

University engagement in achieving sustainable development goals: A synthesis of case studies from the SUEUAA study¹

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While initial discussions of the third mission of universities focussed on market-orientated behaviours of universities, more recently it has been connected to activities that focus on social justice and promoting sustainability (Trencher, Bai, Evans, McCormick & Yarime, 2014; Appe & Barragán, 2017). It has been suggested that the third mission of universities in the Global South may be particularly significant in addressing acutely felt issues of climate change, economic inequalities, food insecurity and urban sprawl. The current paper explores this and asks whether the quadruple helix (Carayannis & Campbell, 2010) is visible in their engagement activities.

¹This work derives from the SUEUAA project (Reference CI170271), which is funded by the British Academy under the Cities and Infrastructure programme, which is part of the Global Challenges Research Fund, itself part of the UK's Official Development Assistance (ODA) commitment. We are grateful for this support and for the contributions to the chapter derived from the work of colleagues in Iran, Iraq, Philippines, South Africa, Tanzania and South Africa

Using a synthesis of case studies developed as part of the ‘Strengthening Urban Engagement of Universities in Africa and Asia’ (SUEUAA) project, a collaborative research project spanning seven cities (Glasgow; Harare; Dar-es-Salaam; Johannesburg; Duhok; Sanandaj; and Manila), we explore ongoing engagement activities where universities respond to city demand. We frame this in terms of Sustainable Development Goals.

Results indicate while universities were seen to address city demands, they often reacted without a network of other influential actors (i.e. industry, local government or NGO partners). This suggests that currently, the quadruple helix is underdeveloped in these cities, and more work should be done in creating closer links.

Keywords: *third mission, Global South, quadruple helix, community engagement*

Introduction

Globally, our cities are facing a range of interconnected challenges, with issues spanning the natural environment, economy and social realms. Banerjee (2003, p. 144) suggests that human progress and economic development ‘has come at a price; global warming, ozone depletion, loss of biodiversity, soil erosion, air and water pollution are all global problems with wide-ranging impacts on human populations’. However, there is an increasing divergence between the challenges facing the Global North and South, with areas of the South often experiencing the most extreme instances with higher levels of unemployment, ill-health and poverty, and issues such as migration placing increasing demands on infrastructure. In addition, those countries experiencing highest rates of inequality are further made vulnerable to the consequences of climate change with flooding, drought and large scale extreme weather events, such as Super Typhoon Mangkhut in 2018. These negatively impacting access to power, damaging housing and infrastructure, and triggering landslides and flooding. It can also have a devastating effect on food production. These issues significantly impact the livelihoods, health and wellbeing of the population.

As the challenges facing the Global South are diverse and complex, with the drivers of poverty multifaceted, resolving these issues requires a complex and interconnecting system of activities. One way to understand and address these issues is through a sustainability approach. There are several different interpretations of this approach, some highlighting the importance of sustainable development for social development (Stenn, 2017) or as a consensus between economic, environmental and social matters (Sachs, 2012). The most commonly used definition of sustainable development comes from the World Commission on Environment and Development (WCED) report in 1987, 'Our Common Future'. In this, sustainable development is 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, 1987). Brundtland, the then chairperson of WCED, acknowledged the present issues of sustainability of non-renewable resources (fossil fuels and minerals), extinction of ecosystems and loss of plant and animal species.

There are significant criticisms of sustainable development. Some critique it for its roots in colonialism, particularly with the Global North setting the definitions for poverty and potentially disempowering rural populations in the Global South (Banerjee, 2003), and its lack of clarity as to what is at the root of sustainability measures (Byrch, 2007; Escobar, 1995). In terms of the latter, many scholars have argued that the core aim of sustainability is to secure economic growth without environmental destruction, leading to a question as to whether economic growth is the subject of sustainability rather than the environment (Escobar, 1995; Redclift, 1987). Acknowledging the complexity of the term, John Blewitt suggests we look at sustainable development as 'a collage or a kaleidoscope of shapes, colours and patterns that change constantly as we ourselves change' (Blewitt, 2008), and therefore to make sense of the shapes in the best way we can, in the lens we chose. To develop a solution for the varied and ingrained issues facing our ecosystems, economy, environment and populations requires multiple voices working together to make sense of these shifting patterns. Importantly, ensuring that we listen and empower voices from differing groups, from academics, industry, government, but also in the communities most affected by these issues.

The importance of sustainability in developing solutions of global challenges has been adopted by the United Nations (UN), first through the

Millennium Development Goals (MDG) (2002–2015), and now with the Sustainable Development Goals (SDG) (2015–2030). The UN has called on its partners to develop a concrete action plan for the world to reverse poverty, disease and hunger affecting billions of people in the world. The goals follow a ‘triple bottom line approach to wellbeing ... a broad consensus on which the world can build’ (Sachs, 2012), with a focus on economic development, environmental sustainability and social inclusion.

This paper aims presents initial findings from the SUEUAA study, exploring how Universities in six Global South cities engage with the Third Mission. We provide case study evidence of ongoing engagement activities of the Universities, using the SDGs as our framework to promote discussion regarding the sustainability agenda of Universities.

Sustainable Development Goals

‘The challenges cities face can be overcome in ways that allow them to continue to thrive and grow while improving resource use and reducing pollution and poverty. The future we want includes cities of opportunities for all, with access to basic services, energy, housing, transportation and more.’

(United Nations, Sustainable Development Goal 11)

The MDGs were a ‘historic and effective method of global mobilisation to achieve a set of important social priorities worldwide’ (Sachs, 2012, p. 2206), focussed on poverty affecting the Global South. Sachs suggested that through the ability to ‘package’ these priorities into eight goals with measurable and time bound objectives, it enabled the easy promotion and, importantly, political accountability to ensure these goals were met. While some countries met the MDG goals, others made little progress. However, there was a consensus that after the time period of the MDG ended, the global fight against poverty should continue. The focus on ‘sustainable goals’ was important, as it ensures that solutions meet the needs of the present without compromising the ability of future generations to meet their own needs (WCED, 1987), with an emphasis on an inclusive and resilient future for both the population and the planet. Unlike the previous MDGs, the SDGs were designed to be universal in scope, and able to be applied to all countries rather than only those in the Global South. Based around a series of 17 goals (see Text Box 1), each with a wide range of

targets, SDGs cover a broad range of socio-economic development issues, including issues of poverty, hunger, health, education, climate change, gender equality, water sanitation, energy, social justice, environment and urbanisation. It has been described as one of the most significant global efforts made to advance wellbeing while recognising the planet's ecological limits (Ramos, Caeiro, Moreno Pires, & Videira, 2018). There appears to also be stronger interconnections among the goal areas in terms of biophysical and socio-economic points of view than existed in the MDGs, with many of the SDG themes (such as 'health') found in their namesake goal (SDG3) but also across a range of other goals (with SDGs 2, 6, 11, 12 all referring to health in their wording) (Le Blanc, 2015). In doing this, we begin to see how the 'bottom lines' of development are informing a wider range of goals and highlight the importance of not viewing the goals in isolation, but in understanding the holistic goals of the wider SDGs.

Figure 1: *The Sustainable Development Goals*

- SDG 1: No Poverty
- SDG 2: Zero Hunger
- SDG 3: Good Health and Wellbeing
- SDG 4: Quality Education
- SDG 5: Gender Equality
- SDG 6: Clean Water and Sanitation
- SDG 7: Affordable and Clean Energy
- SDG 8: Decent Work and Economic Growth
- SDG 9: Industry, Innovation, and Infrastructure
- SDG 10: Reduced Inequalities
- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Production and Consumption
- SDG 13: Climate Action
- SDG 14: Life Below Water
- SDG 15: Life On Land
- SDG 16: Peace, Justice, and Strong Institutions
- SDG 17: Partnerships for the Goals

Role of the university in addressing SDGs

Key to the SDG agenda is partnership working, ensuring that public and private organisations work together for the common good. One partner that is often rarely discussed in SDGs is that of the university. Given the role of universities in social and technological innovation and their so-called *third mission*, where they are increasingly called on to contribute to wider society beyond the research and teaching duties, it is clear that they have an ability to tie their agenda to real world sustainability issues (Crow, 2010).

Similar to the term ‘sustainable development’, there is no agreed definition of the ‘third mission’ or exactly what activities are included in this ‘third’ area, although it is agreed that these activities are those beyond the research and teaching remit of the university. Often third mission asks how universities can make contributions to wider society (Zomer & Benneworth, 2011) across all potential domains of their activity, and whilst in some cases the term is used synonymously with ‘extension’ and ‘outreach’, it has a wider connotation that goes beyond offering continuing education programmes and knowledge transfer. These activities, variously known as ‘extension’ and ‘outreach’, are longstanding in universities (Martin, 2012), the term ‘third mission’ to describe these activities and much more is relatively new. Third mission includes a sense of reciprocal community engagement and service to a range of stakeholders in the locality of HEIs (Inman & Schuetze, 2010). Etzkowitz, Webster, Gebhardt and Terra (2000) describe it as the move away from the ‘ivory tower’ towards having a leading role in creating innovative initiatives in a knowledge based society. Key to these innovative initiatives is the complex set of interactions with institutional actors, such as government, industry and the third sector (Datta & Saad, 2011). It positions the university in place and demands that it works with local actors in order to generate innovations or solutions. The third mission can refer to a variety of engagement activities and has evolved considerably in the last 25 years. It sometimes corresponds to the idea of the ‘entrepreneurial university’ (Saunders, 2010), which relates in large part to university behaviours that are driven by economic consideration, and involves activities such as commercialisation, patents and licensing. Whilst there has been a drive for social change in some aspects of third mission, critics suggest that this is still driven by economic drivers (Trencher, Yarime, McCormick, Doll, & Kraines, 2014).

These engagement activities occur within a range of systems, with the changing macro level system of policy and polity requiring acknowledgement. Specifically, action occurs often within administrative hierarchical systems which leave little room for fully flexible thinking. Therefore the influence of national government, culture, public opinion and influential media all play a role in how university engagement is perceived and facilitated. However, at times, it is unclear as to how much the growing importance of the third mission is a reflection of policy aspirations, changing economic environments, growing links between universities and industries, or changes in the culture of academia (Uyarra, 2008). What is clear is that for the third mission activities that focus on economic drivers, the physical and hard sciences are better able to engage with industry, create patents and generate income (Trencher et al., 2014a).

Another area of third mission activities focus on a social justice agenda, which can be linked to the sustainable development agenda. While some authors suggest this is outwith the remit of the third mission (Trencher et al, 2014a), others suggest it is an evolution of the term. Whether these activities fall within the remit of the third mission or otherwise, the renewed social justice agenda positions universities as potentially a 'social transformer and co-creator' (Trencher et al, 2014a) or 'the anointed agents of social and economic transformation in the 21st century' (Douglass, King, & Feller, 2009). Trencher argues that there is huge potential for universities as leaders in the development of sustainable solutions, as he believes the generation of effective remedies for the embedded and wicked challenges of sustainability across the social, economic, cultural, political and environmental spheres pose too great a challenge for central and local government alone. Instead, the university, with its academic expertise and funding for innovations, could enable a more creative lens to look at problems. For the purpose of this paper, we will focus these activities.

Triple and quadruple helix

Core in the third mission engagement activities are the interactions between universities, government and industry. This has been referred to as the 'triple helix of innovation' (Etzowitz, 2003). The triple helix suggests innovative solutions can be created through the close working of three spheres: industry, government and academia. Within this

relationship, each actor contributes expertise as per their function in society, in that governments establish regulatory frameworks to control the public sphere, industry creates wealth and academia generate intellectual capital to introduce and manage technological change (Borkowska & Osborne, 2018; Datta & Saad, 2011). Within this triad, knowledge creation is flexible and non-linear, relying on the input of all three. This model has been adapted to include a *fourth* helix: civil society, which underpins the importance of the social dimension in innovation generation (Caryannis & Campbell, 2010). Rather than the top-down approach of the triple helix approach, the quadruple helix also includes some bottom-up approaches, where innovation is informed by societal demands. It is within this inclusion of civil society that we understand how the third mission begins to focus on sustainable solutions to population challenges (Borkowska & Osborne 2018).

This is particularly pertinent when looking at the responsibilities of universities in the Global South who are positioned in the cities with the highest need, and are most affected by issues of climate change, economic crisis and social transformation. While universities in the Global South are not necessarily any more engaged than those in the North, Grau, Goddard, Hall, Hazelkorn and Tandon (2017) suggest that the SDGs are a good starting point for establishing concrete global objectives. In particular, ensuring universities build capacities for SDG policies, planning and management. Higher education institutions are increasingly involved in sustainability work, both in terms of engaging in global debates, but also participating in direct action (Pederson, 2017). In a Global Universities Network for Innovation (GUNI) report (Hall & Tandon, 2014), we see examples of universities in the South engaged in projects related to poverty reduction, food security and health, and we seek mutual knowledge exchange. However, often these universities face significant problems in living up to the triple helix paradigm, mainly that while they may wish to participate in the socio-economic development, they are poorly integrated into the wider socio-economic system that it is often difficult to impress impact (Mtawa, Fongwa, & Wangenge-Ouma, 2016; Preece, Ntseane, Modise, & Osborne, 2012; Saad & Zawdie, 2008).

Study context

Given the focus and importance placed on Higher Education Institutions (HEIs) to promote and actively engage in third mission activities, and

how this permeates HEI discourse and policy (Zomer & Benneworth, 2011) both nationally and internationally, our study asks how HEIs in the Global South are engaged in third mission activities.

SUEUAA (Strengthening Urban Engagement in Universities in Africa and Asia) is a collaborative project, funded by the British Academy's GCRF Cities and Infrastructure programme. Alongside the University of Glasgow, academics from six universities (referred to hereafter as 'study partners') in six cities in the Global South (University of Duhok, University of Kurdistan, Philippine Normal University, University of Zimbabwe, University of Dar-es-Salaam and University of Johannesburg) explore the third mission of the university in their city context. The wider hypothesis of the study describes the belief that the SDGs as they relate to education, healthy workforce development and wider city development, can be addressed more effectively through the better understanding of the contribution of HEIs to their place of location. It is argued that a regionally sensitive investigation, particularly through use of case studies, may enable a more nuanced picture to develop of how the third mission is enacted in urban settings in the Global South.

The study sought to investigate the ways in which HEIs contribute to developing sustainable cities in the context of major social, cultural, environmental and economic challenges. In doing so, it aimed to strengthen links between cities and HEIs. Building on work by Charles, Benneworth, Conway, and Humphrey (2010), the study aimed to benchmark the work of the universities in terms of their community engagement and third mission work. The study took a broad definition of urban engagement, including activities that supported the development of physical infrastructure, ecological sustainability and social inclusion. In particular, it was interested in how universities, in dialogue with city stakeholders and NGOs, can impact on policy in order to promote sustainable change. The study was organised in two work streams: development of case studies regarding current work being undertaken by the university relating to the third mission; qualitative interviews and focus groups with university and city stakeholders to better understand the facilitators and barriers to developing strategic relationships with the aim of developing sustainable solutions to city problems. For the purpose of this current paper, we focus on the first work stream.

Methods

Initially a case study approach was taken, as it enabled a holistic and in-depth exploration of how universities in the six partner cities engaged with their city. Definitions of case studies differ, with Yin (1994) for example describing the importance of scope, process, methodological characteristics and the empirical nature of the case, whilst Flyvbjerg (2011, p. 103) states case studies should be seen as an ‘intensive analysis of an individual unit (person or community) stressing the developmental factors in relation to environment’. The literature surrounding case studies is also concerned with the inherent ambiguity as to whether case studies are a *methodology* or a *method* (Harrison, Birks, Franklin, & Mills, 2017). Philosophical underpinnings also differ, although we believe our findings are best perceived using Yin’s (1994) post-positivist belief that case study is a form of empirical inquiry in a ‘real world setting’. In this way, we acknowledge rival explanations, and the interpretive elements in the case study design.

The research team in each city explored current practices relating to the third mission of their HEI system or sub-system². In order to place the third mission activity in context (Yin, 1994), the partner city researchers provided a broad overview of their cities issues as relating to sustainability, and also how the third mission activities could be seen to improve the economic, environmental or social issues affecting their city. The case studies also took account of the lessons of Preece et al (2012) in their discussion of difficulties in implementation of university activities in cities of the Global South, and interrogated how the intervention could be seen to make a difference.

Case studies were presented in two ways: single case study of a single third mission activity by a single university, and ‘thematic’ case studies, which used a multi-site approach involving multiple third mission activities from multiple universities which all centred on a ‘theme’. The research team agreed to these themes prior to the data gathering period. The team agreed the themes reflected the main trends in Global Challenge work: gender, environment, migration and policy. The research team in each city gathered data relevant to each of the prescribed themes. The data took the form of available statistics online,

²This varied according to the size of city and system.

policy documents, with additional information provided through communication with university departments regarding relevant engagement activities. While the individual case studies were single authored, the larger thematic case studies were co-authored, with a member from the University of Glasgow team working in collaboration with at least two partner city academics. All case studies and thematic papers have been published on our study website (<http://sueuua.org>). The links to all the thematic papers, case studies and further reading can be found at the end of the document.

The current paper represents a synthesis of the SUEUAA single and thematic case studies. These case studies were mapped onto the SDGs described above. The results below highlight the ways in which the third mission activities described in the case studies can be seen to promote sustainable solutions to the SDGs.

Results

Prior to discussing the ways in which the SUEUAA case studies can be applied to the SDGs, it is important to first outline how the third mission was understood in our six case study cities. This was the topic of an earlier thematic paper emanating from the project (Hirsu, Reyes, Hashemi, Ketuly, & Mohammad, 2018a).

Hirsu et al commented that university policy across the six case study cities referred to the importance of supporting developmental efforts in their locale. Linked to this was the acknowledgement of their responsibility to respond to the social and environmental challenges, as well as contributing to the global reputation of the university. The paper highlights the importance of the phrase ‘world class’ in these documents, positioning the university beyond merely the city location. Table 1 illustrates the general trends in terms of third mission policy discussions. In terms of what type of community engagement was referred to in policy, the areas were varied. These included: responses to environmental change; unstable social or political environments; disparities between rural–urban communities; health-related challenges; knowledge production and building collaborations between universities and various stakeholders.

Table 1: Third mission in university policy documents (adapted from Hirsu et al, 2018a)

	Knowledge transfer	Training and outreach/ extension services	Working with government and policy makers	Working with local community	Sustainability	Dedicated space for third mission activities
Duhok, Iraq	Y	Y	Y	Y	?	/
Sanandaj, Iran	Y	Y	Y	Y	?	Entrepreneurship Units and Growth Centres, Support Incubators, Science and Technology Parks
Manila, Philippines	Y	Y	?	?	?	Extension Programmes Centres for Excellence and Centres for Development
Harare, Zimbabwe	Y	Y	Y	Y	?	Industry Creating Hubs
Dar-es-Salaam, Tanzania	Y	Y	Y	Y	Y	Institute of Production Innovation Research and Development Institutes
Johannesburg, South Africa	Y	Y	?	Y	?	Township Marketplace Platform

Hirsu et al (2018a) highlighted a number of barriers experienced when collating evidence regarding the third mission of the universities. One of the main barriers was that university policies do not always reflect the wide range of ongoing public engagement and impact activities occurring in the university. This may be due to the differences between

departments, with individual academic units or staff members taking more responsibility than others to engage with local communities. These activities are therefore not documented in official policy, and are rather the career-orientated activities of small teams. Also missing from the policy documents was the importance of interdisciplinary working, and holistic partnerships between municipalities and universities. The latter also relates to the relative paucity of policy relating to the quadruple helix (community-directed engagement).

Another issue was that while there were general comments regarding third mission, and the need to connect with civic society; less was discussed regarding specific action plans or guidelines to support these important public–private partnerships. Hirsu et al refer to the work of Bailey, Cloete and Pilla (2011, p. 107) and their comment of the policy of the University of Dar-es-Salaam that ‘there is no real linkage between economic development and higher education planning at the ministerial level, and higher education issues are limited to only one ministry’. This suggests a gap between the ambitions of policy makers, and the reality of work at the university. The paper goes on to comment that several of the policy documents refer specifically to vulnerable populations, or the importance of joined up working. Some city policies, such as those of Sanandaj, only briefly mention the importance of university partners, but lack detail regarding their active role in university strategic plans.

Therefore the next section of results is presented while being mindful of the policy environment through which the third mission was enacted. Using the SDGs as a framework, we explore case studies of engagement provided by our SUEUAA partners. These case studies are not an exhaustive list of all engagement of the various universities, but rather aims to provide an overview of some of the active projects being conducted in the year of the study (2017/18).

Case studies collected for the SUEUAA project showed a strong contribution to five SDGs in particular: end hunger (SDG 2), inclusive education (SDG 4), gender equality (SDG 5), sustained economic growth (SDG 8), and make cities inclusive, resilient and sustainable (SD 11). These are summarised in Table 2, and discussed in more detail below.

Table 2: Overview of case studies

SDG	SUEUAA paper	Cities involved	Activities	Target audience	Stakeholders involved
2	Case study four	Dar-es-Salaam (Tanzania)	Development of new technology, training workshops, conference	Agricultural sector, local farmers	Consortium of Universities, policy makers
4	Case study six	Manila (Philippines)	Outreach work in local community around health and wellbeing	Local women, orphaned children	Directly working with local communities
	Case study two	Duhok (Iraq)	Inclusive education programme	Individuals with additional support needs in local community	Made possible by change in education policy
5	Thematic paper four	Manila (Philippines) Sanandaj (Iran) Duhok (Iraq)	Scoping paper exploring gender mainstreaming in three cities (<i>specific example from thematic paper</i>)	/	/
		Duhok (Iraq)	One-to-one support in refugee camps (<i>specific example from thematic paper</i>)	Migrant women (particularly those affected by trafficking)	University collaboration in Duhok and Germany
		Sanandaj (Iran)	Workshops supporting gender empowerment (<i>specific example from thematic paper</i>)	Orphaned children, children with disabilities	
	Case study six	Manila (Philippines)	Gender sensitivity training programmes and seminars	University staff, teachers, community leaders, citizens	University developed training to be delivered to others. No other stakeholders involved in developing materials.
8	Case study one	Harare (Zimbabwe)	Training workshops on basic business skills and basic mathematics	Street sellers in the local informal economy	Pilot programme with agreement from local ministers

11	Thematic paper two	Johannesburg (South Africa) Duhok (Iraq) Sanandaj (Iran) Mania (Philippines)	Scoping paper exploring how Universities respond to environmental challenges across different climatic situations	/	/
		Sanandaj (Iran)	Research focused on developing earthquake resistant construction strategies (<i>specific example from thematic paper</i>)	Urban areas, rural areas, unemployed populations (who may receive employment in building)	/
		Johannesburg (South Africa)	Developing renewable off-grid solutions for agriculture; development of biofuel (<i>specific example from thematic paper</i>)	Rural populations, urban populations	Neighbouring technology stations, Sustainable Energy Technology and Research Centre, University of Johannesburg
		Dar-es-Salaam (Tanzania)	Research into possible sustainable replacements for wood fuel	Rural community, wider country implications (90% of energy comes from wood fuel)	Responding to Government desire to reduce use of charcoal when cooking
	Case study seven	Sanandaj (Iran)	Consultation regarding environmental damage caused by dam construction	Rural community; water access to wider Kurdish region	Consultancy with private dam construction companies

SDG 2: end hunger, achieve food security, improve nutrition and promote sustainable agriculture

As the global population continues to expand, a strain is put on agricultural production as the demand for food increases. SDG 2 comments that ‘ending hunger demands sustainable food production systems and resilient agricultural practices ... increased investments are needed to enhance capacity for agricultural productivity’ (UN, 2017a). The 2030 Agenda recognises that this focus on both development and investment in agriculture (in terms of livestock, fisheries, crops, aquaculture) has a major role to play in ending poverty, bringing about sustainable development, and combating climate change (Food and Agriculture Organisation of the United Nations, 2016). There have been calls for greater attention to be paid to innovative solutions to these issues, to ensure agricultural production is increased in a sustainable manner, to manage food waste and loss, and ensure those experiencing malnutrition have access to nutritious food. This includes increasing smallholder productivity, and income of these smallholders, and recognising the links between poverty, gender, public health, climate change and the local economy. Boosting yields on existing agricultural lands is a challenge, particularly in areas experiencing drought, land degradation or over-farming. Sustainable agriculture practices require wise management of scarce water (i.e. through improved irrigation or storage techniques), through new innovations in farming, or through development of new crops.

One way to develop sustainable solutions is through an increase in integrated decision-making processes, and the promotion of the quadruple helix, encouraging collaborative working between national and regional decision makers, and experts in industry and university sectors. A concrete example is found in our Tanzanian case study (Mwaikokeysa & Moshi, 2018). Our partners at University of Dar-es-Salaam described the work of the College of Agricultural Sciences and Fisheries Technology at the University of Dar-es-Salaam in addressing the issues faced by the agricultural informal sector in the city. During a pilot project, involving a consortium of local universities, the department sought to address the inadequate value addition in agricultural and fisheries products, and inadequate adherence to standards. The project designed an integrated poultry, tilapia and vegetable farming system with the aim to enhance fish, poultry and

vegetable harvests. In order to engage with local communities, the consortium of universities has offered training workshops for relevant stakeholders, produced policy briefings and held a high-profile conference. There are echoes here of the land-grant universities in the United States which were established as agricultural extension (McDowell, 2003), and of course this linkage between agriculture and universities has been part of the role of African universities for decades (Mtawa, Fongwa, & Wangenge-Ouma, 2016).

SDG 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all

Education for all is one of the core elements of the sustainable development agenda. Irina Borkova, Director-General of UNESCO commented that ‘economic and technological solutions, political regulations or financial incentives are not enough. We need a fundamental change in the way we think and act’ (UNESCO, 2014, p. 16). Education for all also means eliminating gender disparity, and ensuring that rural and urban, and affluent and deprived children are all able to access quality education; and to have these aims extend to adult lifelong learning. Many development agencies recognise the key role education plays in promoting sustainable development, and the necessity to ensure the integration of sustainable development into both the formal curriculum and informal educational opportunities (UN, 2017b). By highlighting the need to encompass both formal and informal education, it ensures individuals are able to acquire understanding, skills and values that will enable their participation as active citizens in society (Association of Southeast Asian Nations (ASEAN), 2014), whether this be through early years education, vocational training or workshops. One issue is how to ensure groups with multiple disadvantage are also able to access these opportunities. Globally, it is acknowledged that these groups, those who experience a number of challenges linked to issues such as ill health, disability, poverty, rurality, illiteracy and (forced) migration are less likely to have access to services (UN, 2017b).

In our Philippines case study (Reyes, 2018), our partners at Philippine Normal University described the work by the University Centre for Gender and Development (UCGD) in providing outreach work for disadvantaged and disempowered groups in the local community

in Manila city. This outreach work did not involve city or industry partners but instead worked with the local community, and ran workshops with local women on issues of health and wellbeing, child rearing and nutrition. They have also conducted work with local orphanages looking at issues of body autonomy, personal safety and hygiene. Another example of SDG 4 was found in our Iraq case study (Ketuly & Mohammad, 2018), our partners at the University of Duhok describe working with German universities to develop solutions and interventions focussed on creating a more inclusive educational environment for individuals with disabilities or additional support needs. The result of the collaboration was the joint programme ‘disability studies and rehabilitation’, which has been ongoing for two years. The programme aims to create more opportunities for adults with disabilities who may have previously experienced barriers in participating in formal education in Duhok, and the wider nation of Iraq.

SDG 5: Achieve gender equality and empower all women and girls

Issues of gender inequality persist worldwide, affecting access to basic rights and opportunities for girls and women. These include issues affecting access to decent work, wage equality, access to education, healthcare and representation both in professional/managerial positions but also in political and economic decision-making processes. The necessity to include and promote women’s participation in all areas of sustainable development was highlighted in the UNESCO report ‘The Future We Want’ (UNESCO, 2014).

Aspects of gender were explored in the gender thematic case study (Hirsu, Reyes, Hashemi, Ketuly, & Mohammad, 2018b), and involved contributions from our partners from Philippines Normal University (Manila, Philippines), University of Duhok (Duhok, Iraq), and University of Kurdistan (Sanandaj, Iran). It explored the issue of *gender mainstreaming* in city-level interventions and leadership using publicly available data, and policy documents from each of their cities. Gender mainstreaming refers to activities that promote ‘women’s full and effective participation and equal opportunities for leadership at all levels of decision making in political, economic and public life’ (SDG 5.5). Although critics have suggested it mainly acts to integrate women into existing neoliberal and patriarchal structures

(Alston, 2014), rather than seeking to create substantial engagement opportunities to ensure women have ability to create sustainable impact in communities. Discussions in the thematic case study highlighted issues of employability after formal education, with a focus on post-university transitions across the different cities. Despite relatively equal levels of participation of males and females at undergraduate stage, at postgraduate level and above, increasing levels of inequality are seen. Also, in all three cities, women are yet to enter the top-level management of the University. As stated in the paper, the lack of visibility of women in top-level management positions is significant as 'it limits the prospects of change in relation to gender issues and policies'. This trend was also seen in broader employability of university staff, with higher levels of male staff compared to female staff in some areas.

The paper goes on to discuss city-level interventions directed by university staff, to address issues affecting women in the city. Including the University of Duhok's College of Medicine supporting migrant populations at refugee camps, and in particular women who have experienced physical abuse, sexual violence or slavery; and the University of Kurdistan being involved in a charity focussed on supporting orphans, children with disabilities and promoting gender empowerment. The work of the Philippine Normal University has been discussed above (SDG 4).

SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

SDG 8 highlights that increasing labour productivity; reducing the unemployment rate (especially for young people) and improving access to financial services are essential components of sustained and inclusive economic growth (UN, 2017c). In the 2030 Agenda for Sustainable Development, there was an emphasis on decent work, employment creation, social protection, and workers' rights as integral elements. Particularly as social rights and income are seen as tools to eradicate poverty, there is a responsibility on governments to establish productive occupational opportunities for their populations. This is particularly the case for vulnerable groups such as women, the urban poor, low income urban residents and unemployed rural labour.

However, the 2016 ILO report comments:

[E]conomic growth on its own has failed to reduce poverty. A case in point is Africa which experienced the fastest growth rates among all regions over the past decade, yet decent work deficits persist and improvements in poverty rates have been slower to materialise than in other regions.

(International Labour Organization, 2016, p. 97)

This report instead described the need to have carefully designed employment and income policies to support individuals and boost participation in the labour market and facilitate transition into formal employment. In doing so, there is a need to create sustainable enterprises, for small and medium size ventures. This would be realised through supportive mechanisms in local and central government and could be managed through effective tax regimes, business registration and regulation.

A Zimbabwe case study from our partners in University of Harare (Nherera, 2018) highlights the ways in which their university has responded to high levels of local unemployment, and corresponding levels of individuals in the informal sector. Zimbabwe is currently facing rising unemployment, because of policy inconsistency, sanctions, corruption, inadequate infrastructure and a dependence on external currencies (International Labour Organisation, 2016). While formal employment rates are low, there is a rising informal economy, in industries such as mining, agriculture and street vending. The informal economy is characterised by poor working conditions, no job security and no investment in civic society. While an estimated 90% of the working age population engage in the informal economy, they contribute approximately 5% to national GDP. Currently, an intervention is being developed to enhance the capacity of the informal sector workers to transition to formalised work. The University is seeking funding to develop a training scheme targeted at groups of informal street vendors in the city. They will be taught a variety of skills which would enable them to develop a formal street trading business (social skills, basic mathematics, as well as professional skills such as bookkeeping, marketing and management). They believe this will enable workers to receive adequate training to becoming formalised business owners, and therefore be able to contribute fully to the local economy.

SDG 11: Make cities and human settlements inclusive, safe, resilient, and sustainable

Over the last 50 years, the world has experienced unprecedented urban growth, with 55% of the world's population living in urban areas, rising to an estimated 68% by 2050 (UN, 2017d). One in every three people will live in cities with over 500,000 inhabitants. Understanding key trends in urbanisation is crucial to the development and implementation of sustainable solutions to the increase in urban population. As urban populations require an abundance of sustenance and energy to function, increased urban populations are associated with a range of challenges: strain on infrastructure, energy systems, transportation, and for services such as healthcare and employment. Rapid urbanisation is also linked to large slum settlements, increased air pollution and unplanned urban sprawl, which all make cities more vulnerable to disasters.

The environmental thematic case study explored these issues across different city contexts (Burnside, van Rensberg, Moshi, Ketuly, Mohammad, Azizi, and Argamosa, 2018). It involved contributions from our partners from University of Johannesburg (Johannesburg, South Africa), University of Dar-es-Salaam (Dar-es-Salaam, Tanzania), University of Duhok (Duhok, Iraq), University of Kurdistan (Sanandaj, Iran), and Philippine Normal University (Manila, Philippines). Using policy documents and other available data from each city, they highlighted existing work being carried out to respond to environmental challenges facing cities in very different climatic situations. The thematic case study focussed on academic interventions in response to long-term chronic environmental stresses (increasing temperature, air quality degradation, major disasters). One such disaster is earthquakes, an issue in Sanandaj where seismic activity is common. The University of Kurdistan is engaged in research concerning building materials and earthquake resistant construction strategies. It also explores the growing green economy, using an example of a case study from University of Johannesburg in waste to energy conversion, and exploring renewable off-grid solutions to support production, food processing, waste and waste management of rural and urban small-scale farmers. Through the use of biofuels (liquid or gaseous fuels derived from organic material or biomass), they explored the significance for using this as a fuel source for the transport sector. A similar case was developed by the University of Dar-es-Salaam, who explored possible replacements for wood fuel

(which currently accounts for 90% of energy in Tanzania). As this has implications for deforestation, soil quality and water retention, it is important for a sustainable solution to be found. One potential solution is a plant-source feedstock that would be drought resistant, so it can be grown in Tanzania and support the local economy's fuel requirements.

In the individual case study of Sanandaj, Iran (Azizi, 2018), the issues surrounding environment were also discussed. In particular, collaboration between private companies building dams in Kurdish region of Iran and University of Kurdistan's Department of Urban and Natural Resources. Initially dam construction led to compulsory purchase of land, and the subsequent displacement of populations in the regions. The water from the region was diverted, and there were issues of water and air pollution, and destruction of eco-systems in the area. The University was involved in discussions aimed at lowering the environmental impact of the construction and have created more effective methods for maximising outputs of natural resources.

Discussion

The work highlighted here, based on evidence gathered in individual and thematic case studies provides a baseline to understand the variety of ways in which universities in our case study cities were engaged in activities directed towards developing sustainable solutions to issues at city level. As illustrated in Table Two, these activities affect a range of populations, and can be seen as engaging with a range of knowledge; engineering, education and health to name a few.

The wider aim of this study is to explore the third mission of the university within the context of the Global South, being mindful that in each city a differing range of challenges emerge which shapes the engagement priorities of the university. Future work will be directed more towards how these important decisions are made, and how the university and city stakeholders do (or do not) work together for this purpose. The current paper allows us to initiate these discussions, asking what is happening now, and who is involved in these activities.

This paper also aimed to interrogate the quadruple helix, the strong working relationship between industry, government, university and civil society. The functioning of these four areas should enable a stronger third mission for the university, as these inter-related networks would

allow interventions to be more focussed to these parts of the community in most need, and to be delivered with policy and technological backing from public and private partnerships. What we found in these case studies was that while this was the case for a few interventions or engagement activities, it was not seen to be the norm. Instead, some arms of the quadruple helix worked closer together than others, often at the cost of engaging fully with all.

For some of the engagement activities, there appeared to be a strong connection between the university and the public, with the university responding to a city issue (e.g. Philippine Normal University running workshops for vulnerable women's groups, or University of Dar-es-Salaam creating an intervention for agriculture). At times, we also see instances of the university working with industry (University of Kurdistan offering expertise in dam construction) although was less frequent, and often involved universities offering consultations, rather than working in collaboration. There are also instances of universities working with other universities (e.g. University of Duhok working with German counterparts), although this did not involve other elements of the quadruple helix. Within the current work, we were not able to locate a case study where all four elements of the quadruple helix were collaborating equally, or were visible.

The case studies described here also were relatively small in scale, detailing pilot work or research being conducted at the university which may go on to have a societal impact. There is scope for government or industry to become closer affiliated to the university, in order for some of the activities to be scaled up; for example the University of Zimbabwe's intervention regarding providing training to local people in the informal economy, or University of Dar-es-Salaam's pilot work in enhancing harvest through integrated farming techniques. We suggest that the ability to scale up these ideas is dependent on the operationalisation of the quadruple helix. However, for this to work, many universities would have to be better connected to local business, policy makers, government and civic society, in order for these ambitions to become a reality. Reflecting on the wider policy of third mission in these cities, we are struck by the comment that while the policies refer generally to the importance of the third mission activities, less is said about the specifics of these engagement types. The lack of specificity and guidelines to engaging with other stakeholders has led to small-scale interventions

and a lack of interventions that utilise the expertise of the university in addressing sustainability issues in their local city.

The ability to work in closer collaboration with city stakeholders, NGOs, industry and local government is integral to the move towards SDG 17. SDG 17 centres on the ability to 'strengthen the means of implementation and revitalise the global partnership for sustainable development'. Tandon and Chakrabarti (2017) describe the significance of SDG 17 in calling for partners, whether they be in business, NGOs, communities, HEIs, governments or other actors (Dodds, Donoghue, & Roesch, 2017) in mobilising and sharing knowledge, expertise and resources in order to achieve the desired outcomes. The partnerships developed can be based around one issue or can have overarching collaborative power. The success of a partnership, they argue, is based on utilising different interests, perspectives, resources to understand the problem and create a sustainable solution.

For these global challenges and for the sustainable development goals to be achieved, it is clear that there are some barriers to be overcome, to ensure that universities in the Global South are better integrated into the wider socio-economic system (Preece et al, 2012, Saad & Zawdie, 2008), and to become better able to utilise knowledge exchange to interested parties. What these particular barriers are, and how they can be overcome is likely to differ across the different study site, although we are confident that there will be overarching narratives across the different contexts.

Our future work will focus on conducting qualitative fieldwork with city and university stakeholders in the six study sites, and exploring their understanding of the positioning of the university in city decision making, and how to improve the relationships between the city and university in order to better understand whether the quadruple helix model can be replicated in the Global South.

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