

## Research

# The transformative power of networking in the implementation of the Sustainable Development Goals

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## Abstract

Networks can help implement the United Nations Sustainable Development Goals (SDGs) in a variety of ways. They can facilitate the sharing of best practices and resources among organisations, enabling them to more effectively implement the SDGs. They can also help spread awareness on the SDGs and encourage people to take action. Networks can also assist coordinate collaborations between different organisations to support the SDGs implementation, especially in the academic sector. This study aims to fill the literature gap in assessing the transformative power of sustainability networking and reports on a worldwide analysis of the international networks which are believed to have been playing a significant role in the implementation of the SDGs in higher education. A concise online questionnaire was designed and administered to experts via an expert database mailing list and social networks, and collected 153 responses from 37 countries. This was complemented by an assessment of a set of case studies, where 5 major sustainability networks—ESSSR, IUSDRP, SDSN, AASHE and Copernicus Alliance—were evaluated in respect of their scope, target groups, types of activities and contributions to the SDGs. The results have highlighted the fact that, whereas assessed networks are very active, there is still a perceived need for more concerted actions to allow these networks to become more engaged in the implementation of the SDGs. This study suggests some specific actions which may foster a greater collaboration among networks in order to maximise the impact of their sustainability initiatives. The process of networking contributes to the advancement of sustainability and is closely related with contributions to policy, economic development and society, as well as particularly to SDG 17—Partnerships for the Goals. This study supports the role of networking, while indicating the need for greater collaboration among networks in order to maximise the impact of their initiatives and their transformative power.

**Keywords** Network · Sustainability · International development · 2030 Agenda

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## 1 Transformative power of networks evidence

Networks have the power to transform organisations, communities, and even entire societies, creating environments for communication and accelerate the share of knowledge and experiences among members. Networking is a long-standing communication tool. For many decades now, networking has traditionally been used as a communication tool in many different sectors. As a source of information, networking is not a current social phenomenon. Networking has been used as a source of information for centuries [1]. Human beings use to group with his peers and establish relationships of interest that developed over time. Since the twelfth century, information was disseminated through groups in ports, universities, and monasteries, constituting information networks [1]. According to Phillips [2], different generations view information networking differently, and over the years, the way people obtain information has changed. The emergence of the internet and other technological advancements in the twentieth century caused a sociocultural shift, leading to changes in people's behaviour [3, 4]. The process of mediatization, which is a continuous social and technological phenomenon, has transformed the way people communicate.

The advent of Web 2.0 and social networks has revolutionised global communication by enabling "many-to-many" communication, as noted by Kaushik [5]. This has led to significant transformations in the way people interact and exchange information. In recent years, cyber networks have emerged as a new means of facilitating information flow, as observed by Corradini et al. [6]. Through internet access, cyber networking enables individuals to send and receive information within the larger online community, as highlighted by Fadhli et al. [7]. These digital technologies have unlocked new possibilities for interaction and communication, thus shaping the way we communicate in the digital age. The increasing prevalence of digital networks has made them an indispensable source of information worldwide, rendering physical contact unnecessary for communication [7]. By connecting individuals and groups to one another, networks can facilitate collaboration and communication, facilitating resource, knowledge, and idea sharing. They may also open up new avenues of communication and exchange that can lead to innovative solutions and new opportunities. It allows for easy transfer of knowledge and resource sharing while enhancing communication and increasing the availability of information [4]. This can have a ripple effect, leading to positive change and growth in areas such as business, education, and healthcare.

Networking technology has revolutionised communication, making information more accessible and enabling people to connect instantly worldwide [2, 7]. The process of mediatization of networks has become an essential information technology for communication between people. With this new technology, a large number of information networks have emerged [7]. The networks allowed the expansion and spreading of information. Nowadays, it is possible to instantly connect and communicate with individuals all over the world. Networking is an environment of collaboration, leveraged to introduce a variety of opportunities for a wide range of people, including best practices, jobs and career advancement [2]. They serve as intermediaries between individual and collective structures [3], promoting the expansion and dissemination of information. The emergence of networking as a source of information has sparked interest and debate. The use of network language in academic discourse and its popularity in scientific research as a tool for data collection and information transfer has increased the diversity of points of view and efficiency of the research process [8]. In the scientific field, the use of information networks for data collection and as part of research methodology became popular and provided opportunities to obtain information and results from different countries [9–11]. This has enabled scientific research to encompass a more diverse range of perspectives and increased the efficiency of data collection. Additionally, data collection has become more efficient and less time-consuming. As a result, many studies have adopted this method as a tool for data collection and instrument of information transfer, such as those conducted by Paunovic et al. [12], Sakuljao et al. [13], Liu et al. [14], and Leal Filho et al. [11].

Networking is a key technological foundation for the organisational structure of the Information Age, and it can take various forms, such as formal or informal, short-term or long-term [2]. Through networking, individuals can influence or be influenced by the information they receive. However, a common challenge of networking is the reliability and quality of the information, which can affect people's perception and opinion on critical topics [15]. The proliferation of fake or incorrect information is a particular concern in cyber networking, where sources of information are not always credible or controllable [16]. The employment of networks as a dissemination of information requires a detailed understanding of the target audience [4, 17]. By designing the network topology, the information transfer function can be optimised [4]. Many educational organisations and enterprises have formed networks that allow for cooperation and foster transparency. These networks also promote sustainable development [17]. Several arguments

underscore the importance of understanding the transformative power of networks, and to which extent they may benefit as agentic resources. Networks are inherently dynamic and they can become a liability. Conversely, if adopted with acuity, they can show relevance for innovation, problem-solving, and engagement on trending topics, leading to innovation and transformations, be it organisational, inter-organizational or social [3, 17]. As networks become more pervasive, they may become increasingly instrumental in driving transformation and progress in our world, which is a key feature of social morphology [3, 18]. They presently play a fundamental role in the implementation of the SDGs.

There is a perceived need to investigate the connections between networks and sustainable development, allowing to fill research gaps. Thus, research is needed to investigate how different networks can contribute to sustainable development in the academic sector. This could include studying how information networks can be used to share knowledge and resources and how social networks can be used to raise awareness and promote positive behaviour change. Based on these various and complex interactions and contributions of networks and their roles towards sustainability, this paper aims to report on an exploratory worldwide analysis of the international networks which are believed to have been playing a role in the implementation of the SDGs in higher education.

## 2 Networking and sustainable development

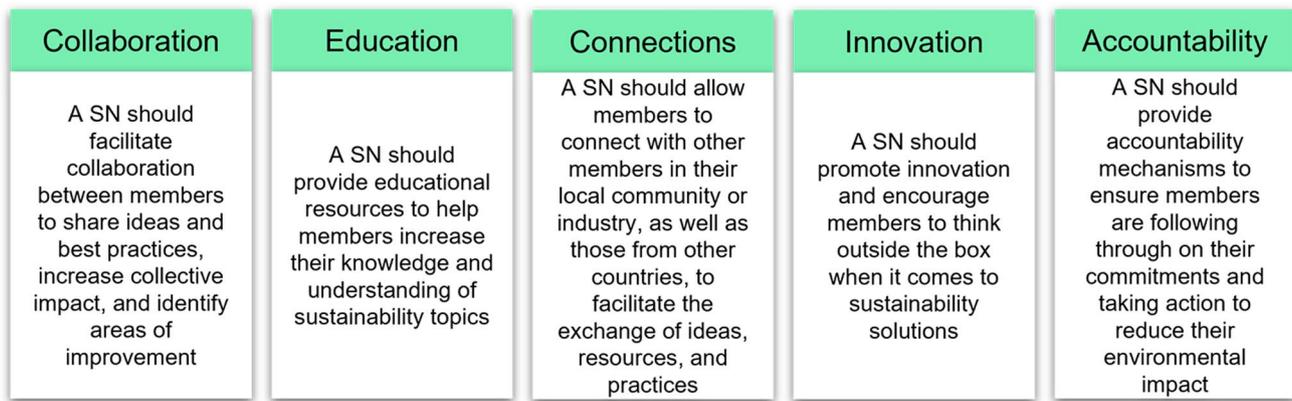
The United Nations (UN) highlights the need to foster global partnerships that aid in the achievement of sustainability [19]. Sustainable Development Goal 17 put forward the call to revitalise the global partnership for SD. Target 17.16 states that the proposed partnership must be “complemented by multi-stakeholder partnership (MSP) that mobilise and share knowledge, expertise, technology and financial resources to support the achievement of the sustainable development goals in all countries” [20]. The MSP is defined as “an ongoing collaborative relationship between or among organisations from different stakeholder types aligning their interests around a common vision, combining their complementary resources and competencies and sharing risk, to maximise value creation towards the Sustainable Development Goals and deliver benefit to each of the partners” [21]. Fostering partnerships between universities and communities can play a vital role in bolstering the execution of comprehensive sustainability initiatives and contribute to the achievement of specific UN SDGs [22].

The SDG Partnership Guidebook [23] refers to network development as one of the main ways to enhance the effects of collaborative interactions between multi-stakeholder partnerships in integrating Sustainable Development initiatives. According to this Guide, many categories of MSP encompass many types of collaborative arrangements with quite different qualities. These partnerships can include only a few organisations or group hundreds of institutions [23].

Gulati et al. [24] define a social network in a broad sense as a “set of nodes (e.g., persons, organisations) linked by a set of social relationships (e.g. friendship, transfer of funds, overlapping membership) of a specified type”. In their most comprehensive perspective, organisational networks might be formed by a multitude of actors such as the private sector, the government and their agents, non-governmental organisations and civil society organisations [25, 26]. Under a sustainable development context, networking can refer to systems designed for transferring information between organisations, or it may occur through transferring knowledge within groups of people. This knowledge can further be disseminated to other individuals, expanding the knowledge transfer. Networking has been shown to allow information exchange with a large group of socioeconomic agents while ensuring that they participate in processes or activities that shape sustainable development [27, 28]. Networks are also crucial for value creation, brand building, and strategic positioning across all sectors of the economy. In the context of sustainability and digitalization, these platforms play a pivotal role in enhancing international competitiveness, based on both intellectual and social capital [29–31].

More specifically, networks allow different organisations to connect and support each other, especially during innovation tasks crucial to sustainable development [32]. The main features of a sustainable network (SN) are described in Fig. 1.

Concerning Higher Education Institutions (HEIs), and since the Ubuntu Declaration at the UN Johannesburg Summit in 2002, HEIs have pledged to strive for a new global learning environment that fosters collaboration and knowledge-sharing between institutions across all levels and sectors of education worldwide, with a particular emphasis on education and sustainability. According to the Ubuntu Declaration, this space could facilitate international networking and the creation of regional centres of excellence to bring together different educational institutions [33]. Additionally, networking has proven beneficial to sustainability at universities. Networking among different institutions has been shown to increase sustainability on campuses [34]. More specifically, sustainability awards have been developed, which create good incentives for institutions and intensively link them [35]. This has allowed for effective engagement and networking between the award committees and campuses, promoting a positive movement towards sustainability.



**Fig. 1** Features of sustainability networks. Source: Authors

Unfortunately, such initiatives have been better received in developed countries as opposed to developing countries due to the difference in capabilities [36]. Furthermore, universities are capable of initiating education for sustainable development. This has been proven to diffuse well through social networks and allow regional sustainability [37]. The use of the SN approach to boost sustainable development initiatives has been employed in several societal areas, such as higher education, smart cities, and food production, to cite a few.

It was found that universities could use networking to initiate social change. A study by Zabaniotou [38] showed the ability of a Mediterranean university to initiate informal changes that promoted gender equality. This was carried out through the use of networks to mobilise resources from students and staff to initiate gender equality initiatives in the area. More specifically, a community practice was created with gender equality policies that promoted the achievement of sustainability goals. With focus on transitioning to the workforce, De Schepper et al. [39] highlights the significant role of social networks in graduates' transition from their higher education studies to the labour market. Despite the fact that the effectiveness of these networks depends on their approaches, characteristics and resources, higher education institutions have a key role in fostering the connection between the academic and professional worlds.

Furthermore, networking amongst small cities has proven to be helpful in supporting regional sustainability. Local municipalities are able to share information about planning that can ensure long-term sustainability. In doing so, cities are better able to address socioeconomic problems, which support the achievement of the SDGs, while ensuring overall sustainability in their regions [40]. The study by Chaudhuri et al. [41] summarises existing worldviews on the role of farmers' social networking/learning on rural development in India. The authors highlight that the cyclic and unsustainable use of natural resources has led Indian society to socio-environmental severe crises. These crises have resulted in significant problems related to food insecurity, groundwater depletion, energy scarcity, and loss of livelihoods. In light of these circumstances, participatory action through farmers' social networks provided an effective tool to enhance resilience. Accordingly, the dissemination of new knowledge and ideas was linked to the extent of farmer-to-farmer interaction, specifically through friendship and peer-advising networks.

### 3 Methods

Against this complex background of needs, this study focuses on how users perceive the contribution of networks to the implementation of the SDGs and which networks have been used to receive information about those goals in the context of higher education. Consistent with this aim, a cross-sectional study was conducted, to gather information from a variety of users, following previous experiences of the authors involved [10, 42, 43]. To this purpose, a concise online questionnaire was designed and administered to experts via an expert database of mailing list and also through social networks, i.e., Facebook and Twitter. The survey, disseminated via Google Forms, consisted of four questions. The first two questions pertained to demographic information (country and type of institution), while the third and fourth questions were centred on networks. Specifically, participants were asked, "How do you rate the contribution of networks in the implementation of the SDGs?" and "Which networks do you utilise to obtain

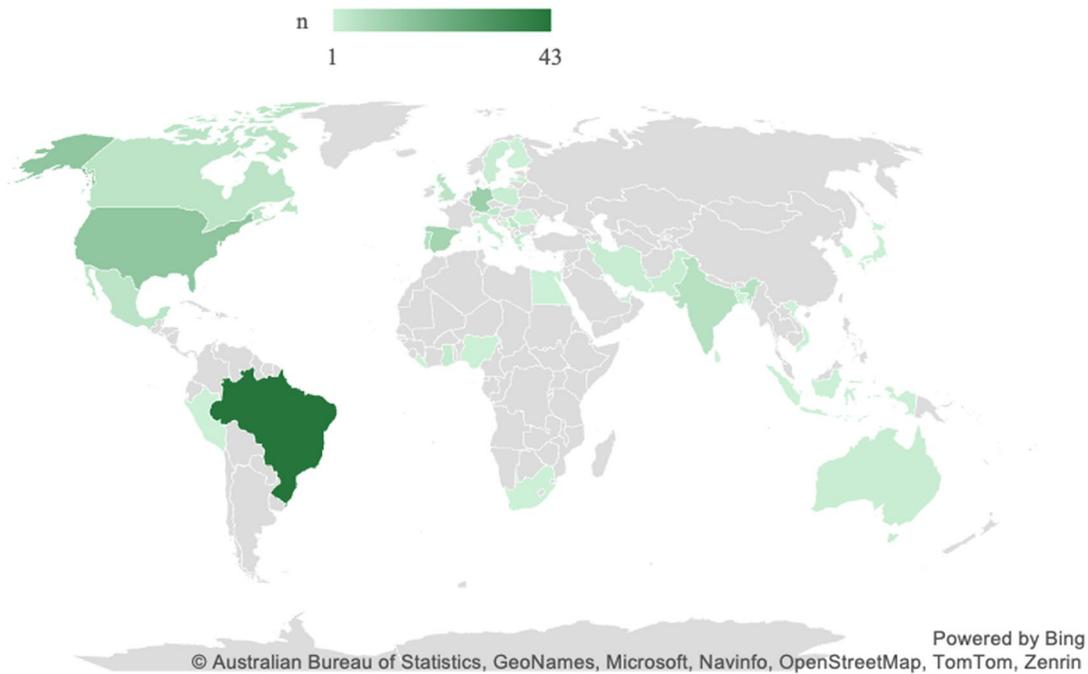
information on activities related to the SDGs?”. The third question was structured using a Likert scale, and the fourth permitted multiple responses, allowing participants to select from a list of the most prominent global and regional networks identified in the literature.

The nature of the research, the methods used, and the fact that no personal data was stored or can be traced back to individuals, conforming with General Data Protection Regulation (GDPR) standards, means that the study is not subject to an ethics permit, as specified by the Association of Medical Ethics Committee in Germany, the body responsible for such assessments in the country leading this study. The online survey was conducted over a period of 12 weeks, from May to July 2021. Table 1 presents the questionnaire applied.

Apart from the survey and statistical analysis (Kruskal–Wallis tests and Scheffe’s multiple comparison test) to assess whether there are differences in how public and private types of institutions and institutions from different regions rate the contribution of networks, an assessment of a set of selected known network case studies was undertaken. These case studies follow the approach used in similar studies on sustainability in higher education [25, 44, 45]. The 5 major sustainability networks according to the sample were analysed in respect of their scope, target groups, types of activities and contributions to the SDGs, based on information from their webpages as well as supporting scientific publications and reports. The results of the study are presented in the next section.

**Table 1** Survey instrument.  
Source: Authors

Your country	
Type of Institution	<input type="checkbox"/> Public <input type="checkbox"/> Private <input type="checkbox"/> Other
How do you rate the contribution of networks in the implementation of the SDGs?	<input type="checkbox"/> Not important at all <input type="checkbox"/> Not so important <input type="checkbox"/> Average <input type="checkbox"/> Important <input type="checkbox"/> Very important
Which network do you use to obtain information on activities related to the SDGs?	<input type="checkbox"/> AASHE—Association for the Advancement of Sustainability in Higher Education <input type="checkbox"/> ACTS—Australasian Campuses Towards Sustainability <input type="checkbox"/> AESS—Association for Environmental Studies and Sciences <input type="checkbox"/> ARIUSA—Alianza de Redes Iberoamericanas de Universidades por la Sustentabilidad y el Ambiente <input type="checkbox"/> CIRSES—Collectif pour l’Intégration de la Responsabilité Sociétale et du développement durable dans l’Enseignement Supérieur <input type="checkbox"/> COPERNICUS Alliance—European Network on Higher Education for Sustainable Development <input type="checkbox"/> EAUC—The Alliance for Sustainability Leadership Education <input type="checkbox"/> ESSSR—European School of Sustainability Science and Research <input type="checkbox"/> GUNI—Global University Network for Innovation <input type="checkbox"/> GUPES—Global Universities Partnership on Environment for Sustainability <input type="checkbox"/> IARU—International Alliance of Research Universities <input type="checkbox"/> IUSDRP—Inter-University Sustainable Development Research Programme <input type="checkbox"/> KAGCI—Korean Association for Green Campus Initiative <input type="checkbox"/> KGUN—Kenya Green Universities Network <input type="checkbox"/> NSCN—Nordic Sustainable Campus Network <input type="checkbox"/> SDSN—Sustainable Development Solutions Network <input type="checkbox"/> SEPN—Sustainability and Education Policy Network <input type="checkbox"/> UAS—University Alliance for Sustainability <input type="checkbox"/> ULSF—Association of University Leaders for a Sustainable Future <input type="checkbox"/> Other



**Fig. 2** Countries participating in the study. Source: Authors

## 4 Results and discussion

A total of 153 responses from 37 countries<sup>1</sup> were collected (Fig. 2). Most respondents are from public institutions, 64%, while 26% are from private ones. The remaining responses, 10%, were mainly from community institutions and non-governmental organisations (NGOs). Regarding the perceived contribution of networks in the implementation of the SDGs, nearly all respondents recognise this role as “important” (25%) or “very important” (70%). Only 2% consider them not so important (1.3%) and “not important at all” (0.6%), or indicated average importance (3%).

A Kruskal–Wallis test was performed to examine whether there is a statistically significant difference in how public and private types of institutions rate the contribution of networks in implementing the SDGs. The test results indicated no significant difference in the contribution of networks in implementing the SDGs across different types of institutions  $\chi^2(2, N = 139) = 0.651, p = 0.722$ . Additionally, a Kruskal–Wallis test was also conducted to assess whether there are statistically significant differences in how the contribution of networks to the implementation of the SDGs is rated across different regions. Similarly, the test revealed that there are no statistically significant differences in the ratings of network contributions among the regions surveyed  $\chi^2(5, N = 139) = 4.732, p = 0.449$ .

The significance of this data lies in its global reach and the diverse representation of respondents from so many different countries. It reflects a broad spectrum of perspectives, with a majority of respondents coming from public institutions, followed by private institutions, community organisations, and NGOs. The fact that nearly all respondents recognize the importance of networks in the implementation of the SDGs is noteworthy. This underscores the widespread acknowledgment of the crucial role that collaborative networks play in advancing sustainability efforts. The high percentage of respondents who consider this role as “very important” (70%) highlights the strong consensus on the significance of networks in achieving the SDGs. This data suggests that there is a global understanding of the importance of collaborative efforts and networks in addressing and achieving the SDGs, emphasising the need for continued support and engagement in such initiatives.

<sup>1</sup> Full list of participant countries and number of responses per region: Africa ( $n=6$ , Ghana, Liberia, Nigeria, South Africa), Asia/Oceania ( $n=20$ , Australia, Bangladesh, Egypt, India, Indonesia, Iran, Japan, Pakistan, South Korea, Sri Lanka, United Arab Emirates, Vietnam), Europe ( $n=57$ , Austria, Bosnia and Herzegovina, Finland, Germany, Greece, Italy, Latvia, Malta, Poland, Portugal, Romania, Scotland, Serbia, Spain, Sweden, United Kingdom), Latin America ( $n=49$ , Brazil, Mexico, Peru) and North America ( $n=20$ , Canada, United States).

**Table 2** List of networks most reported by the enquired experts to obtain information on the SDGs ( $n=153$ ). Source: Authors

Network		Percentage
Acronym	Name and scope	
	European School of Sustainability Science and Research (Regional)	42
	Inter-University Sustainable Development Research Programme (Global)	35
	Sustainable Development Solutions Network (Global)	33
	Association for the Advancement of Sustainability in Higher Education (Global)	26
	European Network on Higher Education for Sustainable Development (Regional)	17
	Association for Environmental Studies and Sciences (Regional)	9
	Global University Network for Innovation (Global)	9
	University Alliance for Sustainability (Global)	8
	Global Universities Partnership on Environment for Sustainability (Global)	7
	UN related networks	6
	The Alliance for Sustainability Leadership Education (Global)	5
	Alianza de Redes Iberoamericanas de Universidades por la Sustentabilidad y el Ambiente (Regional)	5
	International Alliance of Research Universities (Global)	4
	Sustainability and Education Policy Network (Global)	4
	Association of University Leaders for a Sustainable Future (Global)	4
	Australasian Campuses Towards Sustainability (Regional)	3
	Collectif pour l'Intégration de la Responsabilité Sociétale et du développement durable dans l'Enseignement Supérieur (National – France)	2
	Kenya Green Universities Network (Regional)	2
	Nordic Sustainable Campus Network (Regional)	2
	PRME related networks	2
	<b>Other</b>	<b>31</b>
	<b>None</b>	<b>3</b>

Table 2 presents the list of networks most used by the sample to obtain information on activities related to the SDGs. The five most referred networks include the European School of Sustainability Science and Research (ESSSR), the Inter-University Sustainable Development Research Programme (IUSDRP), the Sustainable Development Solutions Network (SDSN), the Association for the Advancement of Sustainability in Higher Education (AASHE), and the European Network on Higher Education for Sustainable Development (COPERNICUS Alliance). Completing the list of top 10 networks there are the Association for Environmental Studies and Sciences (AESS), the Global University Network for Innovation (GUNI), the University Alliance for Sustainability (UAS), the Global Universities Partnership on Environment for Sustainability (GUPES) and UN-related networks (e.g., United Nations Development Programme, United Nations Association of the United States of America, United Nations Educational, Scientific and Cultural Organization, United Nations Environment Programme, United Nations Economic and Social Council). The diversity and scope of networks involved underline the transformative power of networking in contributing to the advance of the SDGs.

Based on these 10 main sustainability networks (Table 1), Fig. 3 shows the distribution of responses per region. Whereas in North America over 70% of respondents indicated AASHE, in Europe the ESSSR is the most expressive network. The regional network run by the COPERNICUS Alliance also has many responses from Europe. On the other hand, although also a regional network, ESSSR has expressive participation in other regions as well. SDSN also showed a presence in Europe, Latin America, and Asia/Oceania.

A Kruskal–Wallis test was performed to examine differences in the five most reported networks by the surveyed respondents from each region. The test revealed statistically significant differences among the regions for the IUSDRP ( $H_{(4)} = 21.911$ ,  $p < 0.001$ ), indicated by 24 respondents; AASHE ( $H_{(4)} = 20.079$ ,  $p < 0.001$ ), reported by 37 respondents; and COPERNICUS ( $H_{(4)} = 21.225$ ,  $p < 0.001$ ), listed by 24 respondents. However, no significant differences among the regions were observed for the networks ESSSR ( $H_{(4)} = 7.789$ ,  $p = 0.100$ ), indicated by 59 respondents, and SDSN ( $H_{(4)} = 7.803$ ,  $p = 0.099$ ), pointed out by 18 respondents. In summary, the results of the Kruskal–Wallis test indicate that the region in which the respondent lives influences the networks they report.

Scheffe’s multiple comparison test was applied to determine precisely which pairs or combinations of regions differ in terms of the average number of mentions for each of the five most frequently listed networks by the surveyed sample. This test was chosen for its conservative approach, which makes it highly recommended for cases with deviation from normality [46]. The averages for AASHE differ significantly across the analysed regions. Specifically, North America has

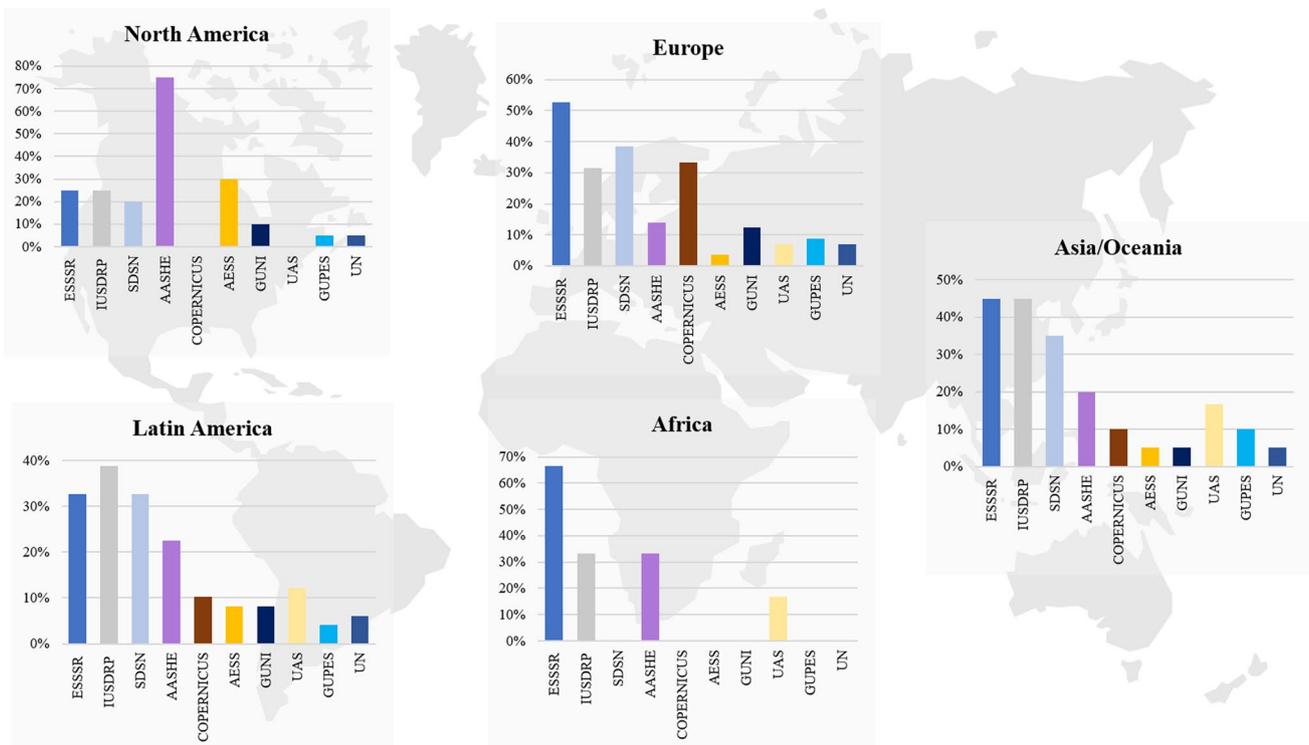


Fig. 3 Distribution of responses among the main assessed networks, per region. Source: Authors

a percentage of 10.79%, which is significantly higher than the proportions of this network's mentions in Asia (2.16%), Europe (5.76%), and Latin America (5.76%). A significant difference was also found when comparing the COPERNICUS network between Europe (13.67%) and North America, as no respondents from North America mentioned this network. This result is expected, given that COPERNICUS is a European network. Finally, the test results for the IUSDRP network indicate a statistically significant difference between regions. The data show that, within the surveyed sample, respondents from South America (10.79%) referred to this network more than those living in Europe (3.60%) and North America (0.72%). This result highlights the network's efforts to foster cooperation strategies in Latin America.

Since the establishment of the 2030 Agenda and its 17 SDGs [20], strategic networks have been emerging throughout the globe, aiming to respond to the international challenges associated with sustainable development [47]. The high percentage of respondents who rate networks in the SDGs context as very important (70%) and important (25%) endorse Rasiah et al. [32] views on the potential of networks in offering effective support for sustainable innovation, and is a way for disadvantaged countries and local communities to get access to information.

The highly cited networks in the survey responses are also the most prominent networks in the sustainability literature. It is interesting to note that even regionally focused networks based on Europe, e.g., ESSSR and COPERNICUS, and in North America (AESS) are embraced by respondents from other countries such as Brazil, Ghana, Pakistan or Iran, among others. Each network, either at national, regional or global level, brings with it a unique perspective and a potential in contributing to the SDGs.

Since HEIs have been working on sustainability issues, and in the implementation of the principles of sustainable development long before the 2030 Agenda was agreed upon, they are now in a unique position to assist with its implementation, having the potential to meet the many international challenges associated with the implementation of the SDGs. Among the top five networks sampled, four of them are straightly connected to HEIs, i.e., ESSSR, IUSDRP, AASHE, and COPERNICUS, placing sustainability as a capital concern of HEIs initiatives and bringing the sustainable development implementation to a mainstream position of HEIs strategies.

An extensive literature review on the integration of sustainability teaching in HEIs, by Moreno Pires et al. [48] shows that despite being diagnosed before, barriers to the implementation of SDGs in the scope of HEIs persist. The lack of network cooperation among HEIs is pointed out. According to the same authors, positive associations are found when SDG commitment involves the signing of declarations or initiatives, thus positively contributing to SDG implementation. Because HEIs have organisational autonomy in teaching and research activities, they are able to benefit from cooperation, such as those involved in sustainability networks knowledge sharing and commitment. The associations behind international networking sustainability initiatives, presented in Table 1, promote and support education and research on sustainability, shaping the development of an education policy for sustainability, as advocated by Ng [49]. The same authors highlight the role of institutional network strengthening, carried out by the (IUSDRP, facilitating know-how transfer through high-standard publications, achieved through international knowledge exchange cooperation with information and communications technology (ICT) playing a fundamental role in the degree of innovation [50]. The role of stakeholder engagement is visible in the responses obtained in the survey of this study, considering the international networking and the role of SDGs in HEIs, as emphasised by Schantz et al. [51]. The same authors state that while HEIs are able to choose how to align with SDGs over the next coming years, it will not be possible to determine how SDGs will be used to assess them.

The second data collection strategy used, namely the analysis of a set of case studies with 5 major sustainability networks, also led to interesting results. They were assessed in respect of their scope, target groups, and contributions to the SDGs.

ESSSR with a research scope and target group formed by researchers, the network aims "to provide a framework upon which teaching and research within the remit of sustainability science may be further developed at European universities" [52]. The strategies to reach the network's goal include joint, digitally-oriented teaching programmes, research projects, research training and dissemination of outcomes in scientific publications. The contribution to the SDGs is expected to happen by means of this support offered to research and the key role it plays in paving the way for concrete action across all goals [9, 53].

IUSDRP as the ESSSR network, IUSDRP has a research scope and researchers as its key target group. The main aim of the network is "to establish a platform through which member universities can undertake more research on matters related to sustainable development" [54] and it recognises the need for more sustainable development research to support the implementation of the SDGs. The action areas of IUSDRP include increasing research income by means of collaborative research bids; enhancing institutional profiles on sustainable development, especially by making research more interdisciplinary and with increased visibility; increasing the intake of PhD students and training a new generation of

sustainability experts; and increasing publication outputs, especially through collaborative efforts among international research teams [11].

*SDSN* this is a United Nations network set up in 2012 and especially dedicated to actions around the SDGs and climate change in universities, think tanks and laboratories. Its scope is directed towards research and policy, with the target group being the academic community and practitioners. The network activities involve free online education, guidelines for sustainability solutions, sustainability reporting and dissemination of content and news, and thematic priorities include education, energy and climate, land use and water, biodiversity, and urban development [55]. One of the best-known initiatives of SDSN is the Sustainable Development Report, published annually, reporting on the progress made towards the SDGs [56].

*AASHE* the scope of this network is directed towards campus operations and includes academic and operation staff as the main target group. In addition to a series of events dedicated to promoting awareness and localization of the SDGs [57], the network has a dedicated sustainability assessment tool [58] and constantly assesses the status of sustainability professionals in higher education [59]. These strategies exemplify the potential of the network in not only advancing sustainability in the sector but also in promoting the SDGs at different levels.

*Copernicus Alliance* this network focuses on academic activities and has academic and operations staff as primary target groups. The Alliance started 30 years ago and signatory universities self-committed to principles of sustainable development. Engagement opportunities include conferences, cooperation funds and monthly exchange meetings [60]. The SDGs are cross-cutting themes in these initiatives, and the Alliance promotes not only Education for Sustainable Development but also informs tools and frameworks for policy-making [61].

The case studies reveal some interesting trends. The first is the fact that research-oriented networks such as ESSSR and IUSDRP tackle several different SDGs. Secondly, some networks such as COPERNICUS, and AESS are able to mobilise academic staff and operations staff. Also, networks such as AASHE prioritise campus operations and tend to mobilise that audience more intensively than others. But despite the potential of collaboration between sustainability networks, some elements hinder their joint efforts. Some of these are:

1. *Lack of trust* Developing trust between different sustainability networks is essential for successful collaboration, but it can be difficult to foster when many of the members are unfamiliar with each other.
2. *Lack of resources* Sustainability networks often have limited resources and can struggle to provide the necessary materials and financial support needed to make collaborations successful.
3. *Different priorities* Different sustainability networks may prioritise different goals and objectives, making it difficult to find common ground.
4. *Incompatible systems* Different sustainability networks may use different systems and technologies, making it difficult to share information and collaborate.
5. *Geographical boundaries* Sustainability networks may be located in different regions or countries, making it difficult to coordinate efforts.

Whereas sustainable development is a concept that focuses on creating a world where economic, social, and environmental well-being can be maintained for the long-term, and many networks work hard to achieve these goals, it is important to understand how different networks work, to promote a more sustainable society. All networks are essential for sharing resources, ideas, and knowledge, and they can be used to promote sustainable practices at all levels of society. However, it is useful to know their remit, areas of work and the communities they are able to reach and mobilise.

## 5 Conclusions

This paper has investigated the transformative power of networking in the implementation of the Sustainable Development Goals. It used an analysis of the literature, complemented by a survey undertaken using Google Forms, centred around two primary inquiries, i.e., how to evaluate the impact of networks in advancing the SDGs as well as which networks are employed to access information concerning activities associated with the SDGs.

The evidence gathered allows some conclusions to be made.

First and foremost, there are various international networks which are believed to have been playing a significant role in the implementation of the SDGs. A number of them focus on the higher education sector, whereas others reach different groups.

Secondly, whereas these networks aim to link people, they have specific remits. Some focus on events, others on research and others on a mixture of both. Thirdly, some networks have a global remit, whereas others have a regional one. Despite their different approaches and focus, collaborative networks enable the collection and sharing of data, which is important for tracking progress, identifying gaps and foster collaboration.

The significance of the results from this study lies in its global reach and the diverse representation of respondents from many different countries. It reflects a broad spectrum of perspectives, with most respondents coming from public institutions, followed by private institutions, community organisations, and NGOs. Nearly all respondents recognize the importance of networks in the implementation of the SDGs. This underscores the widespread acknowledgement of the crucial role that collaborative networks play in advancing sustainability efforts. The high percentage of respondents who consider this role as “very important” (70%) highlights the strong consensus on the significance of networks in achieving the SDGs. This suggests that there is a global understanding of the importance of collaborative efforts and the transformative power of networks in addressing and achieving the SDGs, emphasising the need for continued support and engagement in such initiatives.

The statistical analyses revealed no significant differences based on institution type or region in terms of perceived contribution of networks to the implementation of the SDGs. However, when examining the five most reported networks by respondents across regions, statistically significant differences were found for IUSDRP, AASHE, and COPERNICUS, indicating regional influences on network reporting. Specifically, North America had the highest mentions of AASHE, while COPERNICUS was predominantly mentioned in Europe, and IUSDRP was more frequently reported by respondents from South America. The study concludes that regional context significantly influences network participation and reporting.

In addition to the survey, an in-depth examination of a curated selection of established network case studies was conducted. This analysis encompassed the study of five prominent sustainability networks, delving into their overarching objectives, intended beneficiaries, the array of activities they engage in, and their tangible contributions to the SDGs. These case studies yielded noteworthy insights. It becomes evident that research-focused networks like ESSSR and IUSDRP are actively addressing multiple SDGs, indicating a broad and interconnected approach to sustainability challenges. This underscores their adaptability and comprehensive commitment to addressing diverse global issues. Furthermore, some networks, exemplified by COPERNICUS and AESS, demonstrate the capacity to effectively mobilise both academic and operational resources. This dual engagement reflects their ability to draw upon a wide spectrum of expertise and logistical support, further enhancing their impact on sustainability objectives. Conversely, networks like AASHE concentrate their efforts on enhancing sustainability within campus operations. This targeted approach tends to resonate more strongly with the academic community, as it directly addresses and involves them in the pursuit of sustainable practices on campus. However, despite the evident potential for collaboration among sustainability networks, certain barriers hinder their collective endeavours. These challenges may include logistical, organisational, or ideological disparities that limit the synergy and combined impact that these networks could potentially achieve. Thus, while there is substantial promise in network-based sustainability initiatives, there are obstacles that need to be navigated to fully harness their collaborative potential.

Sustainable development networks may serve the purposes of informing about political frameworks, assisting in the design and implementation of international, national and local sustainability processes, and providing a fertile ground for social-ecological transformation. Through target group-specific dialogue processes, constructive exchanges, intensive cooperation and mutual inspirations, they are an important ally in implementing sustainability principles into practice. The transformative nature of sustainability-oriented networks may be better understood, if it is considered that they not only provide information, but also act as platforms to share best practices, develop new approaches, and build capacity. Combined, these elements can support more cohesive and effective sustainability strategies. By pooling their knowledge and resources, these networks can develop scalable solutions to sustainability challenges that can be implemented on a larger scale. In this way, sustainability networks have the potential to create a lasting impact among the communities they serve.

This paper has some limitations. The first one is the sample of respondents, which is not enough to cater for definitive conclusions. The sample has been recruited using social and scientific networks, and therefore respondents may have a positive bias towards the use of such networks. The second limitation is the fact that the study was undertaken on-line and did not cater for a wide participation, with unbalanced number of participants from some regions. In particular, Eastern Europe, Africa and Northern Asia were not duly represented which is a shortcoming. Moreover, the paper had specific research questions in mind, and did not aim to explore all aspects associated with sustainability. Despite these constraints, the paper provides a welcome addition to the literature, since there are many research needs as far as the connections between sustainability networks and the SDGs are concerned. In any case, the authors believe that this

article focusing on the specific roles of some widely known networks in contributing to SDGs implementation will serve as a clear illustration of the transformative power of networking.

Since many networks seem to work in an isolated manner, much could be gained by a greater dialogue among them, so as to seek synergies among the activities they undertake in respect of the implementation of the SDGs—particularly regarding SDG 17—Partnerships for the Goals, hence widening the impact of their work, reducing the risks of duplication and maximising synergies. Overall, there are some suggested key advantages of sustainability networks working together. These include:

1. *Increased collaboration* Sustainability networks bring together like-minded individuals and organisations who are committed to making a positive contribution to the environment. This increased collaboration provides an opportunity to share ideas and resources, as well as to work together on projects promoting sustainability.
2. *Enhanced awareness* By working together, sustainability networks can help raise awareness of environmental issues among a larger audience, as well as support individual efforts being made to increase the visibility of sustainability themes. This improved visibility can lead to greater public support for sustainability initiatives.
3. *Greater access to resources* By pooling resources and knowledge, sustainability networks can often access resources and expertise that may have previously been unavailable to them. This can include access to funding, technical assistance, and other resources that can help further their mission.
4. *Improved decision making* When organisations work together as part of sustainability networks, they can often make more informed decisions. This is because they have access to a broader range of perspectives and experiences, which can help them make better-informed decisions.

Future studies will be able to better pursue such recommendations. Future investigations may also explore larger samples and complement these findings with different methodological approaches.

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**Data availability** The authors confirm that all results analysed during this study are included in this published article.

## Declarations

**Ethics approval and consent to participate** The nature of the research, the methods used, and the fact that no personal data was stored or can be traced back to individuals, conforming with GDPR standards, means that the study is not subject to an ethics permit as specified by the Association of Medical Ethics Committee in Germany, the body responsible for such assessments in the country which led the study.

**Consent for publication** Consent was waived due to the point described above.

**Competing interests** The authors declare that they have no known conflict of interest.

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## References

1. Burke P. Uma história social do conhecimento: de Gutenberg a Diderot. Rio de Janeiro: Jorge Zahar; 2003.
2. Phillips DR. The transformational power of networking in today's business world. J Prop Manag [Internet]. 2017;82(2):20+. [https://link.gale.com/apps/doc/A490719005/AONE?u=tacoma\\_comm&sid=googleScholar&id=babb801e](https://link.gale.com/apps/doc/A490719005/AONE?u=tacoma_comm&sid=googleScholar&id=babb801e)
3. Clegg S, Josserand E, Mehra A, Pitsis TS. The transformative power of network dynamics: a research agenda. Org Stud [Internet]. 2016;37(3):277–91. <https://doi.org/10.1177/0170840616629047>.

4. Singh MS, Pasumarthy R, Vaidya U, Leonhardt S. On quantification and maximization of information transfer in network dynamical systems. *Sci Rep* [Internet]. 2023;13(1):5588. <https://doi.org/10.1038/s41598-023-32762-7>.
5. Kaushik A. Avaliação de recursos da internet: uma revisão de literatura selecionada. *Braz J Inf Sci Res Trends* [Internet]. 2013;6(2). <https://revistas.marilia.unesp.br/index.php/bjis/article/view/1838>. Accessed 24 Oct 2024.
6. Corradini C, Santini E, Vecchiolini C. The geography of Industry 4.0 technologies across European regions. *Reg Stud* [Internet]. 2021;55(10–11):1667–80. <https://doi.org/10.1080/00343404.2021.1884216>.
7. Fadhli I, Hlaoua L, Omri MN. Deep learning-based credibility conversation detection approaches from social network. *Soc Netw Anal Min* [Internet]. 2023;13(1):57. <https://doi.org/10.1007/s13278-023-01066-z>.
8. Scott RW, DGF. *Organizations and organizing: rational, natural, and open system perspectives*. Upper Saddle Valley; 2007.
9. Leal FW, et al. Living labs for sustainable development: the role of the European School of Sustainability Sciences and Research. In: Leal Filho W, Salvia AL, Pretorius RW, Brandli LL, Manolas E, Alves F, et al., editors. *Universities as living labs for sustainable development: supporting the implementation of the sustainable development goals* [Internet]. Cham: Springer; 2020. p. 3–9. [https://doi.org/10.1007/978-3-030-15604-6\\_1](https://doi.org/10.1007/978-3-030-15604-6_1).
10. Salvia AL, Leal Filho W, Brandli LL, Griebeler JS. Assessing research trends related to sustainable development goals: local and global issues. *J Clean Prod* [Internet]. 2019;208:841–9.
11. Leal Filho W, Wall T, Salvia AL, Frankenberger F, Hindley A, Mifsud M, et al. Trends in scientific publishing on sustainability in higher education. *J Clean Prod* [Internet]. 2021;296:126569.
12. Paunovic I, Müller C, Deimel K. Citizen participation for sustainability and resilience: a generational cohort perspective on community brand identity perceptions and development priorities in a rural community. *Sustainability* [Internet]. 2023;15(9). <https://www.mdpi.com/2071-1050/15/9/7307>
13. Sakuljao P, Satiennam W, Satiennam T, Kronprasert N, Jaensirisak S. Understanding intention to use conditionally automated vehicles in Thailand, based on an extended technology acceptance model. *Sustainability* [Internet]. 2023;15(3). <https://www.mdpi.com/2071-1050/15/3/1868>
14. Liu W, Shao W, Wang Q. Psychological distance from environmental pollution and willingness to participate in second-hand online transactions: an experimental survey in China. *J Clean Prod* [Internet]. 2021;281:124656.
15. Itkonen JVA. Social ties and concern for global warming. *Clim Change* [Internet]. 2015;132(2):173–92. <https://doi.org/10.1007/s10584-015-1424-0>.
16. Pérez-Escoda A, Pedrero-Esteban LM, Rubio-Romero J, Jiménez-Narros C. Fake news reaching young people on social networks: distrust challenging media literacy. *Publications* [Internet]. 2021;9(2). <https://www.mdpi.com/2304-6775/9/2/24>
17. Wang Z, Chen X, Ji K, Sang L, Bai Z, Chen R. Relationship between social network and individual performance of core members from aged care services social organizations: cross-sectional study. *BMC Geriatr* [Internet]. 2023;23(1):108. <https://doi.org/10.1186/s12877-023-03837-x>.
18. Castells M. Materials for an exploratory theory of the network society1. *Br J Sociol* [Internet]. 2000;51(1):5–24. <https://doi.org/10.1111/j.1468-4446.2000.00005.x>.
19. Leal Filho W, Vidal DG, Chen C, Petrova M, Dinis MAP, Yang P, et al. An assessment of requirements in investments, new technologies, and infrastructures to achieve the SDGs. *Environ Sci Eur* [Internet]. 2022;34(1):58. <https://doi.org/10.1186/s12302-022-00629-9>.
20. United Nations. <https://sdgs.un.org/goals>. 2015. Transforming our world: the 2030 agenda for sustainable development.
21. MacDonald A, Clarke A, Huang L. Multi-stakeholder partnerships for sustainability: designing decision-making processes for partnership capacity. In: Martin K, Shilton K, Smith J, editors. *Business and the ethical implications of technology* [Internet]. Cham: Springer; 2022. p. 103–20. [https://doi.org/10.1007/978-3-031-18794-0\\_7](https://doi.org/10.1007/978-3-031-18794-0_7).
22. Leal Filho W, Dibbern T, Viera Trevisan L, Coggo Cristofolletti E, Dinis MAP, Matandirotya N, et al. Mapping universities-communities partnerships in the delivery of the Sustainable Development Goals. *Front Environ Sci* [Internet]. 2023. <https://doi.org/10.3389/fenvs.2023.1246875>.
23. United Nations. *The SDG Partnership Guidebook—a practical guide to building high impact multi-stakeholder partnerships for the Sustainable Development Goals*. 2020.
24. Gulati R, Dialdin DA, Wang L. Organizational Networks. In: *The Blackwell companion to organizations* [Internet]. 2017. p. 281–303. <https://doi.org/10.1002/9781405164061.ch12>
25. Leal Filho W, Wall T, Barbir J, Alverio GN, Dinis MAP, Ramirez J. Relevance of international partnerships in the implementation of the UN Sustainable Development Goals. *Nat Commun* [Internet]. 2022;13(1):613. <https://doi.org/10.1038/s41467-022-28230-x>.
26. Mountford N, Kessie T. Towards a more holistic understanding of whole organizational networks: anthropological approaches in evolving markets. *Electron J Bus Res Methods*. 2017;15(2):74–84.
27. Rezaei A, Ahmadi S, Karimi H. The role of online social networks in university students' environmentally responsible behavior. *Int J Sustain High Educ* [Internet]. 2022;23(5):1045–69. <https://doi.org/10.1108/IJSHE-05-2020-0168>.
28. Winkler KJ, Bennett E, Chestnutt HR. Mapping social structures for sustainability transformation at McGill University, Canada. *Int J Sustain High Educ* [Internet]. 2022;23(6):1209–28. <https://doi.org/10.1108/IJSHE-04-2021-0164>.
29. Knell M. The digital revolution and digitalized network society. *Rev Evol Polit Econ* [Internet]. 2021;2(1):9–25. <https://doi.org/10.1007/s43253-021-00037-4>.
30. Malecki EJ. Entrepreneurs, networks, and economic development: a review of recent research. In: Katz JA, Corbett AC, editors. *Reflections and extensions on key papers of the first twenty-five years of advances* [Internet] (advances in entrepreneurship, firm emergence and growth; vol. 20). Bingley: Emerald Publishing Limited; 2018. p. 71–116. <https://doi.org/10.1108/S1074-75402018000020010>.
31. Yang W, Chen Q, Guo Q, Huang X. Towards sustainable development: how digitalization, technological innovation, and green economic development interact with each other. *Int J Environ Res Public Health* [Internet]. 2022;19(19). <https://www.mdpi.com/1660-4601/19/19/12273>
32. Rasiah R. Building networks to harness innovation synergies: towards an open systems approach to sustainable development. *J Open Innov Technol Market Complex* [Internet]. 2019;5(3):70.
33. UNESCO. *Ubuntu declaration on education and science and technology for sustainable development*. 2002.

34. Blanco-Portela N, R-Pertierra L, Benayas J, Lozano R. Sustainability leaders' perceptions on the drivers for and the barriers to the integration of sustainability in Latin American Higher Education Institutions. *Sustainability* [Internet]. 2018;10(8). <https://www.mdpi.com/2071-1050/10/8/2954>
35. Yturzaeta JEG. Assessing Sustainability Initiatives in Higher Education Institutions. *J Manag Glob Sustain*. 2020;8:97.
36. Alshuwaikhat HM, Abubakar IR, Aina YA, Saghir B. Networking the sustainable campus awards: engaging with the higher education institutions in developing countries. In: Leal Filho W, Skanavis C, do Paço A, Rogers J, Kuznetsova O, Castro P, editors. *Handbook of theory and practice of sustainable development in higher education* [Internet], vol. 2. Cham: Springer; 2017. p. 93–107. [https://doi.org/10.1007/978-3-319-47889-0\\_7](https://doi.org/10.1007/978-3-319-47889-0_7).
37. Kolleck N. The emergence of a global innovation in education: diffusing Education for Sustainable Development through social networks. *Environ Educ Res* [Internet]. 2019;25(11):1635–53. <https://doi.org/10.1080/13504622.2019.1675593>.
38. Zabaniotou A. Towards gender equality in Mediterranean Engineering Schools through networking, collaborative learning, synergies and commitment to SDGs—the RMEI approach. *Glob Transit* [Internet]. 2020;2:4–15.
39. De Schepper A, Clycq N, Kyndt E. Social networks in the transition from higher education to work: a systematic review. *Educ Res Rev* [Internet]. 2023;40:100551.
40. Mingaleva Z, Sheresheva M, Oborin M, Gvarliani T. Networking of small cities to gain sustainability. Tvaronavičienė M, editor. *Entrepr Sustain Issues* [Internet]. 2017;5(1):140–56. <http://jssidoi.org/jesi/article/140>
41. Chaudhuri S, Roy M, McDonald LM, Emendack Y. Reflections on farmers' social networks: a means for sustainable agricultural development? *Environ Dev Sustain* [Internet]. 2021;23(3):2973–3008. <https://doi.org/10.1007/s10668-020-00762-6>.
42. Leal Filho W, Dibbern T, Pimenta Dinis MA, Coggo Cristofolletti E, Mbah MF, Mishra A, et al. The added value of partnerships in implementing the UN sustainable development goals. *J Clean Prod* [Internet]. 2024;438:140794.
43. Filho WL, Trevisan LV, Dinis MAP, Ulmer N, Paço A, Borsari B, et al. Fostering students' participation in the implementation of the sustainable development goals at higher education institutions. *Discov Sustain* [Internet]. 2024;5(1):22. <https://doi.org/10.1007/s43621-024-00204-7>.
44. Leal Filho W, Eustachio JHPP, Nita AC, Dinis MAP, Salvia AL, Cotton DRE, et al. Using data science for sustainable development in higher education. *Sustain Dev* [Internet]. 2024;32(1):15–28. <https://doi.org/10.1002/sd.2638>.
45. Leal Filho W, Dibbern T, Viera Trevisan L, Coggo Cristofolletti E, Dinis MAP, Matandirotya N, et al. Mapping universities-communities partnerships in the delivery of the Sustainable Development Goals. *Front Environ Sci* [Internet]. 2023. <https://doi.org/10.3389/fenvs.2023.1246875>.
46. Field A. *Discovering statistics using IBM SPSS statistics*. London: SAGE Publications; 2018.
47. Yang A, Uysal N, Taylor M. Unleashing the power of networks: shareholder activism, sustainable development and corporate environmental policy. *Bus Strategy Environ* [Internet]. 2018;27(6):712–27. <https://doi.org/10.1002/bse.2026>.
48. Pires SM, Nicolau M, Mapar M, Dias MF, Horta D, Nicolau PB, Caeiro S, Patrizi N, Pulselli FM, Galli A, Malandrakis G. How to integrate sustainability teaching and learning in Higher Education Institutions? From context to action for transformation towards SDGs implementation: a literature review. In *UA Editora*; 2020.
49. Ng AW. Sustainability and education policy. In: Leal Filho W, editor. *Encyclopedia of sustainability in higher education* [Internet]. Cham: Springer; 2018. p. 1–8.
50. Rodríguez-Abitia G, Bribiesca-Correa G. Assessing digital transformation in universities. *Future Internet* [Internet]. 2021;13(2). <https://www.mdpi.com/1999-5903/13/2/52>
51. Schantz NM, Charles A, Copestake J. The Sustainable Development Goals and the University of Bath: an opportunity. *Bath Papers in International Development and Wellbeing*, no. 64, Centre for Development Studies. 2021.
52. European School of Sustainability Science and Research (ESSSR). <https://esssr.eu/>. What is the European School of Sustainability Science and Research?
53. Leal Filho W, Viera Trevisan L, Dinis MAP, Sivapalan S, Wahaj Z, Liakh O. Ensuring sustainability in internationalisation efforts at higher education institutions. *Int J Sustain High Educ* [Internet]. 2023;24(7):1416–29. <https://doi.org/10.1108/IJSHE-10-2022-0333>.
54. Inter-University Sustainable Development Research Programme (IUSDRP). <https://www.haw-hamburg.de/ftz-nk/programme/iusrp/>. Inter-University Sustainable Development Research Programme (IUSDRP).
55. Zeigermann U. Scientific knowledge integration and the implementation of the SDGs: comparing strategies of sustainability networks. *Polit Gov*. 2021;9(1):164–75.
56. Sachs JD, Lafortune G, Fuller G, Drumm E. *Implementing the SDG stimulus*. Sustainable Development Report 2023. Dublin; 2023.
57. The Association for the Advancement of Sustainability in Higher Education (AASHE). <https://www.aashe.org/>. Inspiring higher education to lead the sustainability transformation.
58. Lemarchand P, MacMahon C, McKeever M, Owende P. An evaluation of a computational technique for measuring the embeddedness of sustainability in the curriculum aligned to AASHE-STARs and the United Nations Sustainable Development Goals. *Front Sustain* [Internet]. 2023. <https://doi.org/10.3389/frsus.2023.997509>.
59. Urbanski M. Salaries & status of sustainability professionals in higher education: results of AASHE's 2020 Higher Education Sustainability Staffing Survey (Association for the Advancement of Sustainability in Higher Education). 2020.
60. COPERNICUS Alliance. <https://www.copernicus-alliance.org/>. COPERNICUS Alliance.
61. Molthan-Hill P, Erlandsson L, Ndlovu T, Patton I, Goodwin F. Global alliance of tertiary education and sustainable development. In: Leal Filho W, editor. *Encyclopedia of sustainability in higher education* [Internet]. Cham: Springer; 2019. p. 1–13. [https://doi.org/10.1007/978-3-319-63951-2\\_375-1](https://doi.org/10.1007/978-3-319-63951-2_375-1).

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