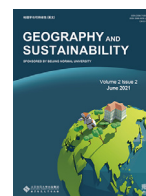




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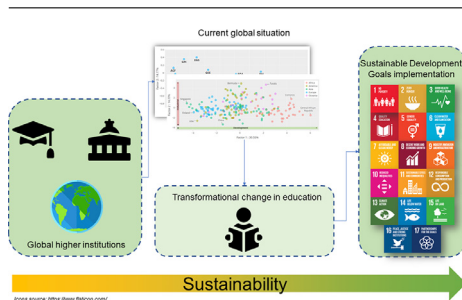
Higher Education For Sustainability: A Global Perspective

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HIGHLIGHTS

- Higher education institutions are key for the implementation of sustainability principles
- Sustainability based curricula and culture change is key to mindset transformation
- Interdisciplinary studies are the basis of the transformation towards sustainability
- Political environment and stakeholders' interest affect sustainability implementation

GRAPHICAL ABSTRACT



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ABSTRACT

Higher education institutions have an essential role in sustainability. They are key agents in the education of future leaders that will contribute to the successful United Nations Sustainable Development Goals (SDGs) implementation. The geography of SDGs this implementation is very heterogeneous, but it is clear that higher education institutions contribute decisively to creating a mindset that facilitates the dissemination of SDGs principle. This perspective paper analyses the impacts of higher education on sustainability and the challenges and barriers associated with this process. Higher education contributes decisively to the SDGs implementation, but especially to Goal 1 (end poverty in all its forms everywhere), Goal 3 (ensure healthy lives and promote well-being for all at all ages), Goal 5 (gender equality), Goal 8 (decent work and economic growth), Goal 12 (responsible consumption and production), Goal 13 (climate change) and Goal 16 (peace, justice and strong institutions). As a transformational agent, the higher education sector has a tremendous impact on students' habit and contribution to a prosperous society. However, to establish the required change in education, sustainability principles need to be at the heart of higher institutions strategy (e.g., curricula, modus operandi) and is key to be incorporated in the organisational culture. Only by leading by example, the external influence in the society will be possible (e.g., implementing SDGs key aspects such as gender quality, reduce waste reduction and energy consumption). For this to be a reality, different communication methods with students are needed (e.g., different student academic levels). Nevertheless, critical challenges need to be tackled in the institutions inside and outside the institution environment, such as incorporating sustainability principles, political environment and stakeholders' interest.

1. Background

The global population is projected to reach 9.7 billion by 2050¹. To support the current levels of resource consumption, energy use and waste production, around 2.3 planets Earth would be required (Bell, 2016). To reduce the ecological footprint is vital to produce more

knowledge and find effective forms to effectively transfer the information created to the broader public to be implemented effectively. Several authors highlighted the importance of environmental-related topics to reduce the ecological footprint (e.g., Cordero et al., 2008; Simsar, 2021), while others consider it of limited efficiency (Moser and Kleinhüchelkotten, 2017). Despite the contradicting results, it is key that education is critical to achieving sustainability (Leal Filho et al., 2018). The establishment of education for sustainability is geographically unequal, and more efforts are needed to reduce the differences around the world (Samuelsson and Park, 2017; Nagendra et al., 2018).

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¹ <https://www.un.org/development/desa/en/news/population/world-population-prospects-2019.html>

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In December 2002, it was declared in the period from 2005–2014, the United Nations Decade of Education for Sustainable Development to emphasise the importance of education to increase world sustainability (Wals et al., 2014). The overall objective was "to integrate the principles, values and practices of sustainable development into all aspects of education and learning."² and create "a more sustainable future in terms of environmental integrity, economic viability and just society for present and future generations"¹. This initiative was key to promote global education for sustainability at all levels. Several vital advances were achieved under this strategy, such as the convergence between education and sustainability agendas, the inclusion of sustainability issues in education systems, the engagement of a large number of stakeholders, the increasing of legal commitments, the inclusion of sustainability issues in the entire learning environment, the promotion of critical thinking, participatory and problem-based learning, and the integration of education for sustainability in formal education. Overall, after the UN Decade of Education for Sustainable Development, there was an increase of the research focused on education for sustainability and high recognition in the international arena that education is key to sustainability and that many countries are committed to establishing a solid education for sustainable development (Figueiró and Raufflet, 2015; UNESCO, 2020).

In 2015, the UN General Assembly adopted seventeen Sustainable Development Goals (SDGs) to be achieved by 2030. The aim of these seventeen goals is "to secure a sustainable, peaceful, prosperous and equitable life on earth for everyone now and in the future" (United Nations, 2015). The report of the Open Working Group Proposal for Sustainable Development Goals highlights four "critical shifts" that made the fifteen-year period of the Millennial Development Goals different from the current period of the SDGs: "(i) a drastically higher human impact on the physical Earth; (ii) rapid technological change; (iii) increasing inequality; and (iv) a growing diffusion and complexity of governance" (United Nations, 2015). Aiming to face and tackle these issues, UNESCO states that education is the "key instrument" in achieving the SDGs, by increasing the knowledge, skills, values, attitudes, critical thinking, competencies, systemic thinking, responsibility and empower the future generations to have the capacity to make the necessary transformational change in our world (United Nations, 2015; UNESCO, 2018).

The Incheon Declaration describes education as a "fundamental human right and the basis for guaranteeing the realisation of other rights". Quality education (Goal 4) is key to achieve all the SDGs. UNESCO highlights it as the most effective way to meet all SDGs to act towards sustainable development. Education is at the frontline of any development from primary school to tertiary education and lifelong learning. UNESCO defines Education for Sustainable Development as a source of empowerment for the learners "to take informed decisions and responsible actions for environmental integrity, economic viability and a just society, for present and future generations, while respecting cultural diversity" (UNESCO, 2018). According to Bell (2016), this is because in its essence, sustainability could be perceived as a challenge for humankind, a challenge to learn to live more sustainably. To become an effective solution to those mentioned above environmental, social, and economic problems, there is a need to make significant changes in the general public and academic communities' attitudes towards global issues covered by SDGs (UNESCO, 2017a). There is a need for "Including SDGs in the education of globally responsible leaders". The "Mindset for Sustainability" (Filho et al., 2019). This must be formed both amongst the students and the education staff. However, for this to be a reality, everyone - "governments, the private sector, civil society and every human being across the world" - must do their part (UNESCO, 2017a).

Education institutions can take on the role of a liaison between different stakeholder groups. Higher education institutions have a particular responsibility to form future professionals and implement the knowl-

edge and ideas. Since 1970, universities have considered sustainability as part of their responsibilities. However, after the Talloires Declaration in 1990, there was an increase in universities that adopted a sustainability strategy. This declaration was followed by several others, such as the Halifax Declaration (Canada) the Copernicus Declaration of Association of European Rectors, and the Kyoto Declaration of the International Association of Universities (Corcoran et al., 2004). However, the implementation of sustainability these principles are not equal in all the world, and some regions are more advanced (e.g., Europe) than others (Bizerril et al., 2018). Irrespective of the differences, many higher education institutions promoted sustainability and are deeply engaged in preparing students who are ready to understand the global challenges and be active actors and examples in implementing sustainability principles. This can be achieved by reducing the institution's environmental footprint, engaging strongly with the communities, and having good governance (UNESCO, 2020). In recent years, a growing body of knowledge has been developed towards higher education to implement a sustainability curriculum in higher education, campus practices and outreach activities (Weiss and Barth, 2019; Menon and Suresh, 2020). Other works were developed focused on the pedagogical barriers associated with this implementation (Blanco-Portela et al., 2017), the pedagogical approach towards teaching sustainability in higher education (Seatter and Ceulemans, 2017), the impact of high education institutions in sustainability (Hallinger and Chatpinyakoo, 2019) and the management of education (Figueiró and Raufflet, 2015). All these aspects are key to achieve national, regional (e.g., European Green Deal) and global (SDGs) targets. The incorporation of sustainability principles is a key aspect to improve the university image, reputation and studies quality. The Universities with the best rankings are the ones that have a sustainable vision towards the development of their students and establish a culture of sustainability (Salvioni et al., 2017). Nevertheless, the high ranked universities are geographically concentrated in western countries³, and it is imperative that this sustainability vision be adopted globally. This perspective paper aims to overview the impact of higher education on sustainability, especially on a) the role of high education institutions in a sustainable world; b) their relevance to achieving SDGs; and c) the challenges and barriers associated.

2. The role of higher education institutions in a sustainable world

2.1. The importance of higher education for sustainability

Education is the driving force of establishing sustainability since it is one of the main communication vehicles and the basis for the "sustainability mindset". This concept includes "a systemic approach to understanding, one which goes beyond technical knowledge and even understanding the basics of a healthy ecosystem and a thriving society". By emphasising management ethics, entrepreneurship, environmental studies, systems thinking and self-awareness, the sustainability mindset encourages us to break away from traditional management disciplinary silos (Kassel et al., 2016). For instance, systems thinking is often mentioned as one of the skills necessary to better understand the meaning of sustainability. This is because sustainability integrates three equally dimensions: environmental, social and economic. According to UNESCAP (2015), "People and the nature of the society in which they live are shaped by and, in turn, shape the economies that support their livelihoods and enhance their overall quality of life. Environments provide life-giving and economically important services to economies and to people". In this case, systems thinking is the key to promote a holistic approach to problem analysis (UNESCAP, 2015).

In last years a considerable number of works assessed the impacts of higher education in sustainability (e.g., Littledyke et al., 2013; Fehner, 2019; Leal Filho et al., 2018; Findler et al., 2019a) and, usually,

² <https://en.unesco.org/themes/education-sustainable-development/what-is-esd/un-decade-of-esd>

³ <https://www.topuniversities.com/university-rankings/world-university-rankings/2021>

higher education institutions are viewed as “changing agents” and “catalysts” in the development of sustainability-related issues (Shields, 2019). Overall, a sustainability-based education affects education contents and the associated process and outcomes (Gatti et al., 2019). To illustrate the importance of higher education, we assessed at a global level how some higher education key indicators, based on country data. In total 120 countries were considered in this analysis. The variables considered were School enrolment, tertiary (% gross)-SET; Expenditure on tertiary education (% of government expenditure on education)-ETE; Government expenditure on education, total (% of GDP)-GEE; Gender parity index-GPI; Access to clean fuels and technologies for cooking (% of population)-ACF; Agriculture, forestry, and fishing, value added (% of GDP)-AVA; Carbon dioxide (CO₂) emissions (kt)-CO₂; Exports of goods and services (% of GDP)-EGS; Gross Domestic Product-GDP; Industry (Including Construction), Value Added (% of GDP)-IVA; Internally displaced persons, total displaced by conflict and violence (number of people)-IDP; Mortality rate, under-5 (per 1,000 live births)-MR5; Particulate matter (PM_{2.5}) air pollution, population exposed to levels exceeding WHO guideline value (% of total)-PM_{2.5}; Renewable energy consumption (% of total final energy consumption)-REC; Vulnerable employment, total (% of total employment) (modeled ILO estimate)-VET and Forest Area (%)-FOA. The above mentioned variables were selected carefully to identify the different countries environmental (CO₂, PM_{2.5}, REC, TMP and FOA), social (GEE, GPI, IDP, MR5) and economic (VET, AVA, IVA, EGS) performance and how this was linked with high education (SET and ETE) and vice-versa. This identification is essential to understand the factors that affect and can be affected by high education enrolment. The description of all indicators and the associated sources are shown in **Table S1**, in the supplementary material.

A Principal Component Analyses (PCA) was applied to identify the association between the variables. The factors extracted are presented in **Table S2**, in the supplementary material. SET was highly associated with ACF, GPI and EGS and inversely related to REC, PM_{2.5}, AVA, VET and MR5. This shows that in the countries where the population enrolment in higher education is the highest, there are several important social, economic and environmental benefits. For instance, the vulnerability to employment, mortality rate under 5 (socio-economic) and pollution are low in the countries where the enrolment in higher education is high. Also, access to clean energy, women participation in higher education, and external commerce reach the highest levels. As expected, GDP has a strong influence on CO₂ emission and link with investment in education (GEE), which is highly dependent on industrial activity (IVA) (**Fig. 1a**). As expected, African countries were the ones with the lowest development (e.g. low MR5 and VET), while European (e.g., Finland) and Asian (e.g., Singapore) had the highest. On the other hand, while China and the USA have the highest industrialisation and CO₂ emission levels, remote territories such as Bermuda and Tuvalu had the lowest (**Fig. 1b**). Overall, it is clear that the geography of high education enrolment and their social, economic and environmental benefits is heterogeneous. Fehlnert (2019) highlighted a positive relationship between higher education and sustainable development. Higher education contributes substantially to the graduates having a well-paid job and build stable and prosperous societies. In addition, higher education promotes the creation of new ideas, technologies that are the basis of sustainability. Despite this, higher education institutions' contribution to society is likely underestimated (Fehlnert, 2019).

Higher education institutions have a decisive impact on shaping mentalities. According to Bowen (2018), the impact of higher education in adult life has an average of fifty to sixty years after graduation. In society, this effect can continue for centuries. Higher education institutions have a key role in the implementation of education for sustainability: 1) teaching and research centres can improve sustainability by project development and incorporation of sustainability principles across the disciplines; 2) the practice carried out by different educators can influence broader opinions through outreach activities; 3) an institutional culture of sustainability increases the awareness of university

staff, local and broader communities; 4) high education institutions are responsible for the formation of next-generation professionals, which will have a decisive impact on their different professional contexts and social engagements; and 5) by implementing sustainable campus practices (e.g., reducing greenhouse emissions, promote biodiversity, efficient use of energy and reduce the ecological footprint). Higher education institutions can lead by example and influence university members (Littledyke et al., 2013). The investment in higher education is a crucial aspect in the development of a culture of sustainability since the organisations where there is the greatest effort in higher education have high academic knowledge and research interest and willingness to adopt and research advancements, including the ones related to SDGs (Rosati and Faria, 2019). The development of a sustainability culture through the different activities carried out on the campus such as institutional framework and assessment, research, education, experiences and operations and outreach, have a substantial impact on the outside world, namely on the environment, economy, society and the stakeholder's awareness of sustainability aspects (Findler et al., 2019b).

A considerable number of works and revisions were developed on the impacts and presence of sustainability principles in degrees, course contents (e.g., Fuertes-Camacho et al., 2019; Sanchez-Carracedo et al., 2021; Sidiropoulos, 2014), and learning methodologies (e.g., Gatti et al., 2019) in higher education institutions have been published. There is an increase in the incorporation and acceptance of sustainability issues in higher education (e.g., Sammalisto and Lindqvist, 2008). Nevertheless, in several cases, they are not uniformly developed and unbalanced between degrees as observed by Sanchez-Carracedo et al. (2021) in Spain or fail to be fully integrated into the programs as identified by Stough et al. (2018) in Belgium. Although several courses include in their contents the learning outcomes that promote sustainability or adopt sustainable practices (Mintz and Tal, 2014). A systematic review carried out by Figueiró and Raufflet (2015) pointed out that the effectiveness of teaching sustainability issues is high if sustainability is considered in the core courses (mandatory disciplines), not in marginal ones. In this context, it is key to ensure that university programs consider sustainability-oriented projects at their core. Several methodological frameworks have been proposed for sustainability topics knowledge transfer. A constructivist approach has been suggested by Hedden et al. (2017) to teach sustainability. Tejedor et al. (2019) identified five different learning strategies for sustainability education in higher education institutions: project-oriented learning, simulation games, problem-based learning, service learning and case studies. According to Mintz and Tal (2013), the learning outcomes are higher when a participatory learning method is applied compared to lecture-based courses. Regardless of the methods applied, the important is that the students perceive sustainability as a critical aspect of their education (Boarin et al., 2020). The inclusion of sustainability principles in higher education institutions and academic curricula increase their knowledge, views, awareness and attitudes towards sustainability (Sidiropoulos, 2014).

2.2. The importance of the correct and effective communication of sustainability issues

To establish a sustainability mindset effectively, sustainability principles need to be effectively communicated. Communication is a pivotal aspect of the successful implementation of various sustainability initiatives (Djordjevic and Cotton, 2011). For instance, Lertpratchya et al. (2017) provide three reasons why higher education institutions are essential channels to communicate sustainability effectively: 1) Despite the different inequalities, many people attend universities and colleges. In 2016, approximately 216 million students were enrolled in higher education institutions in the entire world (ICEF, 2018). For instance, in the UK more than 2,383,970 students were enrolled in higher education institutions in 2018/19 academic year (HESA, 2020), and this is expected to increase in 2030 (380 million) (ICEF, 2018);

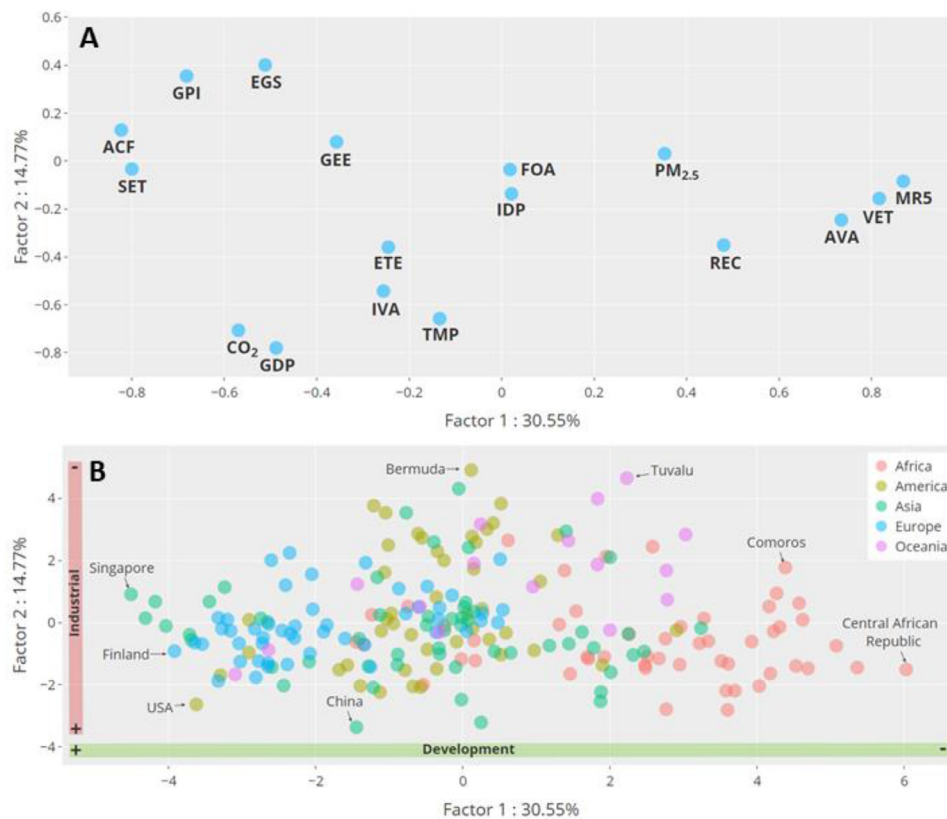


Fig. 1. Relation between PCA factor 1 and 2. A) variables and B) cases (countries).

2) the largest number of students enrolled in higher education are in late adolescence (18 to 21), a critical age for identity development. A consistent increase in identity attainment has been found throughout the college's four years (Marcia, 1980). According to Zelezny (1999), young participants are easily influenced by the ideas discussed in the classroom than the older participants. Also, according to Climate Outreach (2018), “moving from home to university is often an important part of becoming involved in climate change campaigns”; and 3) most often the college/university education is the last stage of education level before entering in the labour world, where they play an influential role as professionals (Lertpratchya et al., 2017). Overall, effectively communicating sustainability initiatives is key to shaping future professional's mindsets and implementing the knowledge acquired in real life.

Effectively communicating sustainability initiatives is key to adjusting the message to different types of students/audiences when targeting different groups of students (Lertpratchya et al., 2017). Lertpratchya et al. (2017) highlighted that the student's age is an influential factor in effective, sustainable communication effectiveness. Usually, new incoming (first-year students) students are less aware of sustainability aspects. Often, entering higher education is a drastic change in students' lives, making them sensitive to the established norms. Therefore, the students would be more likely to comply with the communicated messages and engage in the established behaviours. In this context, the communication campaigns targeted to first-year students are more effective. On the other hand, older students' perception of community norms may be more specific. Very likely, they may have already made strong friendships or joined social groups, and they adjust their behaviours and attitudes to fit those groups. For this reason, investing in promote sustainability in older students may not be as effective compared to new students (Lertpratchya et al., 2017). Effective communication with incoming students, however, is only the first step. In order to ensure long term compliance with these sustainability norms, the concept of sustainability must be continually brought up in the learning

process “so that they [students] can live the experience as well as learn about it” (Stewart, 2010). First, it is essential to implement the campus greening and then change the curriculum (Stewart, 2010) - the hardest part because it requires a very united community (Argento, 2020).

3. High education as a key aspect to achieving UN sustainable development goals

The capacity of high education institutions to influence the transformation to a more sustainable society is tremendous. By considering sustainability principles in studies and research programs, university staff and the students are actively working towards a sustainable world (UNESCO, 2020). Nevertheless, several challenges are essential to consider in high education future. For instance, to implement and adopt SDGs correctly, interdisciplinary studies are needed in the different fields of knowledge. The integration of diverse disciplines improves students' problem-solving capacities, broadening their minds to create solutions for the different challenges (Annan-Diab and Molinari, 2017). For instance, several disciplines, such as geography, consider natural, social, economic, and political dimensions and can help understand the complexity of sustainability and the solutions needed for their correct implementation (Meadows, 2020). Among the ten different targets considered in SDG 4 (Quality Education), described in Table 1, there is one specific target to higher education (Target 4.3). However, higher education has also an important impact on Target 4.4, 4.7, 4.b, and 4.c. Since the 1970s, globally, there has been an increase in the number of girls that accessed higher education, and since the 1980's the number of girls in higher education is larger than the boys (O'Connor et al., 2015). In OECD countries, this was observed after the 1990's, which occurred irrespective of the education and age type. Nevertheless, at the doctoral level, males are in high number. Despite this, the trend is that higher education will become more feminised, and, in the future, girls will likely have a better education than boys (OECD, 2008). According to Stoet and

Table 1
SDG 4 (Quality Education) description. The most relevant targets to high-education are highlighted in bold. Source: <https://sdg4education2030.org/the-goal>

Target	Description
Target 4.1	“By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.”
Target 4.2	“By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education.”
Target 4.3	“By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.”
Target 4.4	“By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.”
Target 4.5	“By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.”
Target 4.6	“By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy.”
Target 4.7	“By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and nonviolence, global citizenship and appreciation of cultural diversity and of culture’s contribution to sustainable development.”
Target 4.a	“Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all.”
Target 4.b	“By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries.”
Target 4.c	“By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States.”

Geary (2020), the reduced boy’s engagement in post-secondary education in OECD countries is mainly related to reading skills. Although females in higher education are increasingly high, they still have limited access to higher education senior positions (O’Connor et al., 2015). The situation observed in OECD countries is not identified in other developing countries (e.g., Bolivia, Tunisia, Ghana, Irak), where the number of males in higher education is substantially higher than females (Evans et al., 2020). Both in OECD and developing countries, it is key to increase the gender balance in higher education (OECD, 2008), which is the ultimate objective of Target 4.3. High education is key to empower, develop skills and competencies for future global leaders. Therefore it is of utmost relevance to provide equal access to males and females and the same opportunities to achieve the same targets. Overall, high education has an essential role in achieving SDG 4 by creating an inclusive, quality and equitable education for all (Owens, 2017; UNESCO, 2017b).

Access to higher education increases students’ skills and open their horizons regarding the different opportunities, which is key to find decent jobs (target 4.4). Several works (e.g., Mason et al., 2009; OECD, 2012; Hasanefendic et al., 2016; Picatoste et al., 2018; Pardo-Garcia and Barac, 2020) observed that higher education increases students’ skills, entrepreneurship and capacity to have decent jobs. This is especially observed in mobile students during their studies (Wiers-Jenssen, 2009). Therefore, higher education will serve as strong support to achieve Target 4.4. Higher education is a vehicle for a society more aware of sustainability problems, as mentioned previously. In the countries where higher education is consistently established, there is a more sustainable lifestyle (Tapia-Fonllem et al., 2017), respect for human rights (Kingston, 2018), gender equality (Lizotte et al., 2020), peace culture (Shehi et al., 2018) and global citizenship (Karlberg, 2010; Tyran, 2017; Lee et al., 2017). Higher education can strongly support the achievement of Target 4.a by creating an inclusive space and a safe learning environment for different types of sensitive groups, such as indigenous people (Brown, 2019) and disabled people (Leake and Stodden, 2014). Finally, higher education institutions and governments are key to create more scholarships tailored to developing countries and invest critical mass essential to fulfil Target 4.a and 4.b. For instance, in Australia, from 1950-1970 until today, there was an increase in the number of scholarships targeted to Asia (Kent, 2018).

Directly or indirectly, higher education is related to all the SDG’s. Higher education institutions have a great responsibility for the achievement of all SDG’s, through innovation, knowledge production and hu-

man capital formation (Chankseliani and McCowan, 2020). According to Owens (2017), two aspects are key for the impact of higher education in SDG’s: 1) regional higher education partnerships and 2) access to public research funding. Higher education institutions are responsible for the next generation of sustainability leaders, responsible for key initiatives at local, regional and global level, and essential to achieve SDGs ambitions (Franco et al., 2019). According to the latest International Association of Universities (IAU) report (IAU, 2016), the majority of the university staff has a medium (43%) or very high (36%) knowledge about SDG’s. Most staff link sustainable development to environmental questions. Higher education institutions work mainly in quality education, while the most adopted SDGs are quality education and gender equality. Franco et al. (2019) identified different gaps in higher education for sustainable development policy, curriculum, and practice across the different continents. For example, in the Americas, the biggest gaps were observed in SDGs 1, 5 and 14, while in Europe they were identified in SDGs 1, 2, 3, 5, 8 and 10. In Asia and the Pacific, the most significant gaps were found in SDG 2, 3, 9, 10 and 16. Finally, in Africa, except for SDGs 4, 5, 7, 11, 12 and 15, gaps were identified in all the other SDG’s. Although higher education is key to the realisation of all SDGs, according to UNESCO², they may be connected with specific goals such as end poverty in all its forms everywhere (Goal 1); ensure healthy lives and promote well-being for all at all ages (Goal 3); gender equality (Goal 5); decent work and economic growth (Goal 8); responsible consumption and production (Goal 12); climate change (Goal 13) and peace, justice and strong institutions (Goal 16)⁴. Although UNESCO highlights these SDGs as the ones where higher education institutions can have the most significant impact, they unequivocally contribute to the other goals. High education institutions can contribute significantly in 1) Research: by creating research capacities, innovation and knowledge, transdisciplinary and interdisciplinary research, SDGs topic investigation; 2) Education: by mobilising students for action, education for sustainable development, SDGs related jobs support and capacity building; 3) Management and Governance: include SDGs in university practices and management and governance aligned with SDGs principles; and 4) Leadership: promote dialogue between sectors, show higher education institutions compromise with SDGs and commitment with the public (SDSN Australia/Pacific, 2017). This will be translated into mul-

⁴ <https://en.unesco.org/themes/higher-education/sdgs>

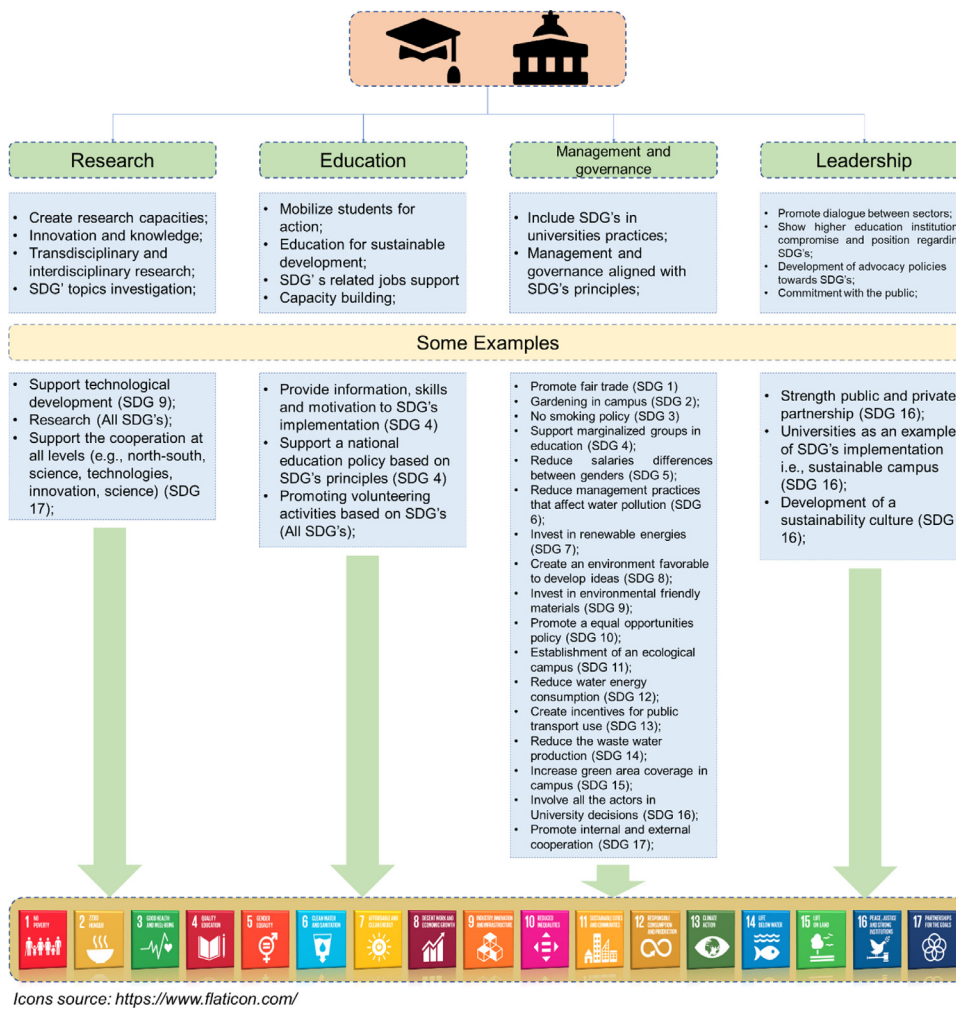


Fig. 2. Contribution of higher education institutions to SDGs. Based on SDSN Australia/Pacific (2017).

multiple benefits for SDGs implementation and achievement, summarised in Fig. 2.

4. Challenges and barriers to implementing sustainability in higher education

Numerous challenges and barriers at different levels affect the successful contribution of higher education to creating a sustainable future. Overall, without depth and fundamental change in the academic world, there is a threat that Universities will lose their essential role in research and knowledge. SDGs are forcing higher education institutions to change to respond to a world in crises. There is a need for a transformation in the attitude and ethical practices to solve our time's most critical challenges. Essential topics such as integration problem solving, anticipation skills and system thinking should be considered in all university curricula. An interdisciplinary approach should be the engine to develop sustainability practices all this (Gual, 2019). Richardson (2019) summarised the problems associated with SDG's implementation. Among them, it is essential to highlight the 1) under-educated audience, the irrational and ineffective learning methods, the lack of curricula relevance and motivational crises; 2) uninformed target audience that has very little awareness about global crises such as climate change; 3) consumption patterns, affected by different cultures and beliefs towards the environment; 4) social identity theory (each person has his own perspective); 5) elitism and lack of diversity (education and job opportunities are not equal for all), and 6) cognitive dissonance theory (the behaviour is not aligned with the beliefs).

The concept of sustainability is inherently complex since it requires integrating people, planet and profit - three high-level considerations. For higher education institutions to fulfil their role as sustainability models, a strong organisational culture needs to be established. For this to happen, substantial changes towards developing a new set of values and behaviours are critical (Adams et al., 2018). Howlett et al. (2015) argue that the higher education institutions' role in educating about sustainability stems from their responsibility for the current environmental crisis. The "current education systems are essentially equipping individuals to become more effective vandals of the Earth". Therefore, modern education systems need to challenge core assumptions that revolve in society (Howlett et al., 2015). Although the benefits are clear, the adoption of sustainability as an educational concept in higher education institutions curriculum and strategies are only considered in academic institutions to some extent, and there are important differences between educational fields (Singer-Brodowski et al., 2019).

Nevertheless, imposing behaviours is a complex task and difficult to achieve without a few key preconditions. Firstly, the effective implementation of sustainability policies is highly dependent on the willingness and commitment of the management to engage in innovative activities (Avila et al., 2017). Freedom to express such critical ideas is highlighted amongst the very few critical preconditions for the tertiary sector to benefit individuals and society, along with the autonomy in choosing research areas and rewarding employment opportunities (Fehlner, 2019). The unwillingness and society lack of commitment could be explained because the investments required for implementing sustainable policies are often perceived as a barrier, while the benefits

are overlooked (Avila et al., 2017). Nonetheless, even in leaders with a sustainable vision, sustainable leadership is highly dependent on the capability to employ the previously mentioned systems thinking. Innovation must be allowed to emerge throughout the institution, which requires the whole organisational community's support. The capacity to establish a culture of sustainability effectively in high-level education institutions is the educators' capacity to cross disciplines to unite and collaborate to achieve organisational culture for sustainability (Argento et al., 2020), which often requires years. Finally, colleges and universities need to adhere to external influences, such as stakeholders. The complexity of the matter can be summarised by the fact that universities are expected to follow two very different paths: market logic, "which means that they need to be responsive to external pressures and expectations stemming from increased competition, accreditation, funding, etc." and state logic, "which means that they need to be accountable to society and create public value for current and future students and other stakeholders" (Argento et al., 2020).

5. Conclusion

Higher education institutions have a great responsibility to form future sustainability leaders and support the ambitious SDGs targets implementation. Sustainability is also an essential aspect of a university's reputation and prestige globally. Higher education establishes the mindset of adult people and is considered a "changing agents" towards sustainability development. Nevertheless, the geography of mindset change is not equal, and not all have equal access to higher education. Despite this, it is clear that there are several indicators associated with higher education levels, such as low employment vulnerability, mortality rate under 5 and low pollution, on the one hand, and high access to clean energy, the participation of woman in higher education and external commerce. Besides, higher education contributes to high paid jobs.

Higher education institutions need to be drivers of a culture change and develop curricula based on sustainability principles. This starts at the campus, where the culture of university staff is key to alumni transformation. For this, proper and tailored communication is needed for different audiences. Overall, education is the basis for the achievement of all the SDGs and has an essential contribution to the formation of society willing to support different SDGs aspects (e.g., global citizenship, gender equality, respect for human rights). Despite the key role in social transformation, several challenges and barriers need to be tackled inside the higher education institutions (e.g., curricula, ethical principles) and externally (e.g., different type of audiences, political environment, stakeholders' interest), that need to be tackled for the realisation of the world that we want.

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.geosus.2021.05.001.

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