The *2030 Agenda* as a challenge to life sciences universities

Life sciences universities (LSUs) play a specific role in achieving the Sustainable Development Goals (SDGs). *A number of* SDGs *address topics that have been focal points for LSUs throughout their history of research, teaching and societal mission. Furthermore, they traditionally have strong links to stakeholders central to the transformative process, such as the food sector, forestry and renewable energies. However, LSUs and the university system will have to undergo transformations if they want to contribute to a profound shift in societies.*

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The UN General Assembly adopted the *2030 Agenda for Sustainable Development (2030 Agenda)* to set the world on a path of transformation towards a fair and sustainable society that leaves no one behind (UN 2015). The 17 *Sustainable Development Goals (SDGs)* stated in the *2030 Agenda* are universal, integrated and indivisible. This creates three challenges for implementation:

- The *complexity challenge* arises from the encompassing nature of the *2030 Agenda*. This raises issues of internal coherence, interdependencies and interactions between individual goals and targets.
- The *indivisibility challenge* arises from the complexity of the *SDGs* and the postulate of the *2030 Agenda* to address and reach all goals. The interlinked structure of the 17 goals through their targets avoids silo approaches and "cherry-picking" of selected goals by individual actor groups at the expense of other goals (Gratzer and Winiwarter 2018).
- The *transformation challenge* emerges from the combination of the first two challenges, which result in the need for a deep and universal societal change towards fairness and sustainability (WBGU 2017).

We will discuss these challenges to life sciences universities (LSUs) and ~~we will~~ present the specific framework conditions and positions for LSUs towards the *2030 Agenda*. Finally, we will propose steps for implementing the *SDGs* at universities.[1]

Why to transform: social responsibility of universities

The preamble to the *2030 Agenda* states that "all countries and all stakeholders, acting in collaborative partnership, will implement this plan" (UN 2015, p. 1). Universities with their combination of education, research and societal mission are crucial actors in addressing these challenges and contributing to achieve the ambitious goals and targets.

The concept of University Social Responsibility can be adapted for the implementation of the *SDGs* at universities. Having evolved from the concept of Corporate Social Responsibility (CSR), it addresses and reflects the role of universities in society and thus refers to fundamental debates that are older than the CSR concept (Felt et al. 2013). Debates on University Social Responsibility benefitted from activities during the *UN Decade of Education for Sus-*

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1 Our paper is based on document analysis and paper discussions conducted before, during and after a workshop *Life Science Universities and the UN Sustainable Development Goals* of the *Global Challenges University Alliance (GCUA)*, held in April 2018 at the University of Natural Resources and Life Sciences Vienna (BOKU). The paper summarises the position of the authors, who were involved in organising the workshop; it is not an official *GCUA* statement.

tainable Development 2005 to 2014 (e. g., Jorge and Peña 2017); today the concept is globally recognised.

The *2030 Agenda* aims at "transforming our world" (UN 2015). Recent debates gravitate around the fundamental agenda of sustainability and transformative science and ask how normative these sciences could be (e. g., Grunwald 2015 on Strohschneider 2014 and Grunwald 2018 on Strunz and Gawel 2017). For the *2030 Agenda*, the goals were set by a global participation process[2] and were adopted by all UN member states. This increases legitimacy and allows universities (and scientists) to take on the challenges described above, sparing them the often controversial agenda setting. Particularly for LSUs that usually do not take part in the science theory discourse, this may be a crucial shortcut for taking up the agenda in their research and teaching programs.

Disciplinary excellence will no doubt be needed to advance on the *SDGs*, but working on the *2030 Agenda* will need to create interactions between social, ecological, technical, institutional and economic dimensions and generate a need for integration. Transdisciplinarity (originally coined by Jantsch 1972) necessarily emerges from working on an agenda as complex and integrated as the *2030 Agenda:* the creation of new knowledge with and through participation of society and academia (Schneidewind and Singer-Brodowski 2013) will provide options for political solutions towards achieving the *SDGs* that are not only unobstructed from disciplinary knowledge boundaries (Russell et al. 2008), but potentially more democratic in avoiding technocratic scientism[3]. The key to success is a stringent focus on interactions between natural systems and society, leading to a pronounced role of social scientists in the *2030 Agenda* process. Furthermore, inter- and transdisciplinary research approaches support co-ownership of project results and are likely to generate practical knowledge directly applicable to regions (Radinger-Peer et al. 2015).

The specific role of life sciences universities in achieving the *Sustainable Development Goals*

For the purpose of this paper, we define life sciences and life sciences university with reference to the historic roots of most LSUs. During the 19th century, the tertiary education system was expanded. Two new types of institutions for higher education and research were introduced: 1. Those dealing with technology and applied sciences (engineering, mining, manufacturing, ...), which today are mostly Universities of Technology. 2. Those addressing the scientific management of land-use and primary production (agriculture and food production, forestry, water resources management, often also veterinary sciences, ...), which today are mostly LSUs. Worldwide, such universities, as they are focussing on primary production had respectively have research stations, field experiments in their own vicinity, thus having strong ties to their regions. This regional core gives them added leverage in *SDG* implementation.

While many LSUs nowadays focus on biotechnology or engineering and less on agriculture, their identity and their perception by society is still shaped by their historical roots (National Research Council 1995: p. v–vi). This distinguishes them from other universities also conducting research in biotechnology or biomaterial sciences.

The *SDGs* pose a challenge to all universities, but LSUs can take a specific role for the following reasons:

- A number of *SDGs* directly or indirectly address the water-food-energy nexus, which has been focal for LSUs throughout their history in research, teaching and societal mission. Figure 1 (p. 102) presents results of a mapping exercise at the University for Natural Resources and Life Science Vien[illegible]OKU).[4] Eight of the *SDGs* are strongly related to departm[illegible], two are related and seven are indirectly related to their work.
- LSUs traditionally have strong linkages to external actors (producers, government authorities, interest groups, ...) across many industries central for a transformation, such as the food sector, forestry and renewable energy production. Therefore, they can readily involve themselves into implementing the *SDGs*.
- Given their traditional focus on "purposive" research (e. g., increasing agricultural yields, regulating water resources; see Jantsch 1972, Max-Neef 2005), LSUs have taken on and continue to pursue integrative approaches, for example, by complementing perspectives from natural and technical disciplines with those of the social sciences (rural sociology, forest policy, water governance, ...). They can thus offer expertise in integrating knowledge from natural, technical and social sciences to provide solutions for many of the global challenges posed by sustainable development.
- Through this well-established linkage to practice and their strong regional ties, many LSUs have a high potential for conducting transdisciplinary research with local stakeholders. This can contribute to theory development, since integrating academic knowledge and the experiential knowledge from practice actors is considered key in transformation towards sustainability.

Structural challenges for life sciences universities

Regionally relevant knowledge vs. globalised scientific research: The role of LSUs to contribute to sustainable development in their regional environment is limited or even counteracted by current trends in academic performance indicators. Highly relevant knowledge for regional contexts might not be relevant on a global scale >

2 Globally, close to two million people in 88 countries participated in "global conversations" (UNESCO 2016).

3 Not vice versa as postulated by Strohschneider (2014), see Grunwald (2015).

4 Members of all BOKU departments attended an internal *SDG* workshop and were asked to discuss and assess their particular engagement in research and teaching to the *SDGs*. The authors compiled the results and shared them in a participatory process with the departments for a final decision.

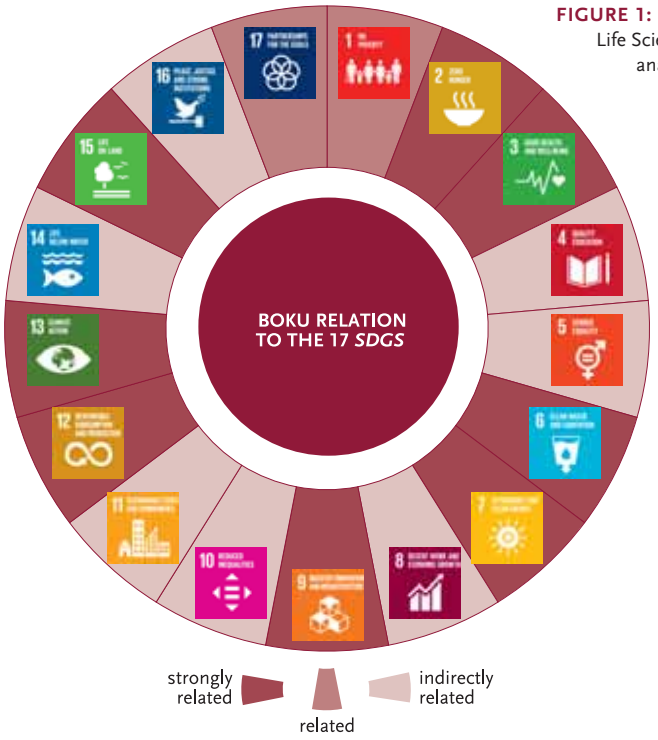

FIGURE 1: Results of a mapping exercise at the University for Natural Resources and Life Sciences, Vienna (BOKU), Austria. Representatives of all 15 BOKU departments analysed and clustered their scientific work in relation to the *SDGs*.

and thus cannot be published in international high impact journals. Engagement with local communities is usually not valued as highly as publication numbers and conventional bibliometrics.

Dependence on industry cooperation: LSUs traditionally have a large share of third party funding, in particular from industry partners in the agricultural, food and energy sectors. Representatives from these industries are often included in governing institutions such as University Councils. While this intense relationship can secure the relevance of research and open doors for dialogue, it can also inhibit innovations when conflicts of interests with mainstream actors in these industries arise. For example, in the early days of organic farming, at some universities research in this direction was confronted with interventions from the agrochemical industry.

Lack of reflection and discourse on new technologies: Many new developments such as in bio- or nanotechnology are discussed controversially in society. Yet it is difficult, if not impossible, for LSUs to define a common standpoint that would be accepted across all departments. As a consequence, an open debate is often avoided. However, the development of integrated pathways towards achieving the *SDGs* will only work, if universities create spaces for reflection and discourse.

Implied hierarchies of disciplines: While most LSUs claim to integrate different disciplines, in reality, for example, when it comes to distribution of resources, there is often an implied superiority of "hard" natural and technical sciences over "soft" social sciences. Differentiation between disciplines regarding performance indicators is lacking. Interdisciplinary co-operation is jeopardised by unequal status.

Thematic challenges

In addition to the structural challenges described above, the *SDGs* create thematic challenges: they include a mix of topics that are already tackled at LSUs like poverty and food production, research on climate change and losses of biodiversity and habitats and newer challenges like bioeconomy, inequality, environmental justice and peace and sustainability. In the following, poverty and food production as a central issue for reaching a number of *SDGs*, climate change as a central challenge in its nexus to poverty and biodiversity as well as inequality, and newer challenges are briefly discussed.

Poverty and food production

Providing food for a growing population with increasing meat and dairy consumption, and the deviation of parts of the food production towards agrofuels is a major global challenge for the coming decades (Tilman et al. 2011). The challenge itself is uncontested. But suggested pathways to reach global food security while at the same time minimising negative environmental consequences differ considerably.

The *2030 Agenda* does not explicitly address the dominance of financial markets or the idea of unlimited economic growth as systemic causes for global imbalances, especially food insecurity (Raworth 2017). However, *SDG* targets *2.b* as well as *17.10* and *17.11* call for correction and prevention of "trade restrictions and distortions in world agricultural markets" (UN 2015, p. 16), and for non-discriminatory and equitable multilateral trading systems. Because they study entire value chains across departments, LSUs can analyse and highlight the role of global financial markets and trade relations for food security and link global economic relations with producers' perspectives. They could also contribute to reconnecting producers and consumers (Gordon et al. 2017).

Concepts of sustainable agriculture that aim at reaching the *SDGs* will have to explicitly address equity and equitable land and resource distribution (*SDGs 10* and *5*) to avoid trade-offs between intensification of production and poverty (by, e. g., providing access to land and agricultural technology for the rural poor).

Further trade-offs exist between intensification and long-term ecological consequences (e. g., soil degradation, biodiversity losses and eutrophication, see *SDG 15*). Future sustainable agricultural and food systems will have to operate within ecological boundaries (e. g., improving/maintaining soil fertility, safeguarding sustainable nitrogen and phosphorus cycles, reducing greenhouse gas emissions and water use, maintaining agrobiodiversity on man-

aged land, reduce pesticide problems) and will have to adhere to economic and social sustainability principles (*Sustainability Assessment of Food and Agriculture Systems,* FAO 2014), connecting, for example, *SDG 8* and *12*. Such integrated concepts will have to combine sustainability strategies in agriculture/land use with sustainable consumption patterns in industrialised and emerging countries (see Muller et al. 2017).

Climate change

SDG 13 acknowledges that the *United Nations Framework Convention on Climate Change* is the primary international, intergovernmental forum for negotiating the global response to climate change (UN 2015, p. 23) and is in synergy with this agreement. The inclusion of this goal into the *2030 Agenda,* however, allows for utilising the complexity of the *SDGs* in designing measures to combat climate change that avoid trade-offs with poverty, biodiversity and inequality. LSUs have both the competences and the obligation to provide research on climate change effects (Kromp-Kolb et al. 2014) but also on the development of adaption and mitigation measures (e. g., by afforestation and their potential of sequester and store significant amounts of carbon, by reduction of land use change, reduction of food waste and meat consumption, see Smith et al. 2013, Muller et al. 2017). They can also analyse the consequences in an integrated and systemic way in context with the ecological, economic and social dimensions and indicators of sustainability (FAO 2014).

Bioeconomy

Bioeconomy is the "the production of renewable biological resources and the conversion of these resources and waste streams into value added products, such as food, feed, bio-based products and bioenergy" (European Commission 2012). A recent analysis shows that it remains uncertain if bioeconomy development will have a positive influence on achieving the *SDGs* (Dietz et al. 2018). Comparing the bioeconomy discourse with (amongst others) the sustainable development discourse, Pülzl et al. (2014) stated that although bioeconomy is supposed to aim at sustainable development, economic aspects are dominant and social considerations are neglected. The *SDGs* offer a comprehensive framework to critically reflect on sustainable intensification and bioeconomic strategies, particularly on the pitfalls of increasing inequality and poverty through unequal access to technologies and resources and negligence of regional values added.

Environmental justice

In a recent framing paper, the International Development Law Organisation points out, law and justice elements are key for achieving targets across the *SDGs* (IDLO 2016). Equal rights to services, resources and opportunities, policy coherence and integration, gender equality, equitable benefit sharing, and inclusive decision-making are mentioned as dimensions of *SDG 16*. The work of LSUs in areas as diverse as spatial planning, hydrology, soil research and agro-economy as well as biotechnology and breeding is rife with potential issues of environmental (in-)justice. All types of environmental justice (distributive, commutative, retributive, restorative, procedural justice) are important for achieving the *SDGs,* not only with a focus on *SDG 16*, but as a cross-cutting issue, in which *SDG 10* (curbing inequality) plays an equally important role. Themes include the question if and how patents on life forms should be possible, and what kinds of benefit-sharing models could be developed, but also how participatory planning can be implemented, for example, when it comes to delineating nature reserves. Integrated river basin management, especially in cross-border cases between nations of different economic power is another field where trade-offs between *SDG 10* and *15* can be expected and need to be addressed in research.

While LSUs do not focus on legal training, almost all fields in which they operate (land use related issues, introduction of new technologies in food production, spatial planning, etc.) have a legal dimension, which needs to be systematically integrated as an *SDG* issue in research and training. On the other hand, mainstreaming the *SDGs* at a life sciences university entails the development and application of methods such as the integrated valuation of ecosystem services which allows to bring the competences of researchers to fruition in legal disputes about natural resources and catastrophes (Aragão et al. 2016).

Mainstreaming *Sustainable Development Goals* at life sciences universities

LSUs can take concrete steps towards reaching the *SDGs* in four fields of action: 1. Provide education for sustainable development; 2. conduct research in fields relevant to the *2030 Agenda;* 3. drive and support political and societal transformation; 4. transform their own institutions in order to align with sustainability goals.

Provide education for sustainable development

We consider the education of "agents of change towards sustainability" a core responsibility of LSUs. Agents of change towards sustainability require particular capabilities, skills and values to facilitate social change (Wiek et al. 2016). When graduates will need to break boundaries between disciplinary knowledge pools and cultures as well as between theory and practice, their learning for sustainability must be dynamic in concept and content (Kopnina and Meijers 2014) and will have to advocate the value of diversity and diverse viewpoints (Wals and Benavot 2017). LSUs have to accept the responsibility to create learning opportunities for students to develop critical thinking, cooperative work, innovation and communication.

Conduct research to identify concepts, strategies and measures to support the implementation of the *Sustainable Development Goals*

The complexity of the *SDGs* calls for inter- and transdisciplinarity in research and development (Pohl et al. 2017, Radinger-Peer et al. 2015). Research for sustainable development in general and *2030 Agenda* in particular needs systems-oriented approaches and >

approaches drawing on impartial knowledge pools that seriously attempt to integrate different scientific approaches (Holm and Winiwarter 2017). A stronger integration of social sciences into these research processes allows an implementation-oriented synthesis of knowledge.

Drive and support political and societal transformation

LSUs will have to redefine their relation to society (Bien et al. 2017) and will proactively have to interpret their "societal mission" in order to become agents of change. They need to be driving and supporting political and societal transformation by targeted interventions into policy processes. Furthermore, they should create and stimulate stakeholder dialogues at the science-society interface for collaborative knowledge generation. Universities realize their brokering and bridging function proactively, for example, by utilising their international networks to serve regional needs or even set the agenda[5].

Transform universities and the university system

To be able to contribute to a transformation, that is, as has to be emphasised, a profound shift of society, universities and the university system will also have to transform in terms of cognitive, normative and regulative institutional changes. At present, prevailing criteria for excellence, modes of publication and academic career pathways can be an obstacle for innovative research towards achieving the *SDGs* because they primarily focus on (high level) publications disregarding engagement in other fields of action.

To turn universities into living labs for a sustainable future, they will have to define new rules and regulations for scientific work that will allow them to transform their captivation with competition towards cooperative working attitudes. Global cooperation could serve as a unifying message in the *2030 Agenda* and would offer an overarching rationale for the normative concept of the *SDGs*. Cooperation and competition are seen as two separate guiding principles and modes of operation within and between universities. Developing a nexus between them and strengthening the cooperation principles necessary to enable Universities to fulfil the claims of the *2030 Agenda* will be required.

5 This should not be conflated with them becoming "issue advocates" (sensu Strunz and Gawel 2017), but would, in line with Grunwald (2018), allow for a qualified discourse on different options towards reaching the *SDGs*.

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