 years old, whereas the proportion of the population under 15 years old was 12.1%, which is the lowest in history.

The demographic change and the over-expansion of universities in the 1990s took Japan into a full-admission stage to higher education (Yamamoto, 2018). According to the Ministry of Education, Culture, Sports, Science, and Technology (MEXT), the number of universities increased from 649 in 2000 to 786 in 2019. There are 86 national universities, 93 local public universities, and 607 private universities. All types of universities are supposed to conduct research and community engagement, in addition to teaching, although the top national universities and top private universities receive more research funds and support from the government. With the expansion of higher education in Japan, nearly 60% of 18-year-olds attended higher education by the early 1990s (Fukudome, 2019), rising to 82.8% in 2019. However, both public and private higher education institutions (HEIs) have to compete for admitting enough students to maintain their business.

Internationalization became a key strategy of higher education in Japan from the 1980s. In 1983, the Japanese government launched the 100,000 International Student Plan, which had a target of receiving 100,000 international students annually by 2000. In 2008, the government launched a new target of receiving 300,000 international students annually by 2020. In the following years, the government launched the Global 30 Project in 2009, Inter-University Exchange Project in 2011, Go Global Japan Project in

2012, Tobitate Japan in 2014, and Top Global University Project in 2014 to further promote studying abroad for Japanese students and studying in Japan for international students. Through these initiatives, by May 2019 there were 312,214 international students in higher education institutes in Japan (JASSO, 2020).

1998 was a milestone in Japanese higher education. The University Council released a report entitled *A Vision for Universities in the 21st Century and Reform Measures*, which presented a new vision of higher education in Japan. The report addressed higher education's role in deepening understanding of nature to promote coexistence for global development and wellbeing with nature while in the era of mutual dependence and competition (Kitamura and Hoshii, 2014; The University Council, 1998).

Entering the 21st Century, the Japanese government has been taking initiatives to promote education for sustainable development (ESD). In 2002, the Japanese government proposed the United Nations Decade of Education for Sustainable Development (2005-2014), adopted by the 57th United Nations Summit. These initiatives gave higher education an essential role in promoting ESD and fostering human resources in environmental protection (Cabinet Secretariat of Japan, 2014). In 2003, the government ratified the *Act on the Promotion of Environmental Conservation Activities through Environmental Education* to promote environmental conservation, motivate participation in environmental conservation and environmental education (Ministry of the Environment, 2003). In 2007, the Ministry of the Environment released the *Act on Promotion of Contracts of the State and Other Entities, Which Show Consideration for Reduction of Emissions of Greenhouse Gases, etc.* to clarify the responsibilities of the State to establish a society that can develop sustainably with reduced environmental loads (Ministry of the Environment, 2007). Incorporated Administrative Agencies, including national universities, are required to take actions to reduce emissions of greenhouse gases and other substances having a negative impact on the environment. In 2008, before the Hokkaido G8 Summit, major universities in Japan took initiatives to announce the *G8 University Summit*

Sapporo Sustainability Declaration. The declaration emphasized the role of universities in education, knowledge creation, community engagement, and campus management for global sustainability (Hokkaido University, 2017). In 2014, The *Nagoya Declaration on Higher Education for Sustainable Development* showed the Japanese government's commitment to further enhance higher education's engagement in advancing sustainable development through ESD (United Nations University, Ministry of the environment, and Ministry of Education Culture Sports Science and Technology, 2014). In 2016, the Japanese government launched *Japan's SDGs Implementation Guiding Principles*. The priority areas include people, prosperity, planet, peace, and partnership. Moreover, the Government of Japan addresses cooperation with a wide range of stakeholders, including HEIs, to promote and implement the 2030 Agenda (Ministry of Foreign Affairs, 2017).

HEIs in Japan have been actively engaging in promoting ESD (Kitamura and Hoshii, 2014; Liu and Kitamura, 2019). In 2008, the Ministry of Environment established Environmental Leadership Initiatives for Asian Sustainability (ELIAS) to foster human resources in Asia's environment and enhance collaboration between universities, research institutes, and the private sector in fostering environmental leaders in Asia (Ministry of the Environment, 2009). With the Ministry of the Environment's involvement, a network of HEIs named the Promotion of Sustainability in Postgraduate Education and Research Network (ProSPER.Net) was established in 2008. This network is aimed at promoting ESD in HEIs of the Asia-Pacific region. As of August 2020, 15 out of 48 member universities are Japanese.

Between 2010 and 2015, the government launched the education programme of fostering strategic environment leaders in developing countries. There were 17 projects proposed by Japanese universities. Moreover, collaborating with the MEXT, many universities were involved in curriculum development for ESD, introducing ESD to teacher training and researching sustainability as a comprehensive and interdisciplinary academic approach to building a sustainable society. Besides, they served as leaders of local and international ESD programmes. The

Associated Schools Project University Network (ASPUnivNet) is a nation-wide university network in Japan that provides support for UNESCO Associated Schools to conduct educational activities. The network started with eight universities in 2008 and has since expanded to 23 universities. In addition, the University of Tokyo set up the Integrated Research System for Sustainability Science (IR3S) in 2005. It has grown into a network of universities and research institutes that promote sustainability science in Japan.

The United Nations University has been promoting the establishment of Regional Centres of Expertise (RCEs) on education for sustainable development. There are 175 RCEs worldwide, including eight in Japan. Higher education institutions have been playing important roles in facilitating activities between these institutions and communities. Some of them have worked with local schools and communities to develop ESD curricula and lifelong learning (Kitamura and Hoshii, 2014).

Facing a low birth rate and a rapidly aging population, Japan's prefectural areas and rural areas face challenges of maintaining sustainable development. The Japanese government has been encouraging Japanese universities to take part in regional revitalisation for a sustainable future. In 2011 the Cabinet Office launched the Promotion of the "Future City" initiative for Sustainability, an enhanced collaboration and partnership between local communities and universities. In 2018, the government released a grand design for higher education to meet rapid social changes and support global sustainable development. A recent survey indicates students' awareness of the SDGs has risen from 24.8% in 2019 to 45.1% in 2020, with 40% of students gaining knowledge of SDGs from the school curriculum (DENSTU, 2020).

Although there are research studies summarising government policies and initiatives on higher education for sustainable development, there are few which critically analyse them. Among them, Kitamura and Hoshii (2014) point out there are limitations of ESD in higher education. First, limited usage of qualifications related to ESD which is widely connected with employment and community development

discourages the younger generation from getting actively involved in ESD. Second, the Japanese government gives priority to environmental conservation without giving emphasis to ESD issues. Third, although there are many ESD-related programmes in Japan's HEIs, few of them are new. Moreover, there is a lack of linkage between these subjects. In their case study of the construction of SDG-related curriculum, Liu and Kitamura (2019) argue it is necessary to build more cross-disciplinary courses between different faculties and between universities to promote higher education for sustainability.

Institutional Case Studies

Tohoku University
Tohoku University is located in Sendai, the capital city of Miyagi Prefecture, in Japan's Northeast region. As the third Imperial University in Japan, it was founded in 1907. The university adopted the principles of "Open Doors", "Research First", and "Practice Orientation" since the beginning. By taking the initiative of "Open Door" policy, in 1913, Tohoku University became the first Japanese university to admit female students despite opposition from the government.

The university became one of three Designated National Universities of Japan in 2017. In 2020, it ranked the top on Times Higher Education's 2020 list of Japanese universities. As of May 2019, there were 10,814 undergraduate students, 6,990 postgraduate students, 1,749 international students, 3,127 faculty members and 3,207 administrative staff. In 2018, the university launched the *Tohoku University Vision 2030* as a roadmap for its activities by 2030. As a comprehensive research university, the university declared its ambition to advance problem-driven research projects to provide solutions for the SDGs. Furthermore, Tohoku University has been involved in various activities contributing to sustainability and climate change in research, education, campus operations, and community engagement.

In terms of research, there are two initiatives on climate change and sustainability taken by the university. One is the "Research with Social Impact" project launched in 2015 to promote cross-sectoral,

interdisciplinary research for building a sustainable and prosperous future for all. The Executive Vice President for Outreach Activity and Earthquake Disaster Reconstruction is responsible for this initiative. As many research topics involved in "Research with Social Impact" overlap with the SDGs, the university is integrating these projects into Tohoku University's SDGs. As of 2020, there are 30 research projects grouped into seven areas, including Creating a Sustainable Development, Health & Well-Being, Safety & Security, Connecting with Global Communities, a Responsive & Prosperous Future, Life in Space, and Academia Supporting Communities. The second initiative is establishing the International Research Institute of Disaster Science (IRIDeS) in 2012. By experiencing the Great East Japan Earthquake in 2011, the university has been committed to regeneration and recovery. Since 2007, by collaborating with experts from 19 fields related to disaster prevention and reduction, the university established an interdisciplinary research team to promote joint research. After the earthquake, the university built the institute to further promote multidisciplinary collaboration. Besides these, the Scopus database shows faculty members of Tohoku University published 60 academic articles with the title including the term of "climate change" between 2011 and 2020. Moreover, between 1999 and 2020, there are 11 academic articles with a title including the term "sustainable development," published by scholars at Tohoku University. In 2018, 58 out of 761 research projects funded by the Japan Society for the Promotion of Science are related to environmental studies.

In terms of education, the Graduate School of Life Science was established in 2001 to explore solutions for environmental issues, food issues, and medical issues for all. In 2003, the Graduate School of Environment was established, aiming at fostering human resources to develop areas of study related to environmental and sustainability issues beyond conventional disciplinary boundaries. In 2005, the Graduate School of Environment, collaborating with the School of Medicine, the Graduate School of Agriculture, and the Graduate School of International Cultural Studies, jointly launched an international collaborative education programme of human security. This interdisciplinary programme included human

security with health, food and agriculture, society, and environment. In 2014, the Graduate School of Environment set up the International Environmental Leadership Programme to foster leaders who can deal with global environmental issues. Moreover, in 2015, the university established the Tohoku University International Joint Graduate Programmes, including Earth and Environmental Sciences and Resilience and Safety Studies. By collaborating with diverse departments and fields within the university and other leading universities around the world, these programmes aim to enhance research ability and create innovation to aid in the creation of a sustainable global society. Moreover, the Graduate School of Life Science is implementing a programme of Professional Ecosystem Management to foster human resources in ecology and environment studies. In addition, the Graduate Programme in Global Governance and Sustainable Development was established to advance global governance and sustainable development through a combination of critical reviews of theories and problem-oriented empirical studies. By December 2020, there were 41 courses hosted by different departments and graduate schools related to the SDGs, 44 courses related to climate change, and the university is actively promoting environmental education through a Massive Open Online Course.

In terms of campus operations, the university has been taking various actions to integrate government policies and initiatives regarding diverse perspectives of climate change and sustainability into university management. These include the general environment, nature protection, energy consumption, pollution, waste disposal, and green procedure on university campuses. Since 2005, to meet the government's requirement for Incorporated Administrative Agencies to take environmental protection initiatives, they have been publishing Environmental Management Annual Reports since 2005, which introduce policies and practices of the university in environment protection. There is an Executive Vice President for Human Resources, Personnel Administration, Environmental Security, and Facilities responsible for implementation. In 2010, the university released an environment policy to comprehensively implement environmental management. Most recently, the university released

a declaration of promotion of Plastic Smart[1] in 2019, followed by the establishment of the Tohoku University Transdisciplinary Research Initiative for Plastic Smart (TU-TRIPS). The university designed a campaign to use Tohoku University Original Eco-bottles on campus. They also set up water points in the main meeting rooms, charged for shopping bags in in-campus stores, restricted plastic straw usage, and set up sorting processes for recyclable plastic products.

In terms of community engagement, the university has organised an open lecture series, and symposia on environmental protection and climate change to disseminate knowledge to the public, as well as lectures on environment and climate change to high schools. In addition, they hosted on-campus events open to the public to disseminate knowledge of climate change and sustainability. With the outbreak of the COVID-19, the university has been closely involved with prevention and treatment efforts by disseminating knowledge and know-how of disease prevention, dispatching experts to the national consulting team, hosting webinars to present the current infection status and prevention strategies, and sending doctors and nurses to support coronavirus tests in local communities.

An interview with a former Executive Vice-President of Tohoku University shows that some barriers hindered promotion of the SDGs and activities related to climate change. One is poor understanding of science and technology in Japanese society.

Facing the challenges for sustainability or climate change, most Japanese people focus more on economic rather than scientific perspectives. University has the responsibility for disseminating scientific knowledge to the public. It is responsible for motivating individual researchers, especially researchers in social sciences, for taking actions to work together.

The former Executive Vice-President pointed out that determining who should take leadership of promoting

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1   Plastic Smart is an initiative taken by the Japanese government to support individuals, enterprises and social groups to take action for dealing with marine pollution by plastic litter.

the SDGs or activities related to climate change at the university is a big issue.

> *So far, we have already established a research platform to promote cross-disciplinary research through collaboration among experts from diverse fields. The IRIDeS which is conducting much cross-disciplinary research related to sustainability is a good example. However, besides research, there is a limited collaboration among different faculties. Now, the challenge is who will take leadership to further promote such collaboration [...] it is necessary to establish a systematic platform that can take the leadership to integrate and coordinate university-wide education and research resources for climate change and sustainability.*

In addition, the interview shows a fragmented management system for promoting sustainability at the university and a lack of awareness of other activities related to promotion of sustainability at the university level. It is also necessary to reach a common understanding at university level regarding university initiatives in promoting the SDGs.

There are gaps in understanding of the role of Environmental Management Annual Reports in promoting the SDGs. Although it is taken as part of the university's initiative in promoting the SDGs, the former Executive Vice-President simply understood it as a strategy to meet requirements for budget-making rather than an initiative for promoting the SDGs.

Ritsumeikan University

Ritsumeikan University is a private university founded in 1900 in Kyoto, the ancient capital of Japan. It is part of the Ritsumeikan Academy, which has campuses in Hokkaido, Shiga, Kyoto, Osaka, and Oita and includes two[2] universities, four high schools, four junior high schools, and one primary school. The university was established upon the spirit of "freedom and innovation" and set "peace and democracy" as its core educational philosophy. As one member of the Ritsumeikan Academy, the university approved *The Ritsumeikan Charter* in 2006. The

2   The other is Ritsumeikan Asia Pacific University.

university's charter pledges it will promote peace, democracy, and sustainable development in Japan and worldwide. Meanwhile, the charter also stresses the Academy as a whole will foster learning and the development of individual talents to nurture just and ethical global citizens. In the newly launched R2030 Ritsumeikan Academy Vision, the Academy defines an ideal shape of the educational institution that serves as a community hub for lifelong learning, tackles the issues facing human society, realizes diversity and inclusion. Meanwhile, they also visualize students' ideal qualities, faculty members, staff, and alumni who have an enterprising spirit; who can respond to social changes, think independently, and take action, equipped with a sense of global citizenship. These strategies and plans are adapted to accommodate social change. Located in Kyoto, the university's development has been deeply influenced by the Kyoto Protocol to the United Nations Framework Convention on Climate Change approved in 1997. The Ritsumeikan Earth and Environment Committee was established in 2010, and aims to monitor the environment management system and reduce the environmental load of the Academy. In line with the recent Ritsumeikan 2030 Academy Vision, the Academy established the Ritsumeikan SDGs Promotion Headquarters under the President's leadership to further pursue the SDGs to solve worldwide problems. The headquarters is currently coordinating various initiatives and activities of the Academy to systematically promote SDGs.

There are 32,243 undergraduate students in 16 colleges of Ritsumeikan University. There are 3,529 graduate students and 2,378 international students. Ritsumeikan University was ranked in the top 200 globally in the latest THE Impact Rankings. It was named as Japan's No.1 university for No Poverty (SDG 1), and for Peace, Justice, and Strong Institutions (SDG 16).

Ritsumeikan University has taken comprehensive initiatives to promote SDGs through education and research activities, campus operations and social engagement. In terms of education, the university provides education related to the SDGs through general and professional education. For example, in the field of international relations, the university has

subjects related to peace and conflict. In the College of Science and Engineering, there is a department of civil and environmental engineering. The education programme in this department aims to foster human resources that can create a peaceful and safe life and a comfortable and sustainable society. In order to apply education and research in practice, in 2019 the university developed a social entrepreneur platform named "Ritsumeikan Impact-Makers Inter X (cross) Platform (RIMIX)". It aims to foster entrepreneurship to solve social issues and achieve the SDGs by collaborating within and outside the school. RIMIX provides seamless training to university students and students at other education stages in the same Academy. It will also establish the Ritsumeikan Fund for approximately one billion yen (8 million €) to support student activities and start-up businesses with social impact.

In terms of research, the university established the Research Centre for Sustainability Science in 2007. It promotes research that focuses on the nexus of the three systems surrounding the earth (the earth system, the social system, and the human system) with the centre's philosophy of "creating and establishing sustainable values." Researchers affiliated to this centre are from diverse fields and jointly conduct integrated, multidisciplinary research related to sustainability. RCS is working on three core projects based on the concepts of sustainable human life, sustainable human activity, and sustainable human survival at both the international and local level. Moreover, research conducted in the Graduate School of Core Ethics and Frontier Sciences is relevant to philosophy, ethics, and fundamental human society value, closely related to sustainability issues. For example, the Institute of Ars Vivendi conducts research related to people with disabilities and how to make an inclusive society for the disabled.

The university publishes a research activity magazine, RADIANT, which promotes work conducted by researchers at Ritsumeikan University. The magazine has covered research related to the SDGs, disseminating research outcomes to society. It aims to attract more private companies that may get interested in the research and provide investment.

In terms of campus management, the Ritsumeikan Academy Earth and Environment Committee was established as an Environment Management System (EMS) in 2010. The committee is responsible for environmental protection, planning, and implementation of campus environmental load reduction. It promotes environmental education and research, and supports student-based activities related to environmental protection. The committee also releases the annual Ritsumeikan Environment Report to introduce its environmental management activities and current progress. They visualise the process of environmental load reduction on the university website "eco+R" to introduce these efforts to the public. In 2014, the Academy released Ritsumeikan Environment Action Agenda, pledging to build a sustainable future environment. In recent years, the Academy has adopted the concept of sustainability in campus construction and management. Their master plan emphasises amenities, natural environment, ecology, and disaster prevention to provide a high-quality campus life. The university introduced an environment-friendly air conditioning system, exchanged the lighting system to LEDs, and introduced new systems to save electricity and water for the toilet system. In 2019, the campus of Ritsumeikan University received Gold Recognition for its Sustainable Campus from CAS-Net Japan.

The university is also involved in local and international networks. Nationally, the university is taking part in a public-private collaboration platform for regional revitalisation and the SDGs. At the international level, the university is joining the United Nations Academic Impact (UNAI), an initiative that aligns HEIs with the UN in supporting and contributing to its goals and mandates. It is a member of CAS-Net Japan (Campus Sustainability Network in Japan). This network aims to encourage more environmentally sustainable higher educational institutions, governmental institutions, and private companies through promoting campus sustainability at Japanese universities and establishing cooperative relationships with campus sustainability networks overseas. The university is taking part in the Asian Sustainable Campus Network, including the Korean Association for Green Campus Initiative, the China Green University Network, CAS-Net Japan, and the

Sustainable University Network of Thailand.

In terms of outreach and social engagement, besides producing reports and disseminating information on SDG-related activities through website, Ritsumeikan University established Ritsumeikan Saturday Lecture in 1946. It has been held over 3,300 times and disseminates new knowledge related to society, the economy, and the environment. The university founded the Kyoto Museum for World Peace in 1992 to foster the understanding necessary to build a peaceful world. RIMIX, as a platform, established collaboration with enterprises, alumni, and other collaborators to jointly develop and manage programmes with social impact. The university and the Academy as a whole have established a firm partnership and dynamic collaboration with local communities. So far, there are 56 projects which are related to SDGs between the Academy and local communities.

An interview with the Chief Administrative Officer of Ritsumeikan SDGs Promotion Headquarters shows that the institution's culture, which emphasises peace and democracy, has provided an interactive culture with trust for the Academy members. It brought not only efficiency but also effectiveness for the Academy to promote the SDGs. The Chief Administrative Officer addressed the role of the headquarters which is taking the lead on initiatives promoting the SDGs at the university.

The headquarters, which is under the leadership of the president, could serve as a platform to involve related divisions within the Academy and nation-wide alumni to share and promote activities of SDGs by the Academy. As a good practice, RIMIX provides a platform for the entire Academy to integrate education, research, and practices related to critical social issues to SDGs. Besides enhancing understanding of these issues, RIMIX provides students, faculty members, and other stakeholders to act together through launching projects or business. It will fit nicely to fostering ethical global citizens, aligning with the academy charter's educational philosophy.

However, there are also some barriers to further promoting such practices. The number of students and the multiple campuses of the Academy brings challenges. The Chief Administrative Officer specified:

In terms of environment management, we always think of efficiency and effectiveness. For example, in terms of Green purchase, products in cheaper price may have negative effectiveness in terms of the life cycle [...] In Ritsumeikan, the challenges could be understood from three perspectives. The Academy has a large number of students. And it has multiple campuses which are located in five different local areas. On the one hand, the Academy as a whole has an overall standard in terms of environment management. On the other hand, each campus needs to integrate this stan-dard to the local contexts.

The Chief Administrative Officer also pointed out that it is a big challenge to consistently implement education for the SDGs within liberal arts education and each academic major at the university level.

Challenges and Opportunities: The Way Forward

Japanese universities have been making efforts to face the challenges of sustainability and climate change. Nevertheless, to make the SDGs a reality by 2030, universities need to build a more integrated approach to comprehensively implement sustainable development. As Leal Filho (2020) emphasises, it is necessary to accelerate implementation through the curriculum, campus management, research, governance, reporting, and integration. In line with the government's commitments for sustainable development and climate change, the Japanese government has introduced various initiatives to promote sustainable development in higher education by integrating the SDGs into education, research, campus operation, and social engagement. Higher education institutions have released institutional frameworks and strategies for the implementation of sustainable development.

The two case studies cannot be generalised to the situation of all HEIs in promoting the SDGs and climate change in Japan. However, the findings indicate two basic models of promoting the SDGs and climate change in Japan's universities. One is an integrated

model, and the other is a fragmented model. In terms of leadership, the private university has an integrated leadership which is under the president's office. This leadership enhanced common trust among members of the academy. And the trust generated collaboration between faculty members and a professional team to improve efficiency for the whole institution to promote the SDGs. In contrast, the national university gave more focus to promoting the SDGs through research. The initiatives of promoting SDGs are fragmented rather than comprehensive or collective. Therefore, although the national university is also taking initiatives to promote SDGs and climate change, the whole picture of their efforts is not clearly presented. Moreover, compared with the national university, the private university is more actively taking part in networks at local and global level to promote the SDGs and climate change. Their partnership with the private sector, local communities and the alumni association is more active. Facing a society with an aging and shrinking population, private universities are actively promoting the SDGs a means of enhancing their social recognition and impact. In addition, it is easier for a private university like Ritsumeikan, which belongs to an Academy with primary and secondary schools, to take a whole-institution approach to promote the SDGs through curricula and activities.

There are challenges that hinder the implementation of sustainable development in higher education. First, it is not easy to build an integrated approach to promote interdisciplinary education and research on sustainable development. Although the independence of each department gives space for them develop their own SDG-related work, this also presents a barrier for different departments to co-create an interdisciplinary curriculum or conduct interdisciplinary research for sustainability. Even though individual scholars in each department have their specific interests in teaching and conducting research related to sustainability, there is limited collaboration between scholars from different departments for interdisciplinary education and research. Moreover, the limited connection between liberal arts education and professional education is a significant challenge. It is essential to encourage collaborations among faculty members and students between departments.

Second, fragmented management of research, education, campus operations, and social engagement becomes a barrier for promoting SDGs comprehensively and effectively. Research output has not been fully integrated into education and social engagement. It is necessary to construct an integrated platform to comprehensively coordinate, manage, and disseminate sustainable development implementation in HEIs. Moreover, it is necessary to build a more inclusive mechanism to attract diverse stakeholders to join sustainable development efforts.

Third, limited awareness of the connection between sustainability and climate change limits integrating these two concepts into education, research, campus management, and social engagement. It is necessary to consider climate change as both a goal and a means for sustainability rather than limit climate change to environmental protection. An emphasis on economic growth limits people's understanding of sustainable development.

A comprehensive platform, such as RIMIX of Ritsumeikan University, which integrates education, research, innovation, and entrepreneurship, provides new opportunities for stakeholders inside and outside HEIs to work together to transform knowledge into social solutions for sustainable development. A government initiative to support building an integrated mechanism for sustainability and climate change could accelerate this process.

In Japan, national or private universities have been taking initiatives to promote the SDGs and climate change based on their individual contexts. For future studies, it is crucial to study the impact of the policies and practices implemented by HEIs.

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Chapter 8:
South Africa

Rudi Pretorius

Sustainability and climate action in the higher education system

As a medium-sized, culturally diverse country with population approximating 60 million (Worldometers, 2020), South Africa is classified as "upper-middle-income" and part of the major emerging economies (World Bank, 2020). Although the *apartheid* policies ended 26 years ago, and good progress has since been made to improve the lives of South African citizens, South Africa is one of the most unequal countries in the world with a Gini coefficient of 0.64 (based on 2015 per capita expenditure) (Republic of South Africa [RSA], 2019a). Despite this, initiatives to address poverty achieved some success, with approximately 2.3 million South Africans who escaped from poverty from 2006 to 2015, if using an income of R758 per person per month (in 2017 prices) as guide – the national lower-bound poverty line (World Bank, 2018). South Africa adopted a National Development Plan (NDP) in 2012 which has a 74% convergence with the Sustainable Development Goals (SDGs) (RSA, 2019a). The NDP prioritises job creation, poverty elimination, reduction of inequality and growing an inclusive economy by 2030 (RSA, 2011a). To achieve this, a number of sectors have been identified to create employment and other opportunities, including education, vocational training and work experience.

Pre-1994, the South African higher education system can be described as fragmented and uncoordinated (Bunting, 2002). This system was the product of South Africa's *apartheid* policies with legislation that allocated higher education institutions according to race. Furthermore, a distinction was made between universities, focussing on knowledge generation, with technikons focussing on knowledge application. Bosire (2014) sets out how the initial 36 pre-1994 universities and technikons in South Africa can be broadly classified as either historically advantaged (designated for primarily whites) or historically disadvantaged (designated for primarily non-whites). This split was inherently contentious, with a huge potential of a bias in the allocation of funding and resources. 'Historically white' institutions were characterised by institutional autonomy in certain areas, while 'historically black' institutions had to follow a more bureaucratic model in terms of academic and administrative structures (Andreadakis and Maassen, 2019). At the same time interaction between academics in these two groups of institutions was severely constrained and limited through legal regulation and other real or perceived obstacles (Fairhurst et al., 2003).

Post-1994 the South African higher education system has been characterised by transformation, starting with Education White Paper 3 (RSA, 1997a) pointing towards the need for a centrally coordinated, single system of higher education to address the fragmented, unequal and inefficient legacy of the past (Elliott, 2005). In addition, a merger process commenced in 1999, which removed the distinction between universities and technikons, reducing their combined number from 36 to 22 (Mouton, Louw and Strydom, 2013). This provided the basis for a new higher education system suited to the needs for a developing democracy (Govender and Rampersad, 2016). Despite these mergers and the development and release of the National Plan for Higher Education (RSA, 2001), Le Grange (2011) points out that issues related to access, equity and quality continued to plague the South African higher education system.

Later in the 2000s the policy focus shifted from transformation to the role of higher education in the economic development of the country and as driver of the knowledge system, as reflected in the more recent White Papers on Post-School Education and Training (RSA, 2014) and Science, Technology and Innovation (RSA, 2019b). In 2016 the overall participation rate in South African higher education was in the order of 20% (measured against the relevant age group), with approximately 975,000 students registered at 26 institutions (Andreadakis and Maassen, 2019). Since 2016, two prominent student protest movements added a new dimension to the transformation debate about higher education in South Africa:

#RhodesMustFall, with focus on decolonisation, and #FeesMustFall, with focus on access and inequality and demands for free higher education (Bank, 2018).

In South Africa environmental sustainability is promoted by the national constitution, which guarantees all citizens an equal right to a healthy and safe environment (RSA, 1996). Building on that, the South African National Environmental Management Act (NEMA) (RSA, 1998) provides a framework for a host of policies which together govern biodiversity, invasive species, waste, coastal zones, natural resources, water resources and related issues (Lotz-Sisitka, 2011). Although these policies serve to bridge inequalities, protect the environment and resources and are important in the context of sustainable development (SD) as well as the SDGs, they were not enough on their own to provide a complete mapping for the route towards the attainment of the South African government's aspirations in this regard (Awuzie and Emuze, 2017). The National Framework for Sustainable Development (NFSD), published in 2009, supplied such impetus and signalled a new wave of thinking about stewardship of South Africa's natural, economic and social resources (RSA, 2008). This was strengthened when the National Strategy for Sustainable Development and Action Plan (NSSD 1, 2009–2014) was launched in 2011, and which involved several initiatives and stakeholders, including universities, to address issues of sustainability in South Africa (RSA, 2011b).

Associated with the NFSD and NSSD1, many South African universities support the SD-drive of the national government through their core activities of teaching and learning, research and operations (Awuzie and Emuze, 2017). It can be argued that SD became the vehicle to drive educational transformation and innovation in research at many South African universities. This occurred notwithstanding the limited direct reference to SD in South African higher education policy, although the intention of Education White Paper 3 (RSA, 1997a) was to imbed SD in higher education (Monnapula-Mapesela, 2014). Despite this contradiction between the importance associated with SD versus the minimal direct reference to SD in higher education policy (Ibid), instruments such as the Higher Education Act (RSA, 1997b), Education White Paper 3 (RSA, 1997a) and the National Plan for Higher Education (RSA, 2001) provide direction for and support mainstreaming of SD in activities of South African universities (Awuzie and Emuze, 2017). The launch of the Green Campus initiative in South Africa in 2012 injected new energy in the SD-drive of South African universities. Apart from creating awareness of the negative environmental impacts of university operations, Mafongosi, Awuzie and Talukhaba (2018) explain that this initiative emphasised the importance of empowering students to address sustainability issues on their campuses and in their communities.

Although many South African universities have implemented comprehensive frameworks to achieve their SD objectives, Awuzie and Emuze (2017) highlight the paucity of contributions in this regard in the scholarly literature. This might be because SD is not a policy imperative in the South African higher education sector and manifests through voluntary engagements and activities at various universities (Monnapula-Mapesela, 2014). However, this paucity of contributions applies across Africa as a whole, as reflected in the results of bibliometric research by Barth and Rieckmann (2016) and Hallinger and Chatpinyakoop (2019). Pretorius et al. (2020) hold a different view and point out that such findings are most likely due to choices of databases and/or search terms, and do not necessarily provide a true reflection of SD-related outputs of scholars from African universities. The research by Pretorius, Nicolau and Adriaanse (2020) comprised of a bibliometric review of sustainability focussed and related outputs by African scholars affiliated to African universities and covers the period 2005 to 2018. Although preliminary, their results indeed reveal a noteworthy contribution from African universities in the field of SD, with a total of 195 outputs (of the initial 469) from African universities which could be related to one or more of the 17 SDGs. The bulk of these (140) were from South African universities.

In terms of SD, the issue of climate change has evolved to the extent that it is regarded as defining context for South Africa's future in the medium to long run (RSA, 2017a). As a result, South Africa significantly scaled up on its climate change response

with the development and implementation of the National Climate Change Response Policy (NCCRP) (RSA, 2011c). The NCCRP is aligned with the global efforts of the United Nations Framework Convention on Climate Change (UNFCC) and other international mechanisms to mitigate, manage and adapt the effects of global climate change. To achieve the objectives of the NCCRP, participation of all stakeholders is essential, and universities have a crucial role to play in terms of capacity building and research (RSA, 2017b). Considerable effort has so far been invested and progress achieved with the NCCRP through implementation of the Climate Change Flagship Programmes. These cover key areas of South Africa's climate change response and involve (1) energy efficiency and demand management, (2) waste management, (3) transport, (4) renewable energy, (5) agriculture, food systems and food security and (6) low carbon, climate resilient built environments, communities and human settlements (RSA, 2017a).

The First Biennial Report to Cabinet on the State of Climate Change Science and Technology in South Africa (2017a), provides a summary of the involvement by South African universities in climate action. This report reveals that the budgets, research and post-graduate outputs for climate research in South Africa is concentrated in five research intensive universities: University of Cape Town, Stellenbosch University, University of Pretoria, University of the Witwatersrand and University of KwaZulu-Natal. From 2005 to 2015 they produced 63% of South Africa's publications on climate research. They also host six climate-relevant SARChI chairs (South African Research Chairs Initiative) and seven climate-relevant research centres. Overall, the journal articles

and book chapters in this field have increased from 131 in 2005 to 596 in 2015. This is a growth of 15% per year, compared with a growth of 5% per year in all research topics. The citation rate per paper is 24.7, which is high relative to global standards. Strong international links are present, with a substantial fraction of climate change research taking place in multidisciplinary, multi-institutional teams. Currently the bulk of South African climate-related research has a strong biophysical focus, with a greater emphasis on the social, legal, institutional and human dimensions of climate change adaptation and policy implementation that is required for future work.

Institutional Case Studies

The two South African universities which have been selected to look in more detail how sustainability and climate change are approached by universities and their leaders in South Africa, are Stellenbosch University (SU) and the University of South Africa (Unisa). Within the South African higher education context, these two universities find themselves at opposite sides of the spectrum, with SU having 31,765 students (2018) and positioned as a leading research intensive university, while Unisa has 373,747 students (2018) through which it is positioned as a teaching intensive university with a significant country-wide footprint. While its research impact is equally significant, it is not comparable with that of SU. Table 1 supplies some additional contextual information on these two universities.

Stellenbosch University (SU)
With reference to research outputs, rated scientists and student pass rates, SU finds itself among South

Table 1. Some features of two South African universities selected as case studies

University	Year founded	Campuses and location	Number of Student	Number of staff	Total revenue
SU	1918	Stellenbosch (main) plus 4 additional campuses	31,765 (2018)	3454 (2018)	ZAR 5.9 billion (2019)
Unisa	1873	Mucleneuck (main) plus 2 additional campuses and 7 regional centres	373,747 (2018)	6996 (2017)	ZAR 7.5 billion (2018)

Source: Stellenbosch University (SU), 2019; SU 2020a; University of South Africa (Unisa), 2018a; Unisa, 2020a.

Africa's leading universities (SU, 2020a), while it is also recognised internationally as a high performing university (Businesstech, 2020). This is illustrated by the fact that SU boasts 484 researchers rated by the National Research Foundation (NRF), with 1,645 doctoral students enrolled in 2018 and more than 2,600 papers published in peer-reviewed journals in the same year (SU 2020b). SU recently adopted a new vision (Vision 2040) and strategic framework for 2019 to 2024 (SU, 2018). These are to support and guide the commitment of SU to be a university that is contextually relevant and of service to South Africa and Africa. Vision 2040 and the strategic framework for 2019 to 2024 feed into and directly support the NDP of South Africa, Agenda and Vision 2063 of the African Union (AU) and the SDGs. In fact, enhancement of sustainability has been one of the strategic priorities of SU for the past decade and is regarded as equally, if not more important than attention to access, excellence, social impact, internationalisation and transformation. According to a top management official at SU:

> *The main drivers or motivations for SU to invest in climate action and sustainability are purely because these are high-risk dilemmas that the world is facing at the moment. If climate change gets out of hand, it will be far worse than what we are dealing with at the moment in terms of COVID-19 because it will be irreversible and you can't develop a vaccine for that. The impact of that will be devastating not only on human life but also on life in general, so the driver there is survival of the human species in the long term, so this is why SU put so much effort into this.*

The adoption of the Policy for the Integrated Management of Sustainability in 2010 by the council of SU committed the university to sustainability (SU, 2010). This policy guides and coordinates campus activities regarding sustainability and serves as the basis for the Operational and Communication Plan for Sustainability, managed by the Executive Director: Operations and Finance. SU does not have a separate policy on climate change, but views climate change as part and parcel of sustainability, and therefore covered by the Policy for the Integrated Management of Sustainability. Apart from campus sustainability,

leadership and overall management responsibility regarding sustainability is vested in the various top management portfolios (i.e. the Rectorate, Operations and Finance, Learning and Teaching; Research, Innovation and Postgraduate Studies, Social Impact, Transformation and Personnel, and Strategy and Internationalisation). Reporting on such activities and initiatives is included in the Annual Integrated Report which is compiled and published each year. Vision 2040 confirms the commitment of SU to systemic sustainability, "which includes people, place (social), prosperity (economic) and the environment and compels responsible corporate governance" (SU, 2018).

> *All the policies at SU speak to sustainability and are managed very well by our division that deals with our physical infrastructure, who is responsible for the implementation of sustainability actions. On the research side SU also have many different projects that speak to sustainability, but these are managed via the portfolio of the Vice-Rector: Research, Innovation and Postgraduate Studies, the various Research Support Divisions, Faculties and Academic Departments.*

Responsibility for the implementation and realisation of sustainability has been allocated to each of the functional areas and environments constituting the university. This allows for activities and initiatives aligned to the diversity of approaches in which sustainability is dealt with in the academic, research and operational environments. In the academic environment the infusion of sustainability manifests through undergraduate offerings such as the BA in Development and Environment, BSc in Geoinformatics and BSc in Conservation Ecology. At postgraduate level examples of sustainability-related offerings include the Postgraduate Diploma and MPhil in either Environmental Management or Sustainable Development and Masters' and PhD options in Water and Environmental Engineering as well as Environmental Education. SU is in the process of establishing a School for Climate Studies, to be launched in January 2021. Once fully functional this school will contribute to the spectrum of sustainability qualifications on offer at SU.

Due to the strong research focus on sustainability and climate change, these two study fields are also embedded in education across the curriculum at SU. In fact, SU offers a number of masters' degrees in sustainability. Examples are the programmes offered through the Tsama Hub and the Sustainability Institute. These aspects are embedded in the curriculum at SU and it will become more so in the future.

The five strategic research areas identified by SU focus on the natural environment, health and human security, social justice and development, human creativity and social innovation, and systems and technologies for the future. These research areas serve as overarching frameworks to facilitate and strengthen inter- and trans-disciplinary research at SU to address the sustainability challenges of the 21st century and which are extensively reported on in the most recent research report of SU (SU 2020c). SU hosts 38 research chairs, of which 26 are within the South African Research Chairs Initiative (SARCHi) and contribute to the ability of SU to pursue research excellence and the development of local and global capacity. A significant number of these research chairs directly or indirectly address sustainability and/or climate change. Examples include the chairs in energy research, economic and social policy, photovoltaic systems, wastewater management, agronomy and science communication, to mention a few (SU, 2016). SU is second place among the top six universities in South Africa concerning research outputs in this field and plays an equally important role in producing related master's and doctoral students (RSA, 2017b).

Regarding resources to encourage and incentivise research on sustainability and climate change, SU is currently investing strategically to establish a School for Climate Studies, which is a huge and important undertaking. It entailed development of a comprehensive business plan and involved 32 professors at SU to decide what needs to be done in terms of climate change and how to go about with setting up the school. The resources invested in the Centres of Excellence can be mentioned as well. SU currently has more centres of excellence which deal with climate

change than any other university in South Africa and also a total of 26 SARCHi chairs. At least 50% of them are working in the field of climate studies and sustainability, which is why SU is so strong on this aspect.

Green campus initiatives occupy a prominent position at SU and align with the strategic objective to be sensitive to the ecological footprint left on the environment by activities and facilities of the university. The range of initiatives include numerous water-saving measures, integrated waste management, exploration of alternative (renewable) energy resources, energy efficiency initiatives, green building projects, exploration of alternative methods of transport and enhancement of biodiversity. The Facilities Management Division plays a leading role in the planning, implementation and coordination of these initiatives, which aim to reduce the greenhouse gas emissions and ecological footprint of SU. This extends to several community engagement and outreach activities, as well as the Student Representative Council, which has an active portfolio concerned with sustainability. Initiatives at SU therefore do not only have a focus on the impact of the university and campus on the environment but also involve the broader Stellenbosch area and community. Social Impact constitutes one of the core functions of SU and involves partnerships/collaborations with communities, municipalities, NGOs and government departments, thereby enhancing the ability of the university to contribute to sustainable development and the achievement of the SDGs.

SU works closely with the municipality so that Stellenbosch can be turned into a sustainable and green campus. To this effect SU have solar panel systems for many of their buildings and all new buildings are ecologically friendly, with water also harvested. Other examples illustrate the application of research conducted at SU to the advantage of communities, including the provision of water to communities through green technologies and access to energy and sustainable food production.

The campus has rapidly been turned into a green campus. Several initiatives in this regard are still in progress, involving the whole of Stellenbosch and

the surrounding areas. A top management official at SU highlighted that an exact similar effort might not be found at any other university in South Africa, for instance, in terms of the initiatives and efforts to save water. These efforts are planned and implemented in such a way that they will have a long-term, permanent impact. SU's green campus initiatives directly connect with research on water and renewable energy, and the university's flagship research programme on complex systems in transition, which deals with resilience in terms of climate change. The top management official indicated that the envisaged School for Climate Studies will go a long way in improving the coordination and the alignment of all sustainability and climate change research initiatives at SU.

University of South Africa (Unisa)
In 1946 Unisa became the first public university in the world to teach exclusively through distance education, and currently enrols nearly one third of all South African students (Unisa, 2020a). The Charter of Transformation (accepted in 2011) provides the basis for Unisa's values and also forms the foundation for the Unisa 2030 Plan, which sets the strategic focus for the university. The revised version of this plan provides indicators to measure the performance of Unisa in terms of its contribution to the SDGs (Unisa, 2019). Unisa's values, mission, vision and strategic focus resonate with the principles of the United Nations Global Compact (UNGC), with Unisa becoming a signatory in 2007. As explained in the 2015 Unisa UNGC Report, Unisa's 2030 Strategy, the NDP, the AU Agenda and Vision 2063 and the SDGs all speak to the same ideal, namely "a world whose nations and societies care enough to put people and planet before personal gain and power" (Unisa, 2015). In this regard a top management official at Unisa commented as follows:

Sustainability and climate change must be central in the work of any university. I mean, we must consistently take leadership in these areas. So I'm pleased that we did not simply just stand on the side to say we are appreciating sustainability, but we took the step forward by becoming the first education institution in South Africa to sign and ratify the United Nations Global Compact. This means we are now reporting every second year,

as per the UNGC's requirements. So in this sense, our own activities in the area of climate change and sustainability have been improving because, once you make such a commitment, you must do something that you can report on so that everyone else can have that appreciation.

While sustainability initiatives are steered from the Vice-Chancellor's office, the Environmental Sustainability Policy (launched in 2012, revised 2015) and the Green Economy and Sustainability Engagement Model (GESM) (launched in 2013) provide the framework to operationalise environmental stewardship at Unisa (Unisa, 2016). The Environmental Sustainability Policy commits Unisa to environmental sustainability through awareness of sustainable living practices and by addressing environmental challenges encountered in the operations of the university. The GESM advocates for a Unisa that prioritises attention to environmental concerns through internal resource pooling and, where necessary, external partnerships. Milestones in Unisa's sustainability journey include: 2008 - Exxaro Chair in Business and Climate Change founded; 2013 - Sustainability Office established; 2014 - Sustainability Framework adopted; 2016 - Energy and Carbon Policy and Integrated Water Efficiency and Rainwater Harvesting Master Plan adopted; 2018 - Sustainable Transport Initiative launched; 2019 - SDGs Indaba and formalisation of localisation of SDGs at Unisa. The views of a top management official on the policy framework for sustainability at Unisa are as follows:

My sense is that without our policy framework, we would have not succeeded. It might have slipped when it comes to implementation. Because we have policy in place, we've been in a position to really get some kind of mileage out of it. All the things we have been doing have been relying largely on our policy development, including our carbon footprint initiatives, the way we manage our energy use, our waste management initiatives and also the sustainability initiative to transform transport.

A number of academic departments at Unisa are actively involved in tuition that addresses environmental sustainability (Unisa, 2016). The College of

Agriculture and Environmental Sciences (CAES) is in the vanguard of such programmes, amongst others hosting the inter-multidisciplinary BA and BSc Programmes in Environmental Management, the National and Advanced Diplomas in Nature Conservation and the BA and BSc Honours in Environmental Management. In addition, departments in various colleges offer modules linked to the theme of sustainability and some of these are used as service modules for various qualifications. Examples include modules as Environmental Law (College of Law), Environmental Engineering (College of Science, Engineering and Technology) and Environmental Education (College of Education). Of particular relevance are the "signature modules", which is an initiative to introduce Africanness, relevance, social responsibility and multi-inter-trans-disciplinarity into curricula (Baijnath, 2014). All undergraduate qualifications need to include one of these modules, of which two are of particular relevance – *Environmental Awareness and Responsibility* (CAES) and *Sustainability and Greed* (College of Economic and Management Sciences).

At this point some serious work that is underway is from the side of the School of Business Leadership and from CAES. There are a number of programmes right now that are addressing environmental and sustainability matters. In the case of CAES, it lends itself to that space, which is why they have several such programmes, comparatively speaking. But there is this interesting signature module from Economic and Management Sciences on Sustainability and Greed, which placed the college on a significant pedestal, because of the number of students who are taking it, which is just above 20,000. Very few universities can talk about having those numbers of students for their offerings. The potential impact of this module on society is therefore fairly huge and wide-reaching.

The focus of research at Unisa links with the 2030 Plan and acknowledges the importance of the African context, the role of women and the need to increase outputs in focus areas as knowledge generation and human capital, the needs of South Africa and Africa, promotion of democracy, human rights

and responsible citizenship, innovation and capacity building in science and technology, sustainability and open distance learning (Unisa, 2020b). The 2018 research report (Unisa, 2018b) showcases several research projects at Unisa that address complex environmental, cultural and socioeconomic problems. Examples include strengthening of water security, contributing to conflict reduction in Africa and highlighting climate change risks. After consistent investment, Unisa succeeded in increasing its publication outputs by 43.8% (2012-2017) and is now one of South Africa's top ten research universities (Unisa, 2018a). The role and impact of Unisa is illustrated by an analysis of papers in the International Journal of Sustainability in Higher Education (2010-2019), which ranks Unisa and Nelson Mandela University as South African leaders with 3 papers each (Poling, 2020).

We certainly do incentivise resources for this cause and do not only pay lip service to sustainability and climate change. In the area of climate change research, we've therefore gone ahead and institutionalised several research institutes and chairs, and that relates to the SDGs as well. We already have this investment, and certainly will continue with it and already have something to show for it, for example the Exxaro Chair for Business and Climate Change. Remember that the Exxaro Chair generates resources, although we also provide resources from our side. And the good news is that the outputs that are coming out of there, is very significant in the sense that the chair is producing not only research articles, but also books that are held in high esteem and which is an exciting thing for us.

A top management official at Unisa highlighted that community engagement is part of the mission and strategic focus of Unisa. In 2018 Unisa had a total of 140 registered community engagement projects, which involved 687,771 people (Unisa, 2018a). Many projects focus on aspects related to the SDGs, including Economic Sustainability, Environmental Sustainability, Health, Human Rights and Social Sustainability (Unisa, 2018a, 2019). Significant research outcomes are generated through this community-engaged scholarship, with 172 publications from

2016-2018. Since Unisa is an open distance e-learning institution, most activities that are part of its community engagement and campus operations and management are performed by staff members rather than students (Mawonde and Togo, 2019). Examples of campus projects include the monitoring of water and electricity use, experimentation with the use of alternative energy sources and the structured collection of data to determine and manage the carbon footprint of Unisa (Unisa, 2018a, 2019).

> *Distinct about Unisa is the scale at which we do things, that's the first thing, but beyond the scale, it is the question of the strategic manner in which we do this investment. In my view, I have not seen it anywhere else in the education sector. We've also made a success, in our case, to take it to our own students and alumni. I'm yet to see the extent to which the other universities have managed to reach this point. Because we've managed to get our ambassadors at that level, it presents a very distinctive part to me that one can talk about, comparatively speaking, and the fact that we've also gone ahead and succeeded in crafting and ratifying our green economy and sustainability engagement model. I can tell you that I don't think that there is another university that has done that in the manner in which we have. Because we coordinate all our efforts and because it is conceptualised and planned correctly at strategic level, you know that the key areas of all operations as institution are part and parcel of it, and this is what assisted us to achieve this kind of success.*

The SDGs Indaba convened in November 2019 at the Unisa Muckleneuk Campus in Pretoria, during which a declaration of intent on the localisation and institutionalisation of the SDGs at Unisa was accepted (Unisa, 2019). However, the fact that the vast majority of Unisa's student body never access the campus and its facilities, deprives students of the learning opportunities available to students attending residential universities. This presents challenges in getting students involved with sustainability issues, although huge potential exists to integrate sustainability messages through the undergraduate curriculum and research on sustainability issues at postgraduate level (Mawonde and Togo, 2019). In this regard Unisa

embarked on research to use place-based assessment for sustainability learning, requiring students to use their local living environments as the basis for their assessment (Pretorius et al., 2019). A related challenge involved the transition from print-based to electronic study materials and assessment. Although these changes make sense in terms of environmental sustainability, students were (and still are) not always willing or able to transform their practices. In this regard the availability of and access to IT infrastructure still remains a huge challenge in South Africa (Lembani et al., 2020).

Challenges and Opportunities: The Way Forward

The situation at Stellenbosch University (SU) and the University of South Africa (Unisa) illustrates that despite some similarities, the way universities and their leaders deal with climate change and sustainability differs considerably between institutions. The situation of SU and Unisa is also not necessarily representative of what can be found at other universities in South Africa. Differences in dealing with climate change and sustainability can be ascribed to a variety of factors. Some relate to the size of the institution (in terms of students and/or lecturers and/or infrastructure), entry requirements, target market and physical location. But these factors may also relate to intangible aspects that are nevertheless of great importance. Examples include access, exclusivity, preferences, perceptions and organisational culture. A few pertinent challenges and opportunities in this regard will now be highlighted, first for SU and then for Unisa.

SU is positioned as a "research-intensive" university and is proactively developing its capabilities and capacity to position itself as a world-leader in climate change and sustainability. At the same time SU has much lower student numbers than Unisa and is focussed on academic excellence rather than providing educational opportunities across the board. Strategic initiatives at SU are focussed on improvement, coordination and alignment to support and enable research. SU benefits from its residential character and location of its main campus as part of the town of Stellenbosch, which facilitates various green campus initiatives as well as the development of the university

and campus as a living laboratory for sustainability.

Based on its large student numbers and nationwide footprint, Unisa has the potential to have a huge impact on climate change and sustainability awareness and skills. Considerable resources for teaching are required given the majority of Unisa's students study at undergraduate level. This may restrict the capacity of staff to do research and engage with communities. Particularly challenging is the drive to go online with teaching, which is constrained by inequalities in internet access amongst Unisa's students. If approached in an inclusive manner and with the provision of suitable alternatives, the online drive has the potential to reach an even wider audience. The Unisa context illustrates the value of a well-developed strategic focus and policy regime for the advancement of sustainability, especially for a large institution. Being a signatory to the UNGC allows Unisa to track progress on its sustainability journey while focusing on key deliverables in terms of teaching, research and community engagement.

The assessment presented in this chapter illustrates how both SU and Unisa are responding to the expectation that higher education needs to assume leadership in matters pertaining to sustainability and at the same time take on the role as change agents towards achievement of a more sustainable world (Calitz, Bosire and Cullen, 2018). This does not only imply adoption of sustainability strategies in policy documents and vision and mission statements, but also implementation across all core functions. The situation at other South African universities is not necessarily similar to that at Unisa and SU in terms of the importance attached to sustainability and climate change and the concern about it, and will differ in terms of implementation details according the unique context in which each university operates and finds itself.

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Chapter 9:
United Kingdom

Valeria Vargas

Sustainability and climate action in the higher education system

The UK combines England, Scotland, Wales and Northern Ireland, and the four nations of the UK have different higher education policies. The system of higher education in the UK has shifted from a publicly funded to a mixed public and privately funded system over the last 40 years (Marginson, 2018). The funding for universities currently comes in great proportion from tuition fees (via student loans) and other sources of funding including research and teaching subsidies, and many universities depend on international students' fees. In this context, internationalisation is one of the most prominent agendas in the higher education sector in the UK.

Universities in the UK were autonomous from government controls until the 1980s when *new public management* started to be developed, an approach that seeks to run public services organisations using private sector management models (Westerheijden, 2018). The higher education system in the UK is still regulated by the government and policy controls (Marginson, 2018).

One of the first evaluation systems that was used for universities in the UK is the Research Excellence Framework (REF) (Torrance, 2019). The REF helps define the amount of funding a university will receive depending on their quantity and quality of their research following a set of metrics. Different iterations of the research evaluation framework have been conducted since 1986 and the next evaluation will be undertaken in 2021. Evaluation frameworks were first driven by the monetarist approach in which governments control the amount of money in circulation to influence the economy. This is problematic because research instead of being driven by knowledge creation and global and local challenges, is driven by targets that can be influenced by specific groups in

society. The Framework has also been criticised because local research is less valued than international research. This is a problem because local challenges are context specific and require local research to address them, and because local research can be a steppingstone to develop quality international research (Torrance, 2019).

The most recent change to the evaluation system for universities is the Teaching Excellence Framework (TEF) which was introduced in 2015 (Hayes, 2017). The evaluation of teaching through the TEF is based on three key metrics (Hayes, 2017): first, alumni employment and earning data; second, student retention and continuation data; and third, student satisfaction data (Hayes, 2017). The TEF also has some problematic aspects, for instance because it focuses on the institutional level, it may not provide enough detailed information about the quality of courses. Also, measuring good quality teaching is complex and the TEF results do not reflect these complexities.

There is an important distinction between pre- and post-1992 universities in the UK. The former are older traditional universities that are research focused. The latter are modern universities, originally polytechnics, that gained university status through the Further and Higher Education Act 1992 and historically have been focused on teaching and learning. There are a small number of private providers with relatively few students. In conclusion the higher education system in the UK is a long-established competitive system, regulated by complex and contested metrics, and considerably driven by financial and economic considerations.

As mentioned, the UK has different higher education policy frameworks for each of its nations and this is also the case for the sustainable development policy frameworks (Vargas et al., 2019b). In Scotland, *Learning for Change: Scotland's Action Plan for the Second Half of the UN Decade of Education for Sustainable Development* (The Scottish Government, 2010) was followed by *Learning for Sustainability Scotland* (RCE, 2013). After working to implement these policy frameworks and reviewing progress, Scotland developed the *Learning for Sustainability Action Plan* (The Scottish Government, 2019). The

latter is focused on schools and only mentions universities as relevant stakeholders through the Environmental Association for Universities and Colleges (EAUC) Alliance for Sustainability Leadership in Education.

In Wales, *Education for Sustainable Development* and *Global Citizenship A Strategy for Action* (Welsh Assembly, 2008) were developed. Later Wales published the *Well-being of Future Generations* (Wales) Act 2015 (Welsh Assembly, 2015). However, the Act does not directly include universities but outlines their responsibilities in public service boards. England and Northern Ireland share Sustainable Development in Higher Education (HEFCE[1], 2008 and 2014) which has not been updated yet. This last policy framework provides examples of universities' contributions towards sustainable development, and suggests a framework for the funding body's support to the sector, as well as policy statements for sustainable development and carbon reduction.

Policy frameworks are enacted in a heterogenous manner and there is a wide range of sustainability activity levels across the country. These policy frameworks mention a range of stakeholder organisations external to the universities (e.g. funding bodies, professional bodies, quality assurance body, local authorities, energy efficiency finance association, The Carbon Trust, national student associations) and the interactions between them (Vargas et al., 2019b). However, the policy frameworks require more detail regarding funding and governance approaches to better support the implementation of sustainable development (Vargas et al., 2019b) and related climate change action. In addition, there is no vertical integration across international, national (i.e. UK) and organisational (i.e. higher education sustainability leading institutions) policy frameworks (Vargas et al., 2019a). Vertical policy integration is vital for supporting policy implementation (Vargas et al., 2019a).

17% of UK universities produce sustainability reports; these are more likely to be produced by large institutions (Sassen, Dienes and Wedemeier, 2018).

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1   HEFCE no longer exists. Its responsibilities have been given to the Office for Students and Research England.

Similarly, universities that are largely dependent on research funding (more likely to be pre-1992 universities) are less likely to produce sustainability reports than universities with lower levels of research funding (more likely to be post-1992 universities) (Sassen, Dienes and Wedemeier, 2018). Sustainability reports and policy frameworks suggest that the UK has some level of sustainable development implementation in higher education including climate change action. However, there are significant differences between the efforts and commitments towards sustainability and climate action of some universities compared to others.

This disparity is apparent in the University League of People and Planet, the largest student network in the UK focused on social and environmental justice (People and Planet, 2019a). The league results from 2019 show that universities' performance in respect to sustainability and climate action range from high, with some universities fulfilling the criteria to a large degree, to low, with some universities failing in several criteria. As well as evaluating universities' sustainability and climate action efforts, People and Planet also supports students to run campaigns to challenge their universities to divest from fossil fuels. These campaigns have resulted in commitments by 82 universities across the UK to divest £12 billion (People and Planet, 2019b).

In the UK students have also helped leading climate action and sustainability through programmes and campaigns organised by the National Union of Students. These include (Students Organising for Sustainability [SOS] UK, n.d.):

1. Green Impact: framework for collaboration and behaviour change in relation to sustainability.
2. Student Switch Off: campaign to engage students in energy saving activities and habits.
3. Responsible Futures: accreditation mark and universities' network that seeks mainstreaming education for sustainable development in the formal and informal curriculum for all students.

The annual national survey run by the NUS Sustainability team, now SOS UK, suggested that for 52% (up from 45% in 2018-2019) of respondents, their

choice of place to study was influenced by how seriously universities take environmental and global developmental issues (SOS UK, 2020). 91% thought that their place of study should actively incorporate and promote sustainable development and 83% would like to see sustainable development actively incorporated and promoted through all courses. This suggests an emerging theme around the incentives for sustainability action arising from the concerns of students and communities, and therefore functioning as a kind of branding mechanism for student recruitment. However, a problematic aspect of this could be universities' "greenwashing" attitudes to student recruitment. If sustainable development and climate action are taken seriously by universities this could contribute to student recruitment in a genuine way.

The EAUC supports and encourages universities to implement sustainability in all their activities. With 194 higher and further education institutions members, the EAUC administers the Green Gown Awards, which are an established set of awards for higher and further education institutions with categories in different areas of sustainability and climate action (Green Gown Awards, n.d.).

The Quality Assurance Agency, the independent body that checks standards and quality in UK higher education, published education for sustainable development guidance in 2014 (QAA, 2014). This guidance is in the process of being updated. In addition, the Higher Education Academy (HEA), now Advance HE, provides support to universities through funding (e.g. Green Academy or funding for a national survey on students' attitudes towards sustainability) and other resources such as conferences to help them become more sustainable. Perhaps linked to the changes in UK higher education and the HEA, funding for sustainability in higher education – grants for campus, curriculum and research into students' attitudes towards sustainability – seems to have decreased at national level in the last 7 years.

Although certain national organisations and rankings encourage universities to contribute to sustainable development and climate action, there are aspects of the higher education system that discourage this agenda. For instance, research suggests that academics think that the approach taken through the REF has not been supportive of interdisciplinary, sustainability and pedagogical research focused on education for sustainable development (Bessant and Robinson, 2019). These three aspects are crucial to advance climate change and sustainability research at universities. Due to the great influence that the REF has on universities this might be a considerable missed opportunity to help embed sustainable development and climate change into research activities across all disciplines.

Two example of initiatives covering education, knowledge production, service delivery, public engagement, and institutional operations are Living Lab approaches and Carbon Literacy. The Carbon Literacy Project started in Manchester and is currently run by Community Interest Company Cooler Projects on behalf of the Carbon Literacy Trust (Molthan-Hill et al., 2019). One of the long-established Carbon Literacy programmes in the UK is run at Manchester Metropolitan University (CL4Ss; Molthan-Hill et al., 2019). The main aims of the CL4Ss are that:

> *Each student knows the basic principles of climate change science, understands how it impacts their lives, including their disciplinary area and future job sector, makes an active commitment to reduce their carbon footprint (both now and in future employment), and develops skill in communication to encourage others to do likewise (Molthan-Hill et al., 2019).*

In addition, the Carbon Literacy training developed at Manchester Metropolitan University works by training students and staff for them to deliver training for their peers at the University. This cascade training model is funded through the Environmental Education Fund (Dunk et al, 2017). This is an internal system to help compensate for climate carbon costs of student air travel that could be replicated in other universities (Molthan-Hill et al., 2019).

Living Labs have also becoming a useful tool to implement sustainability and climate action throughout UK universities. In the context of sustainability and climate action, living labs are approaches for different stakeholder groups to collaborate and address sustainable development challenges:

All stakeholders (i.e. professional services staff, academic staff, students and external stakeholders) benefit in their own areas while contributing to other stakeholders' priorities, as well as making the university or local area more socio-economically and environmentally sustainable. [...] This can help build the capacity of institutions in dealing with major barriers, which in turn helps enable radical education and research potentialities of universities. In doing so, Living Labs can ultimately become a spark for larger internal and external transformations. (Waheed, 2017; p 6-7)

However, there are different extents to which universities can adopt these approaches (Price, Vargas and Wheater, 2017). Living labs are challenging and often remain aspirational. The University of Cambridge has created a Living Lab using funding from Santander (Cooper and Gorman, 2018). The University of Manchester funded a lab partly using England's Higher Education Innovation Fund (Cooper and Gorman, 2018).

In conclusion, universities in the UK are affecting climate change and contributing to sustainability through their activities and in collaboration with their stakeholder networks. This is reflected and highlighted by university rankings and awards. However, there is wide variation in universities' climate action and sustainability activities.

Institutional Case Studies

Nottingham Trent University
Nottingham Trent University (NTU) was founded in 1992 as a new university but its origins date back to 1843. It has about 34,000 students and over 5,000 staff split over four different campuses in Nottingham. The Brackenhurst Campus has 500 acres of countryside including greenery, woodlands and water and is used as an outdoor classroom (Nottingham Trent University [NTU], n.d.).

The University has been awarded 3rd place in the People and Planet University League 2019 (People and Planet, 2019c) and 5th place in the international 2019 UI GreenMetric Ranking (Green Metric, 2019). NTU was the first university in the UK to gain a Gold

Award in the Learning in Future Environment (LiFE) index which is a scheme to improve environmental performance and social responsibility in UK higher and further education (Erlandsson et al., 2017), and its Business School is a signatory to the PRME (Principles for Responsible Management) initiative (Erlandsson et al., 2017). NTU was Green Gown Awards winner in the category 'Outstanding Leadership Team of the Year' 2019 and 2018, and it is also a member of the EAUC (EAUC, n.d.).

NTU has a department devoted to embedding education for sustainable development into the curriculum: the Green Academy. It was created through the Green Academy Change Programme funded by the HEA (Erlandsson et al., 2017), and the approach has been to systematically review the curriculum and engage academics to include education for sustainable development in their teaching at all levels and in all disciplines. NTU Green Academy has become a permanent university team working on issues related to sustainability and climate change with staff and local communities. NTU has a second permanent team working in estate, operations and engagement of students in sustainability. Collaboration between these two teams facilitates NTU's *living laboratory* approach linking the curriculum with the campus to contribute to sustainability and address climate change.

Another aspect highlighted in the interview is the importance of the partnership work between the Student Union and NTU in outreach projects around practical sustainability: "*[we are] working with a lot of volunteer groups, community groups, [and have] a very good engagement with our Students' Union on this.*"

Talking about barriers, NTU's Chief Operating Officer and Registrar mentioned that:

Colleagues have got lots of other things to do. Sometimes the priorities that are set internationally or nationally, I think distract because they seem like good things to do [...] when you try and translate that into a local context, you can't see an immediate impact or benefit or return. It's such a broad area [...] So again, trying to keep calling for focus is what we are trying to do through the

strategy: here are four things that if we do well, will make a difference. The good thing is that people are committed to it and feel very passionate. The challenge is people are committed to it in a very passionate way and that clouds sometimes. What we're trying to do is bring a bit of rationality to it.

Yet according to NTU's Chief Operating Officer and Registrar, it is not looking "*to be distinctive for distinctive sake*", "*it has got to mean something*"; it may not be "*distinctive but it could have great impact*".

NTU's Carbon Management Statement 2010 aims for: "At least 48% reduction in scope 1 and 2 carbon emissions[2] from 2005/6 to 2020/21." (NTU, 2010; p1). NTU's Ethical Investment Statement states that the university does not knowingly invest in the fossil fuel sector and is actively increasing investments in low carbon (2016; p1).

NTU's interview suggested how certain aspects that might not be attractive or exciting can have a very important impact:

> *Managing properly the heating and the lighting and dealing with the waste properly, you know, which is really hard, it's not exciting, but actually I think that's where we'll make some of the biggest impacts.*

Therefore, working in the less exciting parts of climate action and sustainability is as important as working in other issues that people might be more passionate about.

In conclusion, sustainability and climate action at Nottingham Trent University have benefitted from funding to create NTU's Green Academy which is focused on curriculum development. However, the long-term continuation of NTU's Green Academy and the estates and operations sustainability department has been supported by the pragmatic approach by senior leadership and the collaboration between

NTU's staff, students and Students' Union. A key challenge is that the passion and interest by staff and students which seems to be driven by broad national and international ambitions cannot be translated in the way they expect.

The University of Edinburgh
The University of Edinburgh was founded in 1583 and has about 40,000 students and 15,000 staff (Shawe et al., 2019) split over five campuses in Edinburgh. The university is in 38th place in the People and Planet University League 2019 (People and Planet, 2019c) and in 2019 was winner of Green Awards in three different categories. It is member of the EAUC (EAUC, n.d.) and a signatory of the International Sustainable Campus Network (ISCN) Charter which has as a focal point the integration of teaching and learning, research and facilities. This integration is key to the University's Living Lab approach to social responsibility and sustainability. The University of Edinburgh believes that "treating the University as a Living Lab means using our own academic and student research capabilities to solve social responsibility and sustainability issues relating to our infrastructure and practices" (University of Edinburgh n.d.). The university has created three key sets of publicly available online resources to facilitate and encourage Living Lab projects: a Living Lab toolkit, datasets for Living Lab projects and a database of projects.

The University of Edinburgh has a comprehensive number of policies, strategies and initiatives related to sustainability and climate action compared to other universities (Shawe et al., 2019). The documents presented by University of Edinburgh are an example of good practice because they present data clearly, the documents are easy to find, and they are consistent year on year (Shawe et al., 2019).

Regarding the reasons for their sustainability and climate action work, the Principal of University of Edinburgh, Professor Peter Mathieson, commented:

> *We're a big employer, therefore our operation needs to also be founded on principles of sustainability. For that reason, but also and not least because we know that our student community and our staff community care about these issues,*

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2   Scope 1: direct emissions from owned or internally managed sources. Scope 2: indirect emissions from energy obtained externally.

and we need to be responsive to both internal and external societal priorities. For those reasons I think it's absolutely central to the work of a university like Edinburgh.

The interview also suggested that it is very important, especially for senior leadership staff to focus on the process and continuous improvement of sustainability and climate action policies and implementation:

there was very good evidence of divestment in fossil fuels and ethical investments policy. So, that was already in place. In terms of the carbon neutrality pledge, I think it was a pledge without enough substance underneath it. What we've formulated in the last couple of years is a much more detailed policy, which has been presented through a policy formation process.

Or in another instance during the interview:

I worry that some of the sort of comments I've made sound as if we think that we've solved all the problems and we know jolly well that we haven't. I think it's important to remain realistic and to recognise that there's an enormous amount we don't know, and there's an enormous amount of what we've aimed to deliver, which might actually be very challenging to deliver. So I think there is no room for complacency. There is a real danger that every year there'll be something. There'll be some external event it'll be coronavirus or Brexit or something else will happen. And everyone says, okay, well, let's deal with that. And then we'll worry about climate change in the longer term. And if we keep on putting it off it'll be too late to do anything about it. So I do think that the risk of complacency is a real one. And I think also the risk of being distracted by what I would describe as firefighting of short-term issues must not be allowed to, to distract attention from the longer-term agendas. And I think that's a real challenge to us, but also to other organisations like us.

Historically the University of Edinburgh has had a "*civic identity*":

We were the first to be a truly civic university, that goes back right from 430-odd years ago when we were founded. So that identity is very important to the University of Edinburgh and we remain embedded in the city [...] a lot of the things that we do, we do in conjunction with the city council, with other regional councils, with local schools and local businesses. There is a civic emphasis.

The University established the Department for Social Responsibility and Sustainability in 2012 (Cooper and Gorman, 2018). This Department "works to enable the University to understand, explain, and deliver on its ambition to be a leading socially responsible and sustainable university" (University of Edinburgh, n.d.a; n.d.b.). The Department covers a wide range of areas related to society, economy and the environment. The Department's priorities are climate and energy, circular economy, community, supply chain SRS, responsible investment, learning, teaching and research. This is unusual as universities tend to have compartmentalised approaches and do not integrate social responsibility and sustainability holistically (see Chapter 2). The Department includes a Forestry Consultant, a Health and Wellbeing Co-ordinator, a Circular Economy Analyst, a Research and Policy Manager focused on Climate Change and Biodiversity, a Social Responsibility in Supply Chains Programme Manager and a Communications Manager: Finance and Community Engagement. The Department also has a Climate Policy Team. The University of Edinburgh committed to becoming carbon neutral by 2040 (University of Edinburgh, n.d.c.).

In conclusion, sustainability and climate action at the University of Edinburgh have benefitted from a historic identity as a civic university and the links to local stakeholders. However, the long-term continuation of sustainability and climate action activities has been supported by senior leadership staff, continuous improvement and a team of staff dedicated to sustainable development-related work. Key challenges include short-term thinking by both universities and government, and competing priorities such as financial security after the COVID-19 pandemic.

Nottingham Trent University and University of Edinburgh are both large institutions with a history of work in the area of sustainable development. Although they are perceived as different type of universities at national level they have similar approaches to embed sustainability and climate action in their activities. These include policy development through consultation, transparency in their policies and reporting mechanisms, dedicated expert teams for sustainability and social responsibility, stakeholder engagement including staff, students and outreach activities, a focus on research activity in sustainable development, and living lab approaches that aim at linking teaching, research and practice. Both also have some unique characteristics. The University of Edinburgh has integrated social responsibility and sustainability, with a department focused on these two areas. NTU has a strong focus on education for sustainable development work, with a department devoted to this, as well as a focus on sustainability and climate action in estates and operations. The University of Edinburgh seems to have a more marked emphasis on social responsibility and ethical investments than NTU. However, NTU seems to have worked thoroughly and systematically to integrate education for sustainable development in the curriculum.

Challenges and Opportunities: The Way Forward

Implementing sustainability and climate action is complex and requires time. Although there are differences between the four UK nations, the UK presents some signs in the higher education sector of top-down sustainable development policy implementation through policy development, funding and other resources. There is also evidence of bottom-up sustainable development and climate action work through student unions and university associations. In addition, there are some examples of good practice such as the living laboratories approach and carbon literacy, but these are yet to be scaled up nationally.

A key problematic area that impedes a swifter integration of sustainable development and climate action at universities is conflicting approaches. Some more research is required to understand the conflicting national approaches that support or hinder sustainable development and climate action in higher education at national level. Some examples presented by this case study are:

1. aspects of REF that hinder the value of local research which benefits the development of context specific solutions to local and global sustainable development issues.
2. the decrease in nationally provided sustainable development and climate action funding for universities,
3. the withdrawal from updating and creating sustainable development policy frameworks for higher education at national level
4. a strong economic emphasis that can obscure the importance of social and environmental issues.

Making progress towards sustainable development and climate action is a long-term aspiration requiring continuous improvement, reflection and engagement with universities' communities (e.g. staff, students, local communities, government, industry and business). Leading universities are also working to put the sustainability and climate action agendas at the core of their work – a challenge due to the range, number and complexity of other potentially competing agendas.

However, sustainable development and climate action seem to be issues that are of growing interest to students. This is especially relevant because there is research suggesting that sustainable development activity at universities influences students' university choices (SOS UK, 2020). This finding, combined with competition in terms of student recruitment between universities, shows how universities could use their sustainable development and climate change work to respond to students' interests. Moreover, league tables and rankings focused on sustainability and climate action provide an outlet for universities to showcase their work in this area. They also provide an opportunity for students to make more informed choices.

The universities in this case study seem to have met students' demands in this respect. Some of the factors that may help include:

1. Linking policy and practice through interdisciplinary stakeholder engagement for action orientated communities

Active and meaningful stakeholder engagement is required to develop policy and action. University leaders have a crucial role to support internal and external stakeholders in this area, providing strategic vision and creating opportunities and nourishing the passion of staff and students in the short and long term. Both NTU and the University of Edinburgh have prioritised the development of policies and strategies through consultation across their communities and both interviewees agree that universities' staff, students and local communities request and support the development and implementation of sustainability and climate action policy frameworks. In addition, both universities have developed elements of a living lab approach.

2. Linking policy and practice through planning, achieving objectives and creating impact

Both interviewees agreed that planning and achieving objectives is crucial to contribute to sustainable development and climate action. Moreover, planning and achieving objectives need to be directed to create the greatest impact. As has been shown, it is important for university leaders to support evaluation of the process of planning and implementing, for instance, through using a Plan-Do-Check-Act cycle holistically across all areas of university activities.

3. Linking policy and practice now and for the future through a culture of continuous improvement

Evaluation can support improvement as well as the achievement of objectives and planning cycles. However, evaluation results need to be analysed and evaluation recommendations implemented. Therefore, an opportunity and challenge for university leaders is to develop a culture of continuous improvement. This is something that both NTU's Chief Operating Officer and Registrar and the Principal of the University of Edinburgh value greatly.

4. Strategically integrate social, environmental and economic aspects through policy and practice

One of the major challenges for university leaders is to strategically and holistically lead the integration of social, environmental and economic aspects. The University of Edinburgh is one of the few universities with a department that combines the three. This integration is facilitated by interdisciplinary engagement and collaboration between stakeholders, and by a culture of continuous improvement.

There is substantial research focused on sustainable development and climate action at UK universities. However, more could be done to understand the dynamics that influence the work of universities in this area, for instance student demand. In addition, the four aspects discussed above could be developed further in the academic literature as well as links between them.

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Chapter 10:
USA

Julie Newman

Sustainability roots in North America

The intersection of sustainability and higher education in the United States and Canada has deep roots dating back to the 1972 United Nations Conference on the Human Environment which issued the Stockholm Declaration (Washington-Ottombre, Washington and Newman, 2018). Two more decades would pass before a framework would emerge that would begin to question and eventually trigger a re-evaluation with respect to what our universities were and ought to be teaching our students. The question of how much were universities contributing to the global and human health challenges in the world via the manner in which higher education institutions (HEIs) were educating their students began to emerge (Washington-Ottombre, Washington and Newman, 2018). With the evolution of the field came a recognition that HEIs are contributing to the problem and the solutions, thus the emergence of a model that called for academic mission and operational alignment.

Eighteen years after the publication of the Stockholm Declaration, a select group of North American University Presidents would convene in Talloires, France to discuss what role higher education ought to play in advancing the principles of sustainable development via education, research, teaching and demonstration. The Talloires Declaration emerged from that meeting in 1990. This would become one of the first institutional specific declarations in North American tailored for higher education yet drawing on the many international frameworks that came before (Wright, 2004). Moreover, the connection between the normative imperative of how to advance sustainable development on our campuses would begin to connect HEIs' operational and infrastructure design to the academic mission of the campus.

As the field of campus sustainability slowly grew roots across campuses in North America, a limited interpretation of sustainability, predominantly focused on environmental management and operations, became the defining framework (Washington-Ottombre, Washington and Newman, 2018). Regardless of the university, there was a fundamental understanding that the role of HEIs needed to redirect research, teaching and operations in a manner that advanced a sustainable future. Concurrently to HEIs' embracing of sustainability in the 1990s in North America, a number of non-profits began to emerge seeking to shape and support HEIs from the outside (Wright, 2004). Two membership-based organisations provided the foundation for scaling HEIs' efforts and convening leadership: Second Nature (1993) and the American Association of Sustainability in Higher Education (AASHE) (2001). The mission of Second Nature evolved to specifically enable the acceleration of "[…] climate action in, and through, higher education", whereas AASHE was founded with a broader mission to "inspire and catalyze higher education to lead the global sustainability transformation". Both have provided tools and platforms for information sharing, comparative analysis and collective engagement. Both organisations continue to play an important role in providing an essential platform as a connector and amplifier of the climate and sustainability efforts taking place throughout North America.

The success of the work on campuses also relies heavily on industry partnerships. During the same time period that Second Nature took root, the US Green Building Council (USGBC) was established with representatives from the American Institute of Architects. Over the next five years the USGBC created a scalable building standard – Leadership in Energy and Environmental Design (LEED) – with the vision "that buildings and communities will regenerate and sustain the health and vitality of all life within a generation". LEED certification provided a framework that called upon a comprehensive design for sustainability that required achievement across six performance areas of human and environmental health: sustainability site development, water savings, energy efficiency, materials selection, indoor air quality and innovative design. As of 2018 there are 67,200 LEED-certified buildings throughout North America. The development of sustainable design standards catalysed the evolution of related

supply chains, and a growing number of cities integrated LEED standards into local building codes, thus influencing campuses. It became clear in the early 1990s in North America that the successful sustainable transformation of the higher education sector was dependent not only upon internal leadership but also the supply chain – from lab and computer equipment to building materials and food. This sector is still evolving, however the take-away is that a commitment to a sustainable future is a multi-sector systems challenge.

Sustainability and climate action in the higher education system

The goal of achieving a sustainable university is a transformative one with cultural implications that in many instances requires a paradigm shift. Higher education has often been a catalyst in driving both national and global innovation and sweeping shifts in cultural norms. Today, institutions of higher education are being called upon to transform in yet another demonstration of their ability to marshal knowledge in addressing the world's great challenges. A vision for a sustainable campus is uniquely grounded in a trans-disciplinary, problem-solving ethos of a campus, and can be uniquely shaped by the cultural and geophysical context in which the university is embedded.

Many college and university campuses have committed to and have demonstrated leadership in the global sustainability movement by establishing sustainability offices, setting operational and academic targets and tracking various metrics to demonstrate this progress, over time. Ultimately – if successfully framed, executed and scaled – there is great potential to profoundly impact the sustainability of our campuses.

In 2015, an analysis was conducted to determine the aggregate impact of the emissions reductions efforts to date as recorded by the Sustainability Tracking and Rating System (Weber, Newman and Hill, 2016). The findings provided three levels of insight: 1) Universities continue to grow and expand regardless of greenhouse gas commitments; 2) Universities do have an impact at the aggregate level of reducing global greenhouse gas emissions proving that every metric

ton of reduction regardless of location counts, discounting the narrative that organisational level commitments are meaningless; 3) Sustainability goals are often not aligned with regional ecosystem conditions (Weber, Newman and Hill, 2016).

Two pioneering universities establishing climate commitments in the United States were Cornell University (2001) followed by Tufts University (2003). Both campuses were motivated by International and Regional Declarations combined with the lack of leadership at the Federal level in the United States at this time. In 2001, Cornell University students were motivated by the refusal of the United States to ratify the Kyoto Protocol and called upon the university leadership to sign on as an independent entity. In response, Cornell aligned their initial goals with the Kyoto Protocol and set out to reduce their greenhouse gas emissions to 1990 levels. The groundwork for this commitment was already established via their 1985 commitment to Energy Efficiency that led to their pioneering Lake Source cooling project by 2000. This was a ground-breaking project and a significant investment for the university with a price tag of $58.5 million. The pioneering investment exceeded the cost of merely replacing the chillers and enabled Cornell to eliminate refrigerant equipment. Most notably, it was this investment that became the groundwork for Cornell to be an early and once again pioneering signatory to the Presidents' Climate Commitment in 2007, leading the way to a carbon neutral future.

Similarly, two years later in 2003 Tufts University President Larry Bacow led the way as the first university to support the Climate Commitment outlined by the New England Governors and Eastern Canadian Premiers which had been announced in 2001. This was preceded by the creation of the Tufts Climate Initiative in 1999 which sought to reduce emissions outlined by the Kyoto Protocol, similar to that of Cornell. The initial commitments announced by Cornell and Tufts were quite ambitious and pioneering for universities at the time, outlining plans to reduce emissions to 1990 levels followed by reductions of 10 percent below 1990 levels. At the time of these announcements, science was calling for reductions of 75-85% reductions below 2001 levels by

2050. Today, twenty years later, the science as outlined in the IPCC is calling for steeper net reductions of global CO2 emissions by 45 percent from 2010 levels by 2030 and to reach "net zero" no later than 2050. Other universities in North America followed suit and began announcing climate commitments influenced by both the Kyoto Protocol and the New England Governors and Eastern Canadian Premiers. This began to set the stage for the unique opportunity to scale regional and international protocols to the campus and community levels and demonstrated the unique role and underlying challenge for higher education.

In 2006, a meeting of university presidents representing colleges and universities large to small, private and public was held at Arizona State University in collaboration with the leadership of Second Nature, AASHE and EcoAmerica. The game changing recommendation that would emerge became known as the American College and University Presidents' Climate Commitment (ACUPCC). This called upon university presidents throughout North American to publicly pledge that their university would commit to reducing their emissions to zero and seek carbon neutrality by an end date grounded in science as well as commit resources to research and educate on climate change. By 2007, they had 284 signatories and in 2020 they have 441.

The process of becoming a signatory to these ambitious goals calls upon the university to sign the commitment, get organised internally around the commitment, establish a greenhouse gas inventory, design a climate action plan, measure progress and review. This is circular process that many universities with public commitments now follow on an annual basis. As more and more universities, large and small, commit to ambitious science-driven goals, the challenge of how to reduce emissions on site becomes a reality. University leaders are quickly faced with how to manage the trade-offs involved with how to allocate resources, and for that matter how best to allocate emission reduction strategies – straddling on- and off-campus investments.

Colleges and universities that have embraced a commitment to sustainability throughout North America

range from small liberal arts to large public and private research institutions. The driver and leadership catalysts may vary institution to institution but there is enough common ground to share a national organisation and engage in cross-institutional information exchanges and rankings. The two case examples in this chapter of Middlebury College and Arizona State University represent two additional climate leadership models which have sought to develop ambitious, scalable solutions that can contribute to the grand challenges of climate change and sustainability.

Institutional Case Studies

Middlebury College

Sustainability is an integral part of how we teach, work, and play, and we are committed to pushing those boundaries as far as we can go in many ways.

- Middlebury College, Office of Sustainability Integration

Middlebury College was founded in 1800, is situated on 350 acres in Middlebury, Vermont and is home to 2,500 undergraduate students. 95 percent of the student body is housed on campus. There are an additional 750 graduate students at the Middlebury Institute of International Studies at Monterey. Middlebury's educational model extends to thirty-five locations around the world, seventeen of which are Middlebury operated. The annual operating budget for the college in fiscal year 2021 is $272 million which funds all of Middlebury's operations including the Middlebury Institute of International Studies at Monterey, the Middlebury Language Schools, the Middlebury C.V. Starr Schools Abroad, the Middlebury School of the Environment, the Middlebury Bread Loaf School of English, and the Middlebury Bread Loaf Writers' Conferences.

Middlebury's contemporary commitment to sustainability and climate change dates back to its foundational Environmental Studies programme that was launched in 1965 and is the oldest undergraduate studies programme of its type in the United States.

Jack Byrne, the foundational Sustainability Director and now Dean of Environmental Affairs and Sustainability at Middlebury College, reflects that this historical foundation "[…] has been a real underpinning influence as to how the college sees itself and defines what Middlebury is today." The Environmental Studies degree programme uniquely grounds itself in the study of the "human relationship to the environment from many different directions, across 24 departments", thus laying the academic framework for a broader commitment to sustainability. Dean Byrne provided further insight into this evolution of Middlebury's commitment by sharing that "in the early 1990s Middlebury's leadership began to reflect on what it would mean to become a *world class institution*". Environment emerged as one of the priorities that would become distinguishing factors and organising principles for the college. The articulation of that priority became a driver for a renewed commitment to sustainability and environmental leadership. At this time sustainability leadership "was coming from the faculty, the corporation and the President" (interview with Jack Byrne). The hire of a new position of Dean of Environmental Affairs in the late 1990s was catalytic. Since this time Middlebury remained true to its foundational liberal arts roots and grew to become an international force that now spans international affairs, environmental affairs, literature, and language study. One of the winning ingredients has been the development of an Environmental Studies Affiliate programme accessible to faculty across the college. Faculty can become an affiliate to the Environmental Studies programme for trans-disciplinary research and teaching. As an affiliate, the faculty agrees to bring some aspect of Environmental Studies and Sustainability into their work.

The broader campus sustainability and climate commitment began to more formally take shape in 2001 via the launch of an Environmental Council, with representative student, staff and faculty members. Dean Byrne provides further insight by explaining that:

Students played a really strong role in affecting and driving change. They have learned and demonstrated over time that it is productive to

be idealistic and willing to do the homework. In turn the college has been exceptionally responsive to this approach.

The story of sustainability at Middlebury clearly represents a model familiar to many higher education institutions, regardless of size, in which an iterative and engaged process of multi-stakeholder committee-based exploration, debate, evaluation and community dialogue took place prior to the release of grander public commitments or fiduciary investments. Today, Dean Byrne believes that:

The environmental and sustainability reputation of the college has been a significant part of many students' decision to go to the college, even though they may not be choosing to be an environmental studies major.

Similar to the earlier examples of Tufts and Cornell, a greenhouse gas inventory was conducted, an extensive report was written and by 2003 Middlebury, also influenced by the New England Governors' and Eastern Canadian Premiers' Climate Commitment, committed to its initial reduction goal of eight percent below 1990 levels by 2012. Ahead of its time, a course entitled 'Scientific and Institutional Challenges of Becoming Carbon Neutral' was launched in 2003 to inform the process. By 2007, Middlebury committed to Carbon Neutrality by 2016 with a commitment to invest in a biomass gasification plant. In December 2016, Middlebury announced that it had achieved the goal of attaining a net-zero carbon footprint "meaning that the institution has balanced the amount of carbon emissions it releases with an equivalent amount sequestered or offset."[1] .

Underlying the story of Middlebury's climate commitment is the story of faculty leadership, student perseverance, a Presidential vision and a decision-making body that embraces the role of higher education in tackling the grand challenge of climate change via research, teaching, education and investment. The work of the Environmental Council led to a commitment to a plan for bold and aggressive

1   http://www.middlebury.edu/newsroom/archive/2016-news/node/543458

climate action combined with a call to action on sustainability at large. In 2005 a new sustainability coordinator position was established. The position was embedded in Environmental Affairs with an affiliation with the Environmental Studies programme. A few years later, the position formally became the Director of Sustainability and the Office of Sustainability Integration was launched. The addition of the term integration reflects the comprehensive approach that Middlebury College has committed to building and providing to the world.

Today, Middlebury's commitment to sustainability is mission driven, and deeply integrated across schools, majors and departments, including the Franklin Environmental Center, the Office of Sustainability Integration, Environmental Studies, the School of the Environment, Bread Loaf Environmental Writers Conference, and the Global Partnerships for Sustainability. The staffing and funding that was established to advance Middlebury's sustainability and climate commitment in the early 2000s has been institutionalised and now fully integrated into the college. The Governance structure has remained consistent for twenty years and the Environmental Council continues to review, measure, assess and envision the future of sustainability at and for Middlebury.

The evolution of sustainability at Middlebury continues and broadens. Middlebury joined the Greater Burlington Sustainability Education Network founded in 2014 in partnership between the University of Vermont, Shelburne Farms and the City of Burlington to promote education, training and public awareness about the Sustainable Development Goals. The Middlebury model smoothly oscillates between a commitment to sustainability on their campus, in their community and in the world.

Arizona State University

ASU is a New American University, promoting excellence in its research and among its students, faculty and staff, increasing access to its educational resources and working with communities to positively impact social and economic development.

— President Michael M. Crow

Arizona State University (ASU) is located in Tempe, Arizona. The campus is situated across five locations and one innovation centre. The history of ASU dates back to 1885. At this time the Territorial Normal School was established to train teachers, teach agriculture and train mechanical engineers. The school evolved into the Arizona Teachers College offering its first graduate degree in 1937 and by 1945 became the Arizona State College. In 1958 the Arizona State College formally became Arizona State University, resulting from a citizens ballot. By 1994 ASU had expanded broadly beyond its base as a teacher's college and became recognised as a Research 1 institution by the Carnegie Mellon Foundation. Today ASU offers 350 undergraduate programs and majors. Since 2016, ASU has been ranked number one in innovation and number one for its global management programme by US News and World Reports. In 2019, 119,951 students were enrolled and 46 percent of the incoming class came from minority backgrounds, becoming the most diverse class in the university's history. 27 percent of the class are first generation college students.

Today, Arizona State University has positioned itself as a "knowledge enterprise focused on solutions to society's greatest challenges, advancing a better life for all". It is upon this foundational platform that ASU's sustainability vision and organisational structure has been built, implemented and flourished. The story of sustainability at ASU is one of bold Presidential leadership, an engaged faculty and embedded in a community in which ASU is deeply integrated. ASU is committed to meeting its sustainability goals via the advancement of sustainability technology and research, establishing a mission-driven commitment to sustainability that leverages the campus as a living laboratory and extends to the global scale with a learning feedback loop process which instils a commitment to continuous improvement. As will be explored in this case example, sustainability is deeply embedded into academic unit goals, teaching and learning objectives, research priorities and operational practices across ASU, involving the coordination of many schools and initiatives. These ambitious goals, although well-funded and supported by top-down leadership, have been difficult to achieve, bringing light to the global challenge faced.

ASU's bold and transformative commitment to sustainability is attributed to the combination of its historical roots serving the citizens of Arizona and the arrival of Michael Crow who became the 16th President of the University in 2002. Chris Boone, Director of the School of Sustainability and Dean of the College of Global Futures at Arizona State University, reflected in interview on the success of ASU and attributes much of the transformation to the catalytic force brought by President Crow at the time. Boone stated that when Crow arrived at ASU:

He had two really important principles he wanted to put into place. The first was a notion that the idea of disciplinary structures and the reductionist model had served their purpose [...] but these were insufficient for trying to understand the complex systems that govern our lives today.

Crow brought to ASU a new leadership model for higher education dubbed the "New American University" (Crow and Dabars, 2015). Dean Boone explained that Crow arrived and "dissolved the departments on campus in an effort to create a series of interdisciplinary schools".

Crow leveraged his platform of reconceptualising higher education in the 21st century and used the ASU campus as the test bed for this vision. There are eight design aspirations that he articulated that drive this change (Crow and Dabars, 2015): leverage the change, transform society, value entrepreneurship, conduct use-inspired research, enable student success, fuse intellectual discourse, be socially embedded and engage globally. Crow launched a process by which to transform ASU into the New American University placing sustainability as a core value to organise around (Crow and Dabars, 2020). Boone emphasises this point by explaining that "the third organising principle that was really important to Crow was sustainability, as he saw this as necessary to address the most critical existential threats facing the planet". He recognised that a siloed reductionist approach to the world's greatest challenges would not suffice and in turn invited faculty, staff and students to reimagine a university that enabled transdisciplinary research, teaching and partnership. A group of faculty joined by other renowned academics were

invited to a retreat and challenged to consider "how could we redesign a university based on principles of sustainability and intense interdisciplinarity" (Boone interview).

Out of that process grew more than twelve new transdisciplinary schools. One of those was a first-of-its-kind School of Sustainability that was launched in 2006. This was not initially well received by all given the unique interdisciplinary nature of the endeavour. As soon as it opened, however, there were 500 students ready to enrol along with significant donors ready to get behind this new vision. One of the indicators for success which quelled any challenges on campus was that the students were quickly snapped up by employers illustrating the market demand for this type of educational background and training (Boone interview).

Donors began to take notice of ASU's transformative approach and in 2004 Julie Ann Wrigley joined forces with President Crow and provided a donation to launch the Global Institute of Sustainability. This became known as the Wrigley Institute and initially was home to the School for Sustainability. The institute deliberately became a launch pad for this new vision in an effort to be able to work across schools and colleges. Crow, with Wrigley's support, set out to provide a:

Service to the university to promote and support sustainability across all components of the university, practice research and offer educational training [...] in essence this was designed to make sure that we [the school for sustainability] did not own sustainability.

In summary, the purpose of the institute was to support sustainability across all of the schools and colleges and not merely create a siloed programme. Due to this approach, ASU now has a number of cross-disciplinary schools that include sustainability as an organising principle for teaching and learning, such as the School of Sustainable Engineering and the Built Environment. Additionally, a number of concentrations emerged that have enabled cross-disciplinary degrees with sustainability – for example Sustainability and Business.

In 2007 ASU became one of the first large research universities to sign onto the American College and University Presidents' Climate Commitment pledge to seek net zero greenhouse gas emissions by 2025. Crow had been a driving force behind the development of this pledge. Boone recalls a story that when Crow was asked if a commitment to climate neutrality would make a difference when one university commits. Crow responded by stating that "universities and colleges might only be affecting a fraction of the energy production, but we are educating 100% of the future leaders". By March 2012, ASU had installed 15.3 Megawatt hours of solar on-site. By June 2019, ASU announced that it had achieved its goals six years early. The strategy was similar to most leading institutions and included deep energy retrofits across new and old stock buildings, and on-site solar supplemented by large offsite strategies via power purchase agreements and the procurement of carbon offsets.

In the 2017-2018 school year, ASU enrolled over 100,000 students which was a five percent growth rate over the 2016-2017 academic year and a 40 percent growth rate over the previous five years. The challenge of growth in space and either student enrolment or researchers or both is a shared challenge across large research institutions.

ASU's sustainability commitment extends far beyond its carbon impact. The campus sustainability leadership for ASU is embedded in the portfolio of the Chief Financial Officer and referenced as the University Sustainability Practices. The primary position and the staff that oversee the campus-based initiatives used to sit within the Wrigley Institute and in time they learned that to enable effective implementation the position had to be embedded within the financial structure of the university. Boone adds that "when you align what you need to do with sustainability, with the chief financial officer, things happen". According to a 2019 report, "the university's goal is not to have the least negative impact possible, but rather the greatest net positive impact". The current Sustainability Strategic Plan is organised around four primary goals: carbon neutrality, zero waste, zero water, and active engagement and principled practice with a commitment to integrate sustainability across

80 percent of campus operations.

In 2020 ASU launched another new and far-reaching structure by the name of the College of Global Futures. Boone explains that they are now reflecting back on the past eighteen years and commencing the next phase of the transformation at ASU. This new college "brings together the School of Sustainability and the School for the Future of Innovation in Society, which grew out of the Centre for Science Policy Outcomes" (Boone interview). The School of Complex Adaptive Systems has also been announced, with one new degree programme named to date on Biomimicry with more to come. To catalyse research and collaboration within the College of Global Futures, a new Global Future Laboratory was recently announced. According to Boone, this new laboratory is "the 2.0 version of the Institute [...] trying to take what we have learned through [that] and focus on global scale dynamics".

Grounded in his experience at ASU, Boone expressed concern that there are many sustainability programmes beginning to emerge throughout the country and he remains apprehensive that such programmes could be developed to attract students but may miss all that needs to be considered to have impact. Boone holds ASU up as a visionary university with a bold vision for sustainability with demonstrable impact. He explains that ASU is host to 130,000 students and that:

> *When they graduate and go out and do things in the world — and they do things — they are bringing that thinking with them and they are bringing that responsibility of leadership which will have a ripple effect across society.*

Challenges and Opportunities: The Way Forward

A tipping point has been reached in our relationship with nature. Six of the hottest years on record in the past one hundred have been since 2014 (Intergovernmental Panel on Climate Change, 2018). Concurrently there has been a 68% reduction in population size of mammals, reptiles, birds and reptiles (WWF, 2020). Institutions of higher education are positioned

to respond to these global challenges and existential threats, but incremental campus sustainability actions are insufficient to address the state of the world today.

It is possible to identify example after example as to how institutions of higher education are uniquely positioned to leverage their collaborative nature by reaching out to peers across the globe to contribute significant ideas, policies, technologies that can help us protect our future. In doing so a platform is provided for building organisational and community-based solutions – locally.

The case examples of Middlebury College and Arizona State University demonstrate that large or small institutions can develop and implement a comprehensive commitment to sustainability. Many campuses have struggled with how to respond and conform to the breadth of sustainability and how to adopt a whole-systems transdisciplinary approach. Middlebury and ASU are examples of campuses that have embraced the need to both train disciplinary and trans-disciplinary specialists recognising that all learners require exposure to the complexity and multi-disciplinary nature of today's global challenges. In other words, both Middlebury and Arizona State University created systems and mechanisms to restructure disciplinary silos in order to enable and incentivise transdisciplinary teaching, research and learning. Leaders in both universities recognise that the complexity of the global challenges faced today cannot be understood or solved by one discipline acting alone.

In the case of Middlebury, the momentum and drive for sustainability and climate leadership emerged from the students in partnership with key faculty and embraced by the President and the Board of Trustees as an organising principle for the college. Arizona State University is demonstrative of a strong leadership model in which the vision calls for a complete reorganisation of the university and its academic structures to meet the unprecedented challenges of climate and sustainability and was catalysed by the President. In both the case of Middlebury and ASU, the leadership recognises that a transformative model at the organisational level is what the world needs. Incremental steps are expected particularly at the individual daily choice level. However for a university to be comprehensively committed to and contributing to a sustainable future, then academic units must be (re)organised and positioned to drive the educational competencies of their graduates. They embrace that the university system is both part of the solution development process and equally part of the problem. This is an essential underlying principle in guiding a sustainability leadership model.

In our efforts to demonstrate best practices in limiting carbon emissions and reducing impacts on ecosystem services, higher education has begun the arduous process of embracing the need to expose our students, who are full participants in this campus-wide effort, how to grapple with complex challenges and work across, at times, seemingly disparate disciplines. The campus matters. The case studies in this report illustrate that campus commitments are localised models of what is needed to advance a global goal – set within our own cultural context yet with shared values, and solutions where feasible.

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Section III:

Meeting Points and Ways Forward

Chapter 11:
Overcoming obstacles to sustainability: lessons from the seven countries

Tristan McCowan, Walter Leal Filho and Valeria Vargas

Issues of sustainability and climate change are necessarily global, involving questions of natural resources, the atmosphere, wildlife and pollution that go beyond national boundaries. Yet the impacts of environmental destruction occur in different ways in different places, with negative effects in many cases disproportionately felt by the poorest communities, even when they have contributed little to the root problems. Responses to the climate crisis also depend significantly on national level processes and dynamics, the electoral process and government policy, as well as public opinion.

Higher education systems show similar tensions between the local, national and global. On the one hand, higher education is within the remit of national policy, with funding streams, regulation and access determined by ministries of education. Yet universities are also embedded in global systems that have a strong influence on their practice, through competition for placement in the international rankings, and the discursive influence of those measures of success, as well as dynamics such as international mobility of students, global scientific communities, and, for lower-income countries, international aid to higher education.

The previous chapters have provided case studies of seven countries, and explored the ways in which they have navigated these tensions between local, national and global. Through national overviews, and close-up focus on two institutions, they have assessed the innovations and impacts that have been made, as well as the challenges faced. These practices and outcomes of universities result from the interplay of local actors embedded in national policy frameworks and global communities, interacting with sustainability challenges that are simultaneously local, national and global.

This chapter provides a synthesis of the findings from the seven country chapters. It does so through a grounded process of emerging themes, rather than assessing the cases through the lens of *a priori* categories. It also offers a reflection on some of the issues related to the case studies, which are of broader interest. The key themes emerging from these cases are leadership, governance, funding, frameworks and networks, and institutional diversity. This chapter has been structured around these five themes, though they should not be viewed as hermetically sealed, with strong interlinkages between them, as will be discussed in the final section.

This chapter does not attempt to provide a systematic comparison of the seven cases: the diversity of universities, higher education systems and national structures would make this a significant challenge. Instead, the purpose of this analysis is the juxtaposition of what are understood to be unique cases (of institutions and of countries), but which nevertheless generate meaningful and useful knowledge for other contexts. In doing so, this report has selected for the most part successful institutions in terms of their sustainability work. Much of the discussion that follows will, therefore, focus on understanding the factors that have allowed these institutions to overcome the forces of inertia, entropy and conservative resistance that act as significant barriers to transformation of higher education systems and institutions around the world.

Leadership

Leading an organisation is challenging in any circumstances, but particularly so in relation to higher education and sustainability. Universities are not neatly aligned institutions with clear hierarchies and chains of command, and protections of academic freedom prevent enforcement of compliance. As stated by Haddock-Fraser, Rands and Scoffham (2018: 4-5):

> *Like most organizations, universities are an amalgam of individuals, each with a religious, political and moral stance. Unlike most organizations, however, these multiple individuals are engaged in knowledge creation, critique and dissemination across multifaceted disciplines*

within which exist a wide range of ontologies and epistemologies, ranging from the theoretical to the empirical and vocational. This provides a melting pot for creativity, disparate views, ideologies and priorities, some of which may be to rail against the values and remit of the very institution employing them.

Sustainable development as an overarching goal presents its own challenges. First, it is a contested idea in its own right, with challenges not only from conservatives and those in denial of climate change and other environmental dangers, but also from those on the left who see it as too cosy with capitalism, and from environmentalists who see it as being too soft on the radical changes needed in human societies. Yet beyond these contestations, any set of values will be hard to promote in an institution that defends its own heterogeneity of belief, and has as its primary mission enquiry and the pursuit of understanding.

These factors mean that any kind of directive or aggressive top-down leadership style is not only going to be undesirable, but unlikely to succeed, and potentially counter-productive. University leaders are not going to be forcibly converting people to the cause of sustainable development, or making them work towards sustainability goals that they are opposed to. Fortunately, a large proportion of those working in universities strongly support the sustainability agenda, although they may do so in different ways and express it to different extents in their work. The task of the leader, therefore, is to galvanise these energies, to ensure coherence of activities across the institution and foster synergies rather than conflicts and trade-offs. HNEE, for example, which has been highly successful in developing a whole-institution sustainability approach, with strong buy-in from staff, developed its model through a participatory process of dialogue involving a range of different stakeholders, including students, lecturers and other staff members. Ideas of transformative leadership, or authentic leadership can therefore be helpful in understanding this role (Haddock-Fraser, Rands and Scoffham, 2018).

In some cases, for example Arizona State University, Ritsumeikan and the Freie Universität Berlin, sustainability initiatives are overseen by the principal/president/chancellor. Yet leadership comes not only from the head of the institution but also a range of other senior and middle level positions, whose roles are not only those of management, but also to set a vision and inspire those around them. The location of leadership in relation to sustainability varies significantly across the cases. Some institutions have specific sustainability leads for the whole institution (for example Middlebury College and the University of São Paulo), others like Stellenbosch and the University of Southern Santa Catarina distribute sustainability across the senior leadership team with responsibility for different areas.

The cases analysed above highlight three key roles for leaders: presenting a vision, fostering alignment and synergy, and nurturing innovation. As represented in the idea of situational leadership (Haddock-Fraser, Rands and Scoffham, 2018), questions of leadership relate not only to leaders' traits and styles, but also to their contexts and the characteristics of their followers: the seven country cases, and the diverse institutions within them, provide significant diversity for exploring the effect of context. Needless to say, sustainability leadership is not a 'one size fits all', and must be adaptive to the particular circumstances.

Presenting a vision
While the 'great man' conception of leadership has been rightly debunked (Leal Filho et al., 2020), that is not to say that there is no room for inspiring individuals. The case of Arizona State University is the clearest amongst those dealt with in this report of the impact of individual leadership. Michael Crow's vision of sustainability, and tenacity to challenge the entrenched structures of the institution, were without doubt pivotal in the transformation of the university. Nevertheless, there are other cases in which the impact of leadership may have been less visible but no less important. Too much dependence on an individual is of course dangerous, not only because of questions of succession, but also because universities are usually decentralised places where many important decisions are taken by others. Arizona State University's mission is striking in the explicitness of its

commitment to environmental protection, but most of the cases covered have ambitious institutional strategies.

Champions have a vital role to play in developing new lines of work, challenging conventional frames and inspiring others. Ideas of institutional entrepreneurship are relevant here (Owen et al., 2020). But there are dangers of the sustainability work of an institution being focused too much on a few individuals. The Brazil cases raise the issue of importance of institutionalisation in ensuring the longevity of initiatives. Succession planning and embedding work in institutional frameworks and practices are key to ensuring that the vital work of champions has value beyond their stay in the institutions in question.

Fostering alignment and synergy

Silo working in universities has become almost a cliché, but it remains a key challenge to address in relation to climate change and sustainability. The nature of climate change and other environmental threats means that they must be addressed in the various dimensions of human existence (technological, political, economic and cultural) and therefore involve the full range of disciplines (multidisciplinarity). Furthermore, dialogue between disciplines and cooperative working (interdisciplinarity) and even going beyond disciplines (transdisciplinarity) have important roles to play. Finally, as many commentators have argued (e.g. Cortese, 2003, Wals and Blewitt, 2010) harmonisation is needed of the different functions and activities of the university – most importantly research, teaching and community engagement.

There are a number of instances of successful cross-disciplinary work in research: the International Research Institute of Disaster Science (IRIDeS) at Tohoku University and the Research Centre for Energy Efficiency and Sustainability at the University of Southern Santa Catarina, for example. Yet institutions found it more challenging to work collaboratively across disciplines in teaching, and qualifications frameworks can prove an obstacle in this regard. Students can be resistant to interdisciplinary modules if there is a perception that they are distracting them from achieving their professional

competencies and graduating in their chosen field. There can also be resistance from some academics to interdisciplinary working. It is important to highlight in this regard that while interdisciplinary research and teaching are crucial for addressing the challenges of sustainable development and climate change, it is not necessary to do away altogether with disciplinary research, which continues to have a central role.

Conversely, sustainability work is unlikely to take root in universities if coordination and synergies cannot be fostered. Challenges of fragmented management systems in some countries are highlighted in the analyses above, in cases where there was a lack of the necessary leadership to forge cross-disciplinary teaching and to have oversight of sustainability work across the research portfolio.

Nurturing innovation

Given the decentralised nature of most universities and high levels of professional autonomy, top-down initiatives are often limited in their effectiveness. Yet there is an important role for leaders in fostering and supporting the bottom-up initiatives that emerge in their institutions. These grassroots initiatives may be organised by lecturers, but students are also crucial here. The UK case showed how successful student-led initiatives can be, in the cases of Students Organising for Sustainability and their impact on curriculum and environmentally-friendly behaviours. The Green Campus initiative in South Africa has also been successful in mobilising student action, as has Fridays for the Future at the Freie Universität Berlin.

Most national higher education systems give substantial autonomy to their institutions, and few have policies on sustainability that lead to uniformity across the sector. As a result, the extent and effectiveness of sustainability practice varies significantly, even amongst similar types of institution. While there may be multiple explanations, leadership emerges as a key factor. The ability of leaders (working at different levels of the institution) to present an inspiring vision of sustainability, to galvanise the efforts and talents of others, and to bring individuals together and ensure synergies between diverse facets of the institution, is crucial to realising the university's significant potential in this regard.

Figure 1. Elements associated with governance of sustainable development at institutional level.

Governance issues

Effective governance systems need to exist within universities for them to promote and pursue sustainability in a systematic way. They are intimately linked to the questions of leadership outlined above. Governance related to sustainability at universities can be described as processes and institutional policies that are put in place to allow them to pursue sustainable development as part of the overall institutional strategy. They have manifested themselves in different ways. For instance, at the Freie Universität Berlin and HNEE (Germany), sustainability can be perceived as being "embedded in the DNA" of the organisations, and an important part of their business strategy. A similar trend is seen in the cases of the University of São Paulo and Middlebury College.

In other cases, where no formal sustainability policies are in place – as with Pondicherry University (India) and the University of South Africa – universities have operational tools and run various activities with significant impact. A similar trend is also seen in some private universities, such as University of Southern Santa Catarina (Brazil) and Ritsumeikan's

'Academy' in Japan, which have well-organised sustainability frameworks. In this context, governance can be regarded in two main ways:

a) as a political response to a number of sustainability issues, and

b) as a coordination of that response in that it offers guidance on how it will be executed.

This differs from occasional or *ad hoc* activities within an institution, or from individual strategies pursued by specific members of staff (Vaughter et al., 2016) . Commonly, as part of governance efforts, it is expected that HEIs have methods in place to ensure that sustainability is incorporated into a) their syllabus (as with UNISA in South Africa), b) in research (e.g. Stellenbosch University and Tohoku University), c) management and operations (e.g. Ritsumeikan's Academy), and d) in community development/outreach programmes (as shown by Arizona State University).

Figure 1 shows the basic elements associated with governance in the context of HEIs.

Whereas there is no "one size fits all" approach to good governance in the context of sustainable development at HEIs, the case study analysis has led to the identification of six core principles:

- *The principle of student involvement*: policies are designed with a view to truly serving and involving the student community (e.g. Middlebury College), taking into account their needs, views and perspectives.
- *The principle of inclusive leadership:* the university leadership ensures that support, stewardship and encouragement are provided for pursuing and achieving institutional objectives (e.g. Freie Universität Berlin).
- *The principle of staff engagement:* a successful governance process requires that all members of staff (i.e. teaching staff, researchers and support staff) are mobilised, and motivated to endorse and pursue institutional sustainability goals (e.g. Arizona State University, University of Southern Santa Catarina).
- *The principle of continuity:* planned activities are carried out in a well-functioning system, over a long period of time, and across different university administrations.
- *The principle of performance management:* governance strategies should be critically examined on a regular basis to determine whether a change of course is needed (e.g. Pondicherry University; Tohoku University). University management should, as part of its governance efforts, put plans in place for monitoring.
- *The principle of networking and relationship management:* a university works closely with partner organisations, suppliers (which may be encouraged to engage, for instance, by delivering environmentally-friendly products) and sponsors (which may provide additional financial support), as pursued by the Indian Institute of Technology and the Research Centre for Energy Efficiency and Sustainability at the University of Southern Santa Catarina. Good management of existing networks and relationships may consolidate or even lead to new alliances.

Governance in sustainability may also equip HEIs to act as leaders of sustainability efforts within their communities and regions, by actively supporting efforts to promote sustainable development (Vaughter et al., 2016; Tladi-Sekgwama and Ntseane, 2020). This may include showcasing their own campus operations, demonstrating to external stakeholders that their actions are in line with the principles of sustainable development (Purcell, Henriksen and Spengler, 2019) and that such efforts are worth pursuing.

The case studies demonstrate the advantages of governance processes to support sustainable development. For example, there are some universities which use their successful governance systems as part of their student recruitment efforts (e.g Middlebury). Here, the values and achievements of institutions are advertised to prospective students. This is, in turn, beneficial to universities, since they have an additional motivation to integrate sustainability into their operations (Adams, Martin and Boom, 2018; Vaughter et al., 2016), as the UK case studies have shown. Training needs of staff may be addressed by offering capacity-building activities (Albareda-Tiana, Vidal-Raméntol and Fernández-Morilla, 2018) as practiced by Pondicherry University, which may be beneficial to the curriculum and research (for academic staff) and be fed into university operations.

Japan's case study suggests that fragmented management of research, education, campus operations, and outreach activity is a barrier to encouraging SDG-related activity. In addition, the case study notes that it is crucial to consider climate change as both a goal and a means for sustainability rather than restricting climate change to environmental protection. Ritsumeikan University has established a systemic platform to support the leadership required to integrate and coordinate university-wide resources for climate action and sustainable development activity.

In conclusion, the case studies suggest that governance is a key factor in guiding institutional efforts to pursue institutional sustainable development. Effective governance means that universities are not only equipped to truly embed sustainable development as part of their strategies, but are also better placed to benefit from the many advantages of a systematic approach to sustainability.

Financing Sustainable Development in Universities

A major obstacle to the implementation of sustainable practices is the lack of financial support (Aleixo, Leal and Azeteiro, 2018). There are a number of reasons for this. First, there is a shortage of sound financial models designed to support the institutionalisation of sustainable development at universities. As a result, there are many well-designed initiatives whose implementation is impeded by lack of funds. Second, many funding schemes are provided for short-term projects, as opposed to long-term programmes. Although helpful, the often *ad hoc* nature of short-term projects means that they do not support efforts at the whole-institution level. Third, despite many funding schemes provided by foundations, international bodies and NGOs which can support institutional sustainability efforts, only a small number of universities apply for such funds. Therefore, a change in the current financing and fund-raising practices is needed in order to provide a more sound economic basis upon which initiatives to promote sustainable development may be implemented.

The experiences from the case studies suggest that there are interesting financial models being used to direct economic support toward sustainable development. One possible course of action, undertaken by HNEE, is to use their networks to obtain financial contributions to their sustainability efforts. This, as demonstrated by Pondicherry, may help them to implement sustainable development policy frameworks (Vargas et al., 2019a). Another possibility is for universities to request support from alumni, which can be used to implement sustainable development initiatives, as Middlebury and the Freie Universität Berlin demonstrate. Alumni funding can either be in the form of money, or by donating resources such as time, expertise, equipment and infrastructure (Chukwu, Chinyelugo and Eze, 2017).

Universities may also use consultancy to obtain funding that can be used in pursuing sustainability goals (Box 1). This involves, for example, offering paid services to the general public and to organisations, as with UNISUL. The money received contributes to supporting university sustainable development

efforts (Chukwu, Chinyelugo and Eze, 2017). In low-income countries, where funding to support sustainable development initiatives is a particularly acute problem, universities may consider using their expertise to generate income. For example, many universities have agricultural expertise. This may be used to generate income for sustainable development schemes. A study carried out in Nigeria showed that revitalising university-owned farms generated revenues, some of which was being used to finance sustainability research (Ameh, Wonah and Nwannunu, 2018). This model may be carried out in other countries, with access to similar natural resources.

There are differences in the funding structure of universities. Whereas in some nations such as in India, Brazil or South Africa public universities usually charge a nominal registration fee to students, others charge full tuition fees. Universities that charge full fees may choose to allocate parts of this income to finance sustainability efforts. This is the case for the UK and US-based universities, as well as the private universities in Brazil and Japan, which heavily rely on funding from tuition fees. This requires good governance to ensure that funding is allocated in an appropriate manner (Chukwu, Chinyelugo and Eze, 2017).

Universities may also promote and advertise their sustainability plans and strategies. Such promotion may attract the attention of individual sponsors and organisations who are interested in supporting sustainable development, a model which has proven successful in the sampled universities in the UK, USA and Japan. The acquisition of external funding may be used to promote sustainable development efforts at universities, and may be in the form of money, materials, or access to infrastructure (Chukwu, Chinyelugo and Eze, 2017). Furthermore, the promotion of sustainability may prompt the creation of dedicated endowment funds where contributions are made on a regular basis specifically to support sustainability initiatives. At present, however, such funding models are not common (Chukwu, Chinyelugo and Eze, 2017; Wekullo and Musoba, 2020).

If attempts to ensure financial support for sustainable development are to succeed, university management

needs to produce financial plans to ensure that sustainable development is accounted for, demonstrating that initial investment is likely to lead to savings in the future (Bogomolova, Balk and Ivachenko, 2018). Previous studies (e.g. Owens, 2017) have shown that the elaboration of a sound financial plan is among the main drivers towards securing economic support for sustainable development initiatives.

Frameworks and networks of sustainable development and climate change

The case studies suggest that international understanding (i.e. UN international policy frameworks and the SDGs) of climate change in relation to sustainable development has permeated universities' understanding at least in their leaders' narratives and organisational policy frameworks. Universities in the case studies tend to see climate action as a precondition for sustainable development. This is similar to international conceptualisations. Sustainable development policy frameworks coupled with institutional efforts help among other things to reduce CO2 emissions and hence contribute towards climate mitigation. Some of the co-benefits for sustainable development and meeting the climate change agenda include pollution reduction, green jobs creation, and biodiversity enhancement (de Oliveira et al., 2013). However, the integrated understanding of climate action and sustainable development is not apparent in all areas of university activities. Climate action is more often related in the case studies to environmental aspects of sustainable development rather than socio-economic ones. In addition, the conceptualisation and understanding in organisational policy frameworks of sustainable development and climate action differs from practice.

The case study findings suggest that university narratives are influenced by national and international policy frameworks and networks. International examples include the Sapporo and the Talloires declaration (Table 1). However, in practice not all university areas and activities are influenced by national and international policy and by networks. One of the reasons for this is the challenges to holistic implementation and practices, including disciplinary structures – as seen in Japan. Another is climate change

scepticism that is still present in universities.

Campus management and university operations are often focused on environmental management; the University of São Paulo and the University for Sustainable Development Eberswalde are examples of this. These areas are not explicitly connected to social responsibility (or social issues in general) and financial or economic considerations in the case studies. This might be due to the compartmentalisation of sustainable development work in universities (Leal Filho, Shiel and Paço, 2016; Leal Filho et al., 2019a; Giesenbauer and Müller-Christ, 2020).

The implementation of sustainable development and climate literacy in teaching and learning is either approached through the perspective of environmental education or education for sustainable development. While usage of the terms varies significantly, environmental education is sometimes seen to focus on environmental knowledge (Tilbury, 1995), while education for sustainable development goes further and encourages the development of skills and knowledge related to sustainable development holistically – i.e. interconnections between environment, society and the economy (United Nations, 2002; 2014). The difference in approaches may indicate that, in terms of teaching and learning, some universities are focusing more on environmental aspects and others are looking holistically at the interconnections between social, environmental and economic aspects. In addition, national policy frameworks seem to influence universities' emphasis in this respect.

Research activity seems to be influenced by academic interest as well as external drivers. These drivers include funding which in turn is often influenced by policy frameworks. An example at national level is the Research Excellence Framework (REF) that encourages a focus on internationally (rather than locally) relevant research in the UK. The REF has also been criticised for not adequately recognising interdisciplinary research (Bessant and Robinson, 2019). However, research activity in the case studies is varied, focusing on the environmental, social and economic aspects of sustainable development. There are examples of interdisciplinary and cross-disciplinary sustainable development research in all case

study countries.

Outreach activities related to sustainability and climate action in the case studies do not appear to follow a specific approach or sustainability focus (for example on the environment, society or economy). Instead, the activities discussed present a variety of approaches often influenced by community needs or academic and university interests. Brazil's case study shows how universities are working on outreach related to energy and water, for example.

The case studies suggest that the SDGs are influencing all university activities. For instance, some universities have used the SDGs as a tool for reporting and evaluating their work through the Times Higher Education Impact Rankings. Other examples include using the SDGs to support policies and initiatives. The SDGs seem to be also encouraging focus on the interconnections between environment, society and economy. This could in turn support an interlinked conceptualistion between sustainable development and climate change.

Some scholars have suggested that cherry-picking is a risk of using the SDGs (Forestier and Kim, 2020) – that is, focusing on one SDG (e.g. Decent Work and Economic Growth) and neglecting the others. This can lead to reductionism which may lead to unintended consequences (Zhang et al., 2016), and exacerbate the negative impacts of climate change and other sustainable development challenges. However, the case studies show that the SDGs often support holistic progress towards sustainable development and climate action. The case studies in this report support the importance of the SDGs in the shift from environmental education to education for sustainable development, and the shift towards a more holistic conceptualisation and implementation of sustainable development in university activities.

The case studies in this report all refer to external networks and frameworks that influence the work of universities (Table 1). There are frameworks at international, continental, national, regional and city level. Some are relevant but not specific to higher education, whereas others are designed with universities in mind.

The case studies do not mention frameworks specific to higher education at regional (i.e. in-country regions) level. The spread of frameworks (the majority are policy frameworks) at different levels is documented in the academic literature. This shows the importance of vertical policy integration for sustainable development implementation and climate action at universities (Vargas et al., 2019b). Also, it has been suggested that the lack of duly implemented policy frameworks is perceived as a barrier for sustainable development implementation in higher education (Blanco-Portela et al., 2017). The relationship between the frameworks and institutional action can be conceptualised as follows (Figure 2).

The academic literature suggests that higher education networks are important to support climate action (Di Gregorio et al., 2019) and sustainable development at universities (Dlouha et al., 2018). Higher education networks focus on campus sustainability (e.g. CAS-Net Japan or the International Sustainable Campus Network), research (e.g. the Promotion of Sustainability in Postgraduate Education and Research Network Asia Pacific, or the Inter-University Sustainable Development Research Programme), teaching and learning (e.g. Responsible Futures in the UK), or on general sustainability and climate action at universities (e.g. EAUC). Some of the benefits for universities from engaging with these networks include knowledge exchange, best practice exchange, collaboration and partnerships for project work, and access to information on funding opportunities.

The literature also suggests that higher education networks could be conceptualised as policy networks (Vargas et al., 2019c) that can influence policy and implementation at different levels (Keeler et al., 2016; Dlouha et al., 2018, Kusumadewi, 2019). Also, the lack of university networks specifically related to sustainability and climate action is perceived as an implementation barrier (Ávila et al., 2019). The influence of both networks and policy frameworks across all case study countries shows that they support the implementation of sustainable development and climate action across different contexts.

Table 1. Frameworks and university networks (highlighted in grey) mentioned in the case studies

	Non-specific to education or higher education	Specific to education or higher education
International	• 2030 Agenda- SDGs • United Nations Global Compact (UNGC) • Copenhagen COP • Kyoto Protocol • United Nations Framework Convention on Climate Change (UNFCC)	• United Nations Decade of Education for Sustainable Development • Fridays-for-Future movement • Times Higher Education Impact Rankings • SDG Accord and the Climate Emergency Letter • International Sustainable Campus Network – (ISCN) • UI GreenMetric World University Ranking • G8 University Summit Sapporo Sustainability Declaration • United Nations Academic Impact (UNAI) • University Alliance for Sustainability • Talloires Declaration • UN Principles of Responsible Management Education
Continental	Africa • Vision 2063 of the African Union (AU) North America • Climate Commitment outlined by the New England Governors and Eastern Canadian Premiers	Asia Pacific • Promotion of Sustainability in Postgraduate Education and Research Network (ProSPER.Net) • Asian Sustainable Campus Network Europe • UNICA University Network • UNA Europa network North America • American College and University Presidents' Climate Commitment
National	Japan • Act on Promotion of Contracts of the State and Other Entities – Japan • "Future City" initiative- Japan - 2011 • Japan International Cooperation Agency (JICA) • Project for Human Resource Development Scholarship • Public-private collaboration platform for Regional Revitalization and SDGs. South Africa • National constitution- South Africa • South African National Environmental Management Act • National Framework for Sustainable Development • National Strategy for Sustainable Development and Action Plan • National Climate Change Response Policy • Climate Change Flagship Programmes	Brazil • Universities SDG Network Japan • A Vision for Universities in the 21st Century and Reform Measures- Japan – Report • Act on the Promotion of Environmental Conservation Activities through Environmental Education- 2003 • The Associated Schools Project University Network (ASPUni-vNet) • Integrated Research System for Sustainability Science (IR3S)- Network- 2005 • CAS-Net Japan (Campus Sustainability Network in Japan) Germany • Hoch N network- Germany • University network Bildung durch Verantwortung, (Education through Responsibility) South Africa • Education White Paper 3 • Higher Education Act • National Plan for Higher Education • Green Campus initiative in South Africa

	Non-specific to education or higher education	Specific to education or higher education
National	India • National Communications developed by the Ministry of Environment, Forest and Climate Change (MoEFCC), • The Climate action plan of India Germany • Strategy for Sustainable Development	UK • Environmental Association for Universities and Colleges (EAUC) Alliance for Sustainability Leadership in Education • People and Planet University League • Responsible Futures • Education for Sustainable Development Guidance Wales • Education for Sustainable Development and Global Citizenship: A Strategy for Action • Well-being of Future Generations Act England and Northern Ireland • Sustainable Development in Higher Education Scotland • Learning for change: Scotland's action plan for the second half of the UN decade of education for sustainable development • Learning for Sustainability Scotland • Learning for Sustainability Action Plan
Regional	Brazil • Regional social movement for the Global Goals Germany • Brandenburg Council for Sustainability • Regional Biosphere reserves India • State Action Plan on Climate Change for Gujarat State	
City	India • Swachhata Ranking	Germany • Berlin University Alliance • Schools @ university for sustainability + climate protection • University Agreements with the state of Berlin North America • Greater Burlington Sustainability Education Network

Figure 2. Dynamics between policy and practice that support progress towards the implementation of sustainable development and climate action in higher education
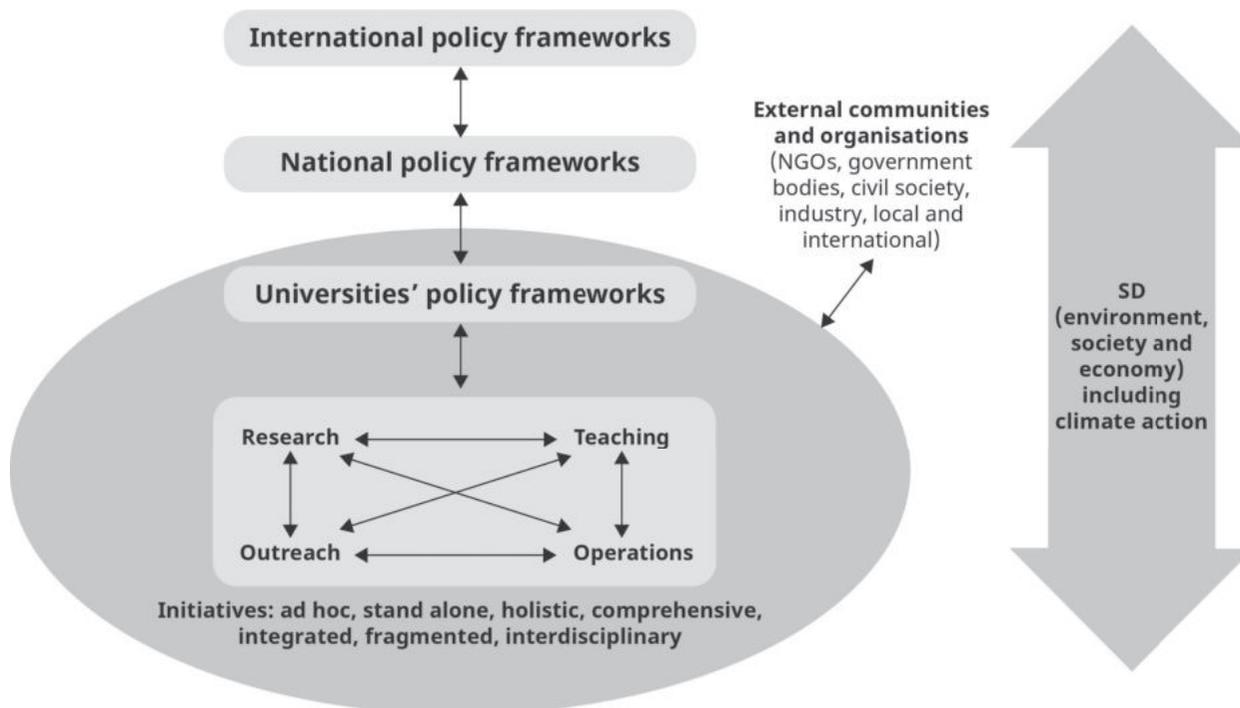
The participation of universities in regional or city-level governance and activities is key for sustainable development (Radinger-Peer and Pflitsch, 2017). Some examples of this include the work of the University for Sustainable Development Eberswalde, the Indian Institute of Technology, Freie Universität Berlin and the University of Edinburgh. Activities include engaging in policy development and implementation, joining city partnerships, and supporting city-wide or regional activities. In addition, universities can use their cities or regions as the context for learning (Shiel et al., 2016; Leal et al., 2019b). An example of this is the place-based assessment for learning initiative at UNISA, South Africa (Pretorius et al., 2019).

Universities also support collaboration between the public and private sector. In some instances, collaboration and innovation stems from active involvement between actors through a quadruple helix model. This model has been conceptualised as links between academia, civil society, government and industry (Carayannis, Barth and Campbell, 2012). The case studies do not yet suggest streamlined and explicit approaches to innovation for sustainable development and climate action through the quintuple helix (i.e.

quadruple helix with the addition of biological and ecological systems; Carayannis, Barth and Campbell, 2012). Quadruple helix actors are included in living laboratories approaches, as seen at the Indian Institute of Technology, Gandhinagar.

University efforts to communicate with and engage external audiences have encountered challenges. An example is some audiences in Japan preferring to focus on financial concerns rather than scientific sources. In addition, not all external partners are motivated by sustainable development and climate action. Therefore, universities are finding ways to navigate and address this, as with the University for Sustainable Development Eberswalde. The university tries to find a balance between putting sustainable development at the top of priorities whilst not putting off cooperation partners.

The country case studies highlight some inter-organisational dynamics that can limit or enhance the sustainability and climate action agendas (Bratman et al., 2016; Lozano and von Haartman, 2018; Vargas et al., 2019c). Sectors involved include student associations, NGOs, schools, governments (local and national) and universities. National university networks

and student associations seem to enhance and put pressure nationally on universities to make progress on sustainability and climate action. Some examples of this include the work of ASPUnivNet or the IR3S in Japan, and the EAUC, the NUS and People and Planet in the UK. NGOs, schools and governments often focus on collaborative and partnership work that seeks to benefit and enhance sustainability and climate action for both parties, such as the work between the University for Sustainable Development Eberswalde or Stellenbosch University and NGOs or government bodies. Another example is Freie Universität Berlin's work with schools across Berlin. Inter-organisational dynamics can also limit progress regarding sustainability and climate action. This is the case of the University for Sustainable Development Eberswalde and some of its partners that do not have these agendas as a priority. Some case studies discuss these dynamics more explicitly, and some universities may be more embedded in these inter-organisational dynamics than others. However, further research at national and global scales is needed to get a better understanding of these dynamics in different contexts.

In conclusion, adopting a proactive and agile approach to influencing and using policy and networks, whilst understanding and working in close partnership with external communities, is crucial for maximising the contribution of universities to sustainable development and climate action. Furthermore, in order to innovate beyond university networks, university leaders could use the quintuple helix. This would require more proactive engagement and the inclusion of case studies using biological and ecological systems for a more concrete understanding of the principles of sustainable development and climate action.

Institutional diversity

Institutional diversity has a clear bearing on considerations relating to sustainability and climate change. The findings of our country analyses suggest that all forms of higher education institution can develop good practice, but that these practices may manifest themselves in different ways, and that distinctive challenges are faced in each case. There are

some fundamental commonalities between higher education institutions globally, on account of the ascendancy of the European model of university in the modern era, and its spread through colonisation and globalisation. Nevertheless, across regions and within regions there exist various forms of diversity: between academic and vocational, teaching-only and research-focused, public and private, large and small, and young and old – and overlaps in the above categories. The forms of institutional differentiation differ greatly by country: while Brazil has a marked public/private divide and distinctions between university and non-university institutions, in the UK most institutions have the same official designation, though there are differentiations of focus and prestige. In Japan, the key distinction is between national universities and local public and private institutions, while South Africa has entrenched divides originating in the apartheid era, despite subsequent policies of transformation.

Setting up a new university has some clear advantages in relation to sustainability. Buildings can be designed for energy efficiency, staff are recruited with the sustainability mission in mind, and curricula are designed to embed issues such as climate change. Turning around the oil tanker of a traditional university can be a much greater challenge. The huge cost of making old buildings energy-efficient can be a barrier, as seen in the case of the Freie Universität Berlin. The Indian Institute of Technology, Gandhinagar, on the other hand, was founded in 2008 with a range of sustainable features in relation to water usage, waste and energy. Yet the institutions around the world that are most generative and inspiring in terms of sustainability practice include some very old ones – those covered in this report include the University of Edinburgh founded in the 16th century, and Middlebury College in 1800, along with a number of others from the early 20th century. With sufficient commitment and leadership it is possible to redirect well established practices, but sensitivity to the existing structures is needed.

Connected to the age of an institution is specialist focus. One of the cases included in this study – HNEE in Germany – has established itself specifically as a university for sustainable development.

While not common around the world, there are institutions created for the specific purpose of furthering the cause of environmental protection and sustainable living, many of them at the margins of the mainstream higher education system – such as Schumacher College in the UK, Earth University in Costa Rica and the online Gaia University. These experimental institutions are vital as beacons of possibility, in showing other institutions what is possible – as the Vice-President of HNEE explained: *"usually universities try to transfer technologies, but we really have the aim to transfer the idea of sustainable development into the society"*. Yet not all HEIs can have specialist status, so attention is also needed to the transformative processes necessary in mainstream institutions, and the way that specialist institutions can coordinate with these in a higher education system.

The cases outlined in this report show that both public and private universities can have good practice in relation to sustainability. At the same time, there are some clear constraints and facilitators in the different sectors. Dependence on the market can be a serious impediment to institutions' ability to promote sustainability through their teaching and research, and embody it within their own workings (McCowan, 2019). The UK cases show how green credentials may enhance branding, and attract 'customers', but student demand for courses and industry's research and innovation requirements may not always align with long-term sustainable development. Public funding and recognition play a vital role in allowing for institutions to pursue these agendas, as can be seen in several of the examples covered above, such as the German cases and the University of São Paulo. Private universities can also fulfil this role when the funding model allows – for example if they have an endowment, or if sources of income allow for cross-subsidisation. Private funding does not necessarily militate against a public benefit, as long as commercial motivations do not predominate, and that would normally require non-profit status and a clear commitment to the public good (Marginson, 2011; Locatelli, 2017), as is the case of the community universities in Brazil. Some advantages of private institutions are shown in the case of Japan, in which Ritsumeikan's 'Academy', which also includes primary and secondary schools, is able more

easily than large public institutions to ensure an integrated approach of sustainability across all of its activities and curriculum. Private institutions can also avoid some of the cumbersome bureaucracy which can hinder sustainability initiatives – for example the restrictive public procurement policy highlighted in the chapter on Germany.

Higher education has expanded dramatically over recent decades, and now more than one third of the global cohort goes on to some form of post-secondary education. But it is important to acknowledge that most of these enrolments are not in traditional universities with the three pillars of teaching, research and community engagement. For complex research-intensive universities, the challenge emerging is how to integrate sustainability initiatives across all of the functions – see for example the cases in Japan. While the synergies provided between these different areas are fruitful, teaching-only institutions also have an important role to play. There are obvious limitations of distance education in providing experiential learning and campus-based opportunities relating to sustainability. Yet the case of UNISA in South Africa shows that distance education providers, and mainly teaching-focused institutions, can still achieve excellent practice in relation to sustainability, through their curricula and in linking with learners' home locations. UNISA has made great strides in enhancing its research profile, whilst remaining a teaching-led institution. It is understandable that most research on the climate and environmental science is located in research-intensive universities with the resources and research capacity to undertake it – in the case of South Africa, in just five of the country's 26 public institutions.

Likewise, both academic and vocational institutions, as well as basic and applied research, have their roles to play. Basic research is vital for understanding the root causes and impacts of climate change – see, for example, the contributions of Stellenbosch University and Tohoku University. Innovation and applied work with external partners is also essential in the tasks of mitigation and adaptation. In relation to teaching, the multifaceted nature of climate change and sustainable development mean that this content needs to be integrated into all forms of courses, from

natural sciences, to social sciences and arts and humanities. Sustainable development will only be achieved if there is relevant professional expertise, but also personal and civic qualities in the lives of all citizens.

Finally, the size of the institution presents some distinctive challenges. The universities analysed in this report range from UNISA with over 370,000 students and the University of São Paulo with 100,000 to Middlebury College and HNEE with just 2,500 and 2,100 respectively, and the Indian Institute of Technology - Gandhinagar with just 1,085. Large institutions have a bigger carbon footprint and environmental impacts, and present challenges of coordination and integration of work, but can also have a more significant postive impact when practices are transformed, and have greater public recognition and lobbying influence with national governments. As highlighted in the chapter on the UK, larger institutions are more likely to produce sustainability reports and plans, and have greater administrative capacity to implement them. Smaller institutions, however, have the advantage in being more nimble in adopting changes throughout the institution.

In summary, all universities face challenges, but these vary markedly depending on institutional type. While traditional institutions in the upper echelons of the rankings may have the finances and public recognition to have greater autonomy over their research profile, they face an uphill battle in shifting the mindset and practices of an institution with decades or centuries of history. New universities will be more dependent on hand-to-mouth income streams, but may be more agile and have built-in sustainability practices from the outset. Institutional leaders and policymakers should be aware of these differences, and work to enhance cooperation and play to their strengths within a coordinated system of higher education institutions.

Conclusion

Systems characterised by complexity have particular features not shared with simple linear ones: they have multifaceted chains of cause and effect, positive and negative feedback loops, they manifest 'emergence'

(the appearance of new characteristics not existent in the initial configuration) and may display self-regulatory dynamics (McCowan, 2020, Tikly, 2019; Williams et al., 2017). Sustainability in higher education is highly challenging because it requires dealing with two such complex systems: that of the natural environment, and that of higher education itself. The institutions in this analysis have been trying to change higher education in order to change human societies and the natural environment. This task requires awareness of interlocking complexities, acknowledging the need for action on multiple fronts, awareness of feedback and tipping points, and flexibility in responding to emergent features. Higher education leaders should maintain this perspective of complex systems, and also recognise the inherent unpredictability of these actions, with the patience and tenacity to keep on course despite the obstacles. The cases above have shown how this is possible even in the face of substantial challenges.

While this chapter has addressed five key themes separately, there are strong interlinkages between them. Forms of leadership depend on institutional type – so a different style may be appropriate in a large or a small university, for example – and are closely linked to questions of governance. Conceptualisations of sustainability and frameworks have a strong influence on the ways actions are developed in institutions, and in turn their implementation is dependent on the funding available. Institutions, therefore, need to be working on these various elements simultaneously, ensuring their consonance and the balance between them. The need for a holistic approach to sustainability in higher education is a key implication from this analysis. This point and other recommendations emerging from the report as a whole are drawn out in the final chapter.

Finally, while this chapter has aimed to draw out commonalities and points of contact between the seven countries, the very real differences between them (and other countries in the world) must not be brushed aside. The relationship between universities, state and the private sector differs dramatically in different contexts – what Cloete et al. (2011) call the 'pact' – with relevance for the flows of influence each way. Countries with a high level of academic

staff autonomy – such as Japan and the USA – will inevitably present a different configuration in relation to integrated institutional initiatives. Levels of resourcing and available technologies also present differences, with institutions in Germany and the UK often better equipped to move towards carbon neutrality than those in India and Brazil, for example. The broader principles drawn out in the conclusion will need to be contextualised within these significant factors of difference, relating to the distinct educational traditions, the political settlement and factors of the natural environment.

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Chapter 12:
Conclusion and Outlook

Tristan McCowan

This report has shown the extraordinary work being undertaken by universities around the world in relation to sustainable development and climate change. Focusing on seven countries – Brazil, Germany, India, Japan, South Africa, the UK and the USA – it has shown the sustained commitment of university leaders, and the transformation of institutions of a variety of different types and histories. In most cases, the locus of change has been the institution, in the context either of a lack of relevant national policy, or a context of decentralisation or university autonomy in which national policies are light-touch. An important finding of this report, therefore, is that institutions can transform themselves so as to make a positive contribution to sustainable development, even when faced with circumstances that act against those efforts.

The challenges facing universities operate at three main scales: the global, the national and the institutional. At the global level there are dynamics of competition that can act to undermine sustainability work. The international university rankings – with rare exceptions such as the *Times Higher Education* impact ranking – promote excellence in research, but give little credit to high quality teaching, to sustainable campuses or to community engagement work. The emphasis on employability globally, by privileging attributes for entry into corporate jobs, can at times undermine the role of higher education in fostering critical, curious and socially committed citizens. While internationalisation has brought significant academic benefits – for instance in encouraging greater mobility of students and staff, circulation of ideas and intercultural dialogue – it often carries a heavy carbon burden and is not sustainable in its current form (Shields, 2019).

One of the key obstacles to embedding sustainable development is the financial model of higher education globally. With only a few exceptions, university systems do not enjoy ample public funds to cover their activities, and resources have been further stretched by rising numbers of enrolments. The marketisation that characterises most higher education systems today is not conducive to the promotion of public goods, of which climate change and sustainability are examples. The more individualised that higher education systems become – with students as consumers investing in their own financial returns through career advancement – the harder it will be to resource actions with public benefit (Marginson, 2011). Nevertheless, it has to be recognised that public funding for higher education is unlikely to be significantly increased in the short term. Universities must be creative in their use of the resources that they do have, and in exploiting those opportunities that are there in a market system to enhance their sustainability actions. This report has provided examples not only of highly successful publicly-funded institutions (e.g. HNEE, University of São Paulo), but also institutions with mixed sources of funding (e.g. Arizona State University, Edinburgh University) which have brought synergies between their environmental activities and income generation.

While national level governments are generally supportive of university efforts to address climate change and promote sustainability, there are challenges at this level too. Frameworks of qualifications and accreditation can be rigid and act against innovation, for example in interdisciplinary work. Academic staff promotion systems often work against dedication of time towards public engagement activities and community involvement, and procurement policies can constrain institutions' abilities to encourage local providers. Domestic competition for resources and students can also act against public good activities, including sustainability and climate change.

The challenges at the institutional level too are not insignificant. As discussed in the previous chapter, universities are conglomerations of semi-autonomous groups and independently-minded individuals with diverse commitments, and rarely paddle in the same direction. Deeply entrenched traditions can slow institutional reform. Haddock-Fraser, Rands and Scoffham (2018) identify three particular challenges for sustainability leaders: goal definition, competing

priorities in the institution and the complexity of the decision-making process. Leal Filho et al's (2021) survey of university leaders in 29 countries across the world showed that 80 percent identified lack of funding as a challenge to sustainability leadership; 54 percent lack of support from administration; 52 percent lack of interest in the academic community; 48 percent lack of expertise; and 32 percent lack of materials or resources. Aligning sustainability work between departments and faculties can be challenging, and while most staff and students support pro-environmental causes, there is still resistance to many of the changes needed to curricula and research.

Challenges exist also at the level of students, and their expectations of the courses undertaken. While the employability agenda presents some tensions with sustainable development, it cannot be ignored that it constitutes a primary motivation for attending university and is the major driver of the expansion of higher education systems globally. Sustainability initiatives, therefore, must be synergistic with the development of professional competence and career opportunities through the university. In doing so, universities should certainly be proactive in focusing on the new opportunities in the green economy, and ensuring that ethical or public good focused professionals are fostered (Walker and McLean, 2013).

So what is it that enables some institutions to transform themselves into universities for sustainable development, in the face of all these challenges? Leadership emerges as a pivotal factor here, although manifesting itself in diverse ways. In some cases it may be more visible, with a charismatic leader providing a central focal point for radical change in the institution. In others skilful leadership may operate in a quieter way, and be distributed across the different levels of the institution. What is common to all of these styles is that they are dialogical and not directive, and that they empower rather than impose themselves. Climate change and sustainability are underpinned by fundamental human values, and universities are institutions in which staff and students maintain freedom to construct their ideas and beliefs with autonomy. Sustainability leadership, therefore, is primarily a question of harnessing the energies that are already there, coordinating and building coalitions, and nourishing innovation from the bottom up.

Combined with effective leadership, the other factors analysed in chapter 11 are also vital. Effective governance, with a combination of sustainability focal points (such as a green office, or director of sustainability) and embedding of sustainability values, procedures and monitoring at all levels of the institution and in all of its activities, is needed to ensure coherence and synergies across the institution. Nurturing bottom-up initiatives and supporting the work already carried out by academic staff is vital, as is involving students in campus, research and community engagement activities. Sustainability requires not only enhancing the outputs of the university – research, innovation, skilled graduates and so forth – but also transformation in the internal workings of the university. These workings include its human relations – of equality, diversity and inclusion – as well as an environmentally friendly campus, what in McCowan (2019) is termed *embodiment* of sustainable development.

The next of the themes emerging is institutional diversity. Attention is needed to this factor for two reasons: first, in acknowledging that leadership and governance will inevitably vary depending on the size, shape and mission of the institution; and because the system of higher education should involve different kinds of institution, providing a horizontal diversity, while avoiding vertical stratification (Altbach, Reisber and de Wit, 2017; McCowan, 2019). In this regard, the importance of specialist environmentally-focused institutions can be highlighted. Funding has already been discussed above: while not all actions to address climate change are costly (and some will actually save money for institutions), there are inevitable costs in allocating staff time to addressing these issues and transforming existing infrastructure. Protecting existing funding, sourcing new funding and spending wisely are therefore vital.

The fifth factor, the adoption of frameworks of climate change and sustainability, does not entail a unified understanding. As argued by Jickling and Wals (2008) a 'Big Brother' sustainability, through which predefined ideas are imposed on students and staff,

must be avoided. There are a range of legitimate conceptualisations of the problems and solutions, even while accepting the current empirical evidence on the environmental crisis, and academic freedom must be protected. What is required is the space to clarify conceptions, and clear communication at the institutional level about the issues, their interconnections and their implications for the work of the university. There is also the role played by national and international networks. There has been a marked increase in the number of agreements and associations relating to sustainability, and specifically to higher education and sustainability: these spaces for collaboration can be vital for sharing experiences of good practice and overcoming challenges, and in providing inspiration and impetus, as well as intercultural dialogue.

The framework put forward in the introduction (Figure 1) highlights the most common pathways through which university impact on climate change can be realised. The figure helps us to map the areas of work most commonly practised, and those in need of attention – starting from the presupposition that all of these areas of action are needed simultaneously in order to address an issue as complex and multifaceted as the climate crisis. Both the literature reviewed in chapter 3, and the new cases analysed in chapters 4-10, concur on the main areas of focus of universities. The most visible work has been in the area of campus operations, transforming buildings, energy and waste, transport and procurement to ensure lower carbon emissions and reduced pollution.

There is also a fair amount of work on teaching and learning, assessing the creation of new modules and courses relating to sustainability and climate change, but also embedding these within existing ones. Nevertheless, many courses are still untouched by issues of sustainable development, and not all institutions have crosscutting units that students can access. Furthermore, universities need to make available opportunities for learning beyond the classroom, in campus activities and experiential learning through voluntary work, work placements and grand challenges schemes. These learning opportunities are particularly hard to roll out in poorly resourced institutions, in distance education, and in for-profit higher education, in which there is little in the way of campus life.

Without doubt, there has been a huge growth in climatology and environmental science, developing an ever sharper understanding of the causes and impacts of the challenges facing humanity. A number of universities, including those featuring in this report, have established interdisciplinary centres specialising in issues of climate and environment, which along with some non-university institutions (e.g. NASA in the USA, the Met Office in the UK) are leading the advance of our understanding of these environmental crises. One task that faces universities is integration of this work across all disciplinary areas: a recent global study (Overland and Sovacool, 2020) estimated that only 10 percent of research funding on climate change goes to social sciences and humanities, with the vast majority going to natural sciences and engineering.

Community engagement is an area in great need of development. While there are some notable exceptions – including a number covered in this report – universities have too little positive engagement with external communities, including their immediate geographical context. While institutions in some regions maintain this line of work – in Latin America, for example, most public universities retain extension as one of their fundamental functions – the marketisation of higher education globally has led to a reduction of community engagement work, except when it presents an opportunity for income generation. While there are many environmental services that universities can provide to government and industry that are accompanied by sources of income, this is not always the case, particularly when working with marginalised groups who may be facing the brunt of the impacts of climate change. On the other hand, university-based academics are very active in public engagement, communicating the findings of scientific research, engaging in advocacy and campaigning, and other forms of awareness-raising around environmental issues.

When reviewing the availability of literature on a given topic, it must be remembered that gaps have various explanations: they may be caused by a lack of action in a particular area (in this case that universities are not conducting sustainability work of a particular type), but it may also be the case that

universities are conducting this work, but that researchers have not focused on these areas, or that they have but the studies had not been published (publication bias), or have been published in more marginal outlets. It is not always easy, therefore, to interpret these gaps, and identify whether the implication should be to enhance the work undertaken or the focus of researchers – i.e. whether it is a *practice deficit* or a *research deficit*.

Nevertheless, some well-grounded suppositions can be made in this regard. The cases analysed show clearly that the majority of efforts in practice have been in the area of campus operations, with some emphasis on education and research, and less evidence of community engagement. In high-income countries the focus of researchers has largely followed these trends, though there is a significant deficit of analyses of the public engagement work of universities, even though many academics and institutions have extensive work in public communication through books, traditional media and new social media. Given the contestation around climate change, this public engagement work is crucial and should have greater research attention.

Another important question relates to the global distribution of research. Our seven countries all have strong research communities in the areas of sustainability and climate change, and also in higher education research, and there is no lack of literature on these topics. With a broader global view, however, the landscape is very uneven. Most countries, particularly those in the Global South, have very little research evidence available on the role that higher education is playing in addressing sustainability and society, and as a consequence it is hard to leverage support from policymakers, or to improve practice within and across institutions.

In terms of future research needs, therefore, it is important to maintain the impetus that has been generated in recent decades around universities and sustainability, illustrated by the establishment of the *International Journal of Sustainability in Higher Education* in 2000. Yet academic research needs to be extended to cover not only campus operations and teaching, but other functions of the university.

While there is extensive research on climate change and environment in universities, much more 'meta-research', or research about research, is needed, analysing the distribution and organisation of knowledge production within and across universities, in order to generate knowledge on the benefits and obstacles to interdisciplinarity, gaps in research coverage and so forth. Furthermore, critical analyses are needed to scrutinise how the deep foundations of the university, and the knowledge project emerging from the European Enlightenment on which it is built, may be clashing with the forms of society needed for a sustainable future (Facer, 2020; McCowan, 2019).

This latter point is an area that this report has not been able to cover in depth. Climate change and sustainability raise a host of epistemological and ontological questions, casting doubts on the values underpinning contemporary societies and education systems, and their compatibility with a form of development that will ensure social justice and environmental protection. These complex questions require separate treatment. Nevertheless, as argued by Haddock-Fraser, Rands and Scoffham (2018), while a paradigm shift is necessary, in the short term and when working with institutions and their leaders, a pragmatic approach must be taken – and it is this aim that has oriented this report.

There are some other important areas that this research has not been able to address in depth. Detailed qualitative and quantitative work is needed on the perspectives of students and staff working in universities, to illuminate their understandings of sustainability and climate change, and the ways in which they interpret and enact institutional and national policies and initiatives.

Furthermore, the report has only been able to focus in depth on a small number of countries – albeit ones with large higher education systems and significant influence on global trends. A comprehensive understanding would require additional analyses of, for example, Spanish-speaking countries of Latin America, Francophone Africa, Southeast Asia and post-Soviet countries. Moreover, while the institutions covered in depth here are of a range of different types (public/private, large/small, old/

newly established), they cannot be said to be representative of all institutions in their countries. Many higher education institutions do not fit the mould of the research-intensive campus-based institution – for example, online universities, for-profit and teaching-only institutions – and yet are still vital to the task of promoting sustainability. In addition, this report has taken as its institutional cases largely examples of good practice, with other institutions facing significantly more challenges. Nevertheless, the principles identified through the analysis of the cases here are relevant to all kinds of institution, in all cultural contexts, though of course realised in ways that are specific to the distinct cultures, missions and resource levels.

The findings and analysis of this report give rise to the following 12 recommendations for universities and policy-makers:

1. Ensure a diverse system of higher education, with differentiated institutions able to contribute in distinct ways to the challenges of sustainability and climate change
2. Establish specialist sustainability-focused higher education institutions in contexts where they do not exist
3. Protect public funding alongside creative diversification of sources of income and earmarking specific resources for sustainability work
4. Promote interdisciplinary research and teaching (while maintaining specialised disciplinary work), and incorporate aspects of sustainable development and climate change in arts, humanities and social sciences as well as natural sciences
5. Participate in and raise the prominence of green rankings, as a counterpoint to traditional international university rankings
6. Ensure that all students, regardless of their disciplinary area, emerge from their university studies literate in environmental challenges
7. Involve students fully as active participants in sustainability initiatives within and beyond the university
8. Create an institutional plan for carbon emission reductions and ultimately carbon neutrality (and

where relevant divestment from fossil fuels)
9. Provide opportunities and incentives for academic staff to develop their own bottom-up sustainability initiatives, and make available opportunities for professional development
10. Build stronger ties with local communities to support processes of climate change adaptation
11. Ensure coherence and synergies between sustainability action, and those of other global crises and challenges, including pandemics
12. Promote further research on the role of universities in climate change and sustainability, including underrepresented themes, countries and contexts.

Above all, it is important to view the university as protagonist. One of the pernicious trends of the 20th and early 21st centuries has been that of universities increasingly adjusting themselves to fit in with the prevailing winds, and in their financial vulnerability accepting any role that will ensure a reliable income. Adaptability and responsiveness are important, but not at the expense of the university's role as an actor with the power to shape society. Climate change and sustainable development in this sense are opportunities for universities to reclaim their central role in society, given the essential part played by research, innovation, communication and education in addressing the challenges.

The COVID-19 pandemic has provided a wake-up call to humanity that, despite the undeniable achievements of science and technology in recent centuries, it is still vulnerable to natural forces, and to the repercussions of its own actions on the world. The pandemic has brought severe disruption to higher education systems, closing down universities, impeding their research and community engagement activities, and straining their budgets (Leal Filho et al., 2020). At the same time, universities have been at the forefront of the response, documenting the spread of the disease, producing vaccines and providing the education and training needed by medical staff around the world. While the contribution of individual universities has been fundamental, ultimately it is a global endeavour, requiring co-operation and coordination between institutions and systems.

There are many parallels between the pandemic and the challenges of climate change and sustainability. While the effects of the latter may not be so dramatically evident in the short term, they present a fundamental threat to humanity and its ways of life, including the functioning of higher education systems. Universities have historically been part of the problem, in contributing to carbon emissions, but also promoting the acquisitive and exploitative mindset that has led to a prioritisation of profit over care. Yet they are also a fundamental part of the solution. While universities cannot solve the climate crisis alone, it is unlikely that a response will be found without the contribution of scientific advances, technological innovation, specialised training, human development and public engagement that are provided by universities.

This report has brought together analyses of seven countries that are all grappling with questions of climate change and sustainability in light of their own particular characteristics. Comparative analysis – whether systematic comparisons, multiple case studies or simple juxtaposition – is vital for generating knowledge and understanding of how to transform higher education systems. Experiences from around the world provide not only lessons in how to identify challenges and overcome them, but also in providing inspiration that change is possible. This report has also brought together authors and researchers from these different countries, cultural contexts, institutions and disciplinary backgrounds, all of whom seek a common understanding of how to handle the challenges posed by sustainable development and climate issues.

This dialogue across diversity in the creation of a collaborative text has also been central to generative learning. The significant challenges of climate change and environmental destruction – and the threat to our very existence if they are not overcome– mean that this form of dialogue across humanity, its particular contexts, cultures, sectors and institutions, becomes pivotal.

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Acknowledgements

Author biographies

Luciana Londero Brandli is a professor at the University of Passo Fundo, Brazil and researcher at the Programme in Civil and Environmental Engineering. Currently, she is Deputy Editor of the International Journal of Sustainability in Higher Education, Deputy Editor for Springer Nature journal Discover Sustainability and Deputy Editor of the Encyclopedia of Sustainable Development Goals: Transforming the World We Want. Her current research interests include sustainability in higher education, the Agenda 2030 for Sustainable Development, Climate Change, Education for Sustainability and Sustainable Cities. Currently she is pursuing the international project "Transforming Universities for a Changing Climate" involving the UK, Kenya, Mozambique and Fiji.

Golda Edwin is the Executive Director of Research at APSCC - Association for Promoting Sustainability in Campuses and Communities. She holds a PhD in Ecology and Environmental Sciences from Pondicherry University, India and her research interests include sustainability in education, water management, climate change, and green campus. She has worked for the past 20 plus years with a fundamental goal of fostering 'environmental awareness' and 'sustainable development' among the educational campuses and communities. She has organized multiple conferences and workshops on topics of environment and sustainable development. She Co-developed the Comprehensive Green Protocol for the Union Territory of Puducherry, and currently, piloting its implementation at various organizations.

Walter Leal Filho is the founding Director of the European School of Sustainability Science and Research at the Hamburg University of Applied Sciences in Germany, and holds the Chair of Environment and Technology at Manchester Metropolitan University in the UK. He is coordinator of the Inter-University Sustainable Development Research Programme (IUSDRP) and the International Climate Change Information and Research Programme (ICCIRP), having a special interest on the connections between climate change and sustainability. He is also Editor-in-Chief of the Encyclopedia of the UN Sustainable Development Goals, the largest editorial project on matters related to sustainable development ever undertaken, with in excess of 2,000 authors.

Jing Liu is an associate professor at the Graduate School of Education, Tohoku University, Japan. Prior to the current position, he served as an assistant professor at the Graduate School of International Development, Nagoya University, Japan, from 2013 to 2017. Then, he worked as a JSPS research fellow at the Graduate School of Education, University of Tokyo between 2017 and 2019. His research areas include sociology of education, international comparative education and development, and education for sustainability. His current research projects include school collaboration for school improvement in China and Japan, small-scale schools and quality education in rural China, and transformation of higher education for sustainability in Asia.

Tristan McCowan is Professor of International Education at the Institute of Education, University College London. His work focuses on higher education and international development, particularly in Latin America and Sub-Saharan Africa, including issues of access, quality, innovation and impact. His latest book is *Higher Education for and beyond the Sustainable Development Goals* (Palgrave Macmillan, 2019), and he is editor of Compare – a Journal of International and Comparative Education. He is currently leading the multi-country Global Challenges Research Fund project *Transforming Universities for a Changing Climate*.

Nandhivarman Muthu has around 30 years of experience in the academic, administrative, and entrepreneurial domain and is currently working as the coordinator of the Office of Green Campus at Pondicherry University, India. He holds a PhD in Ecology and Environmental Sciences from the same University and his research interests/ expertise include lab-to-land environmental education, sustainable campus, green economy, waste management, and environmental law. He introduced the concept of industrial resource recycling for 'symbiosis' and integrated market resource management since the 1990s. Further, he has been a resource person/ panelist/ committee member on numerous occasions and actively participated in multiple national/ international conferences/training/ seminars/ workshops with a good number of publications and books to his credit.

Julie Newman joined the Massachusetts Institute of Technology in 2013 as the first Director of Sustainability for the institute where she also holds a lecturer appointment with the Department of Urban Studies and Planning. In 2004, Julie founded the Office of Sustainability at Yale University where she also held a lecturer appointment with the Yale School of Forestry and Environmental Studies. Prior to that she assisted with the launch of the University of New Hampshire Sustainability Institute in 1997. In 2004 Julie founded the *Northeast Campus Sustainability Consortium*, the longest standing active network of university sustainability professionals in the United States, to advance education and action for sustainable development on university campuses in the northeast and maritime region.

Rudi Pretorius is an Associate Professor of Geography at the University of South Africa. His research interests cover education for sustainability, open, distance and e-learning, sustainability in higher education and the scholarship of teaching and learning in geography. His qualifications include a MSc, MBL and PhD in Geography. He authored a number of publications in the International Journal of Sustainability in Higher Education, Springers' World Sustainability Series and recently co-edited the book "*Universities as Living Labs for Sustainable Development*". In 2020, he co-chaired the international symposium "*Accelerating the implementation of the SDGs in Africa*" in Pretoria, South Africa, and is currently guest editor of a special edition of the International Journal of Sustainability in Higher Education on the same topic.

Amanda Lange Salvia is a Research Associate at the University of Passo Fundo, Brazil, on the 'Transforming Universities for a Changing Climate' research project. Her work focuses on the role of universities towards sustainability, the impacts of climate change and the Sustainable Development Goals. Amanda is an Editorial Board Member of the International Journal of Sustainability in Higher Education and of the journal Discover Sustainability. She also serves as Deputy Editor of the Springer publication Encyclopedia of the UN Sustainable Development Goals: Transforming the World We Want.

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- Scepticism and the role of education
- 2030 Agenda and the SDGs

The Role and Impact of the University

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Middlebury College

RECOMMENDATIONS
to address the climate crisis and promote sustainable development

- Ensure a diverse system of higher education
- Promote interdisciplinary research and teaching
- Involve students fully as active participants
- Ensure synergies between sustainability action and other global challenges
- Protect public funding and diversification of sources of income
- Build stronger ties with local communities

- Establish specialist sustainability-focused institutions
- Participate in green rankings
- Create plans for carbon emission reductions
- Ensure environmental literacy for all students
- Provide opportunities for academic staff
- Promote further research on universities and sustainability

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Imprint

»Universities facing Climate Change and Sustainability«,
conducted by University College London for Körber-Stiftung
in preparation for the Global University Leaders Council Hamburg, 2021
Publisher: Körber-Stiftung, Hamburg
Responsible according to the German Press Law: Tatjana König
Illustration Cover: Pia Bublies
Design Cover: Veronika Grigkar
Typesetting: University College London
Print: Bartels Druck GmbH

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