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Universities as Potential Actors for Sustainable Development

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Abstract: Universities can contribute to the solutions of major challenges of the 21st century such as increasing environmental and socio-economic crises, inequalities of income and wealth and political instabilities by integrating the concept of sustainable development (SD) in research, organization, and by educating future decision makers. For instance, by integrating sustainability into the organization, universities can lead by example. Furthermore, through the curriculum, future decision makers can learn the competences needed to solve ecological, social, and economic problems in societies. However, despite their possible importance, universities in Germany fall behind internationally in implementing sustainable strategies. Therefore this paper presents/introduces an approach to how universities can implement the holistic concept of SD that considers all three dimensions (economic, ecological, and social) relating to their main functions of research and education in addition to their organization. Additionally this paper analyzes the current state of implementing sustainability strategies at universities, and how the success of these implementation efforts can be evaluated and be fostered further. We find that assessment systems enable universities to systematically use their potential for action for SD by initiating, evaluating, and accelerating the sustainability process. This also applies in the case of German universities, where the implementation of SD is still in the early stages.

1. Introduction

Universities can be major actors for supporting sustainable development (SD) in developing SD strategies through research, educating future generations and in implementing sustainability in their organization. At the international level, the United Nations (UN) has proclaimed the years 2005–2014 as the UN "Decade of Education for Sustainable Development". It proposes that education for sustainable development (ESD) be integrated at all levels of education. At the national level, the *Hochschulrektorenkonferenz* (Committee of chancellors and principals of German universities, colleges, and schools) and the German Commission for UNESCO issued a joint statement in 2010 entitled "Universities for sustainable development" which expressly requests universities to focus on the principle of SD and to develop "Education for Sustainable Development as a constituting element in all areas of activity" [1].

The universities with their three core functions, research, teaching, and services, are called upon to accept their responsibility and contribute to SD [2]. In doing so, they could clearly position themselves within society. The challenge and importance of SD for universities is underscored by numerous international networks like the network of international elite universities "International Sustainability Campus Network (ISCN)". As one of Europe's largest research institutes, Fraunhofer-Gesellschaft has anchored the principle of sustainability in its current mission statement and initiated the internal project "Sustainability Strategy" in 2011 to promote the shaping of a sustainable society, economy, and environment [3]. As major research centers and important institutions in the education system, universities contribute sustainable solutions to the challenges of the 21st century through basic and applied research and by generating knowledge and suitable responses to complex interrelationships. Future decision makers in government, business, and society acquire the knowledge and skills required to shape the future through the integration of sustainability issues in the curricula at their universities [4].

However, very little attention has been given to the subject in Germany. SD has only been sporadically integrated into the research, teaching, and operations at most German universities in the past. There is limited research specific to the role of German universities in implementing SD strategies. Thus, the findings presented in this paper are the results of an ongoing research project entitled "Sustainable Technical University of Kaiserslautern" focusing on the University of Kaiserslautern. The research project includes not only the review and analysis of the current university activities related to sustainability, but also in a second phase, the development of a sustainability strategy. We proceed using the approach of the three dimensional model of SD, which has international recognition and was grounded in theory [5].

This paper presents a methodology in the sense of a management tool to serve universities in their efforts to systematically introduce and integrate sustainability into the institution's areas of action in the interest of SD. In this context, the existing assessment systems for the university level are analyzed using the German experience to determine the extent to which they can be used to initiate, evaluate, and accelerate this transformation process. The paper is organized as follows. The next section discusses international efforts and is followed by a review of the current state of SD developments in the German higher education system. Section 3 presents a methodology to move from the general requirements of SD to derive specific fields of actions in the various areas of responsibility at a

university. These areas of action provide universities with a variety of starting points for implementing the SD process. In Section 4 we discuss how the implementation of SD strategies can be evaluated, and whether the standard assessment tools work particularly for universities. This is followed by a summary of our major conclusions drawn from this discussion.

2. Universities and Sustainable Development—A Review of the International and National Levels

This section provides a review of the international initiatives and networks in the area of SD in the higher education sector. It clearly reveals the regional differences in effort and progress in this area that exist worldwide. The aim of Section 2.1 is to present the international standard regarding the development and implementation of the "sustainable university" concept. Several countries have already reached a relatively high standard. Section 2.2 examines the present level attained by Germany and then compares this to the more advanced countries.

2.1. International Sustainable Development Initiatives and Networks in the Area of Higher Education

There are many and diverse international and national initiatives that ask universities worldwide to assume responsibility for SD by integrating sustainability in their core functions: research, teaching, and services. These initiatives can include statements of intent, networks and cooperative action programs. One statement is the "Tailloires Declaration" from 1990. The "Tailloires Declaration" is a 10-point action plan for the integration of sustainability at universities. An international network called "University Leaders for a Sustainable Future (ULSF)" currently coordinates and supports 440 schools in 40 countries that have made commitments to this action plan, although the priorities of the action plan are on the ecological dimension of SD [6].

The "Cooperative Program in Europe for Research on Nature and Industry through Coordinated University Studies (COPERNICUS Charter)" was adopted at the European Rector's Conference (CRE) in 1994 and is an example for a cooperative action program. Today, there are more than 320 universities in the EU that have made commitments to support it. Ten principles of action are formulated for universities, colleges, and schools that pursue a broad, but nevertheless, ecologically dominated sustainability approach [7].

The principles formulated in the "COPERNICUS Charter" are similar to those of the "Tailloires Declaration" and they also reflect the state of the academic debate concerning the specification of the SD concepts in the 1990s. Both, the "Tailloires Declaration" and "COPERNICUS Charter", include all stakeholders at an institute of higher education in the process of designing and implementing SD. Accordingly, they support the fundamental idea of participative SD [8]. This development is also mentioned in the updated version "COPERNICUS 2.0" published in 2011 by the "Copernicus Alliance", a European network established in 2010 by the Leuphana University in Lüneburg and the University of Bremen. The network has the goal of advancing SD at the European university level as well as promoting education and research on sustainability in cooperation with society [9].

The goals of the European initiatives correspond to the goals of the "UN Decade of ESD, 2005–2014" which includes all areas of the formal education system, non-formal educational opportunities as well as informal learning. Besides supporting the learning of competencies required to shape the future, it also encourages innovation in the educational establishment. These institutions

must not only meet the requirements of SD through the participation of teachers and students in the decision making processes, but also through the sustainable actions of the institutions of higher education (e.g., universities) themselves [10].

Similar goals can be found in the "International Sustainable Campus Network (ISCN)", which demonstrates the acceptance of the topic and the claim by the elite universities to a leadership role in shaping the SD concept. ISCN includes many elite universities from America, Europe, Asia, and Australia. The membership in the network includes, for example, Harvard University, Massachusetts Institute of Technology, Stanford University, and Yale University in the USA. In Europe, ISCN members include the Institut Européen d'Administration des Affaires (INSEAD), the London School of Economics, and the Universities of Oxford and Cambridge. Asian members include the University of Tokyo, the University of Hong Kong and the National University of Singapore. In Australia, ISCN members include the University of Melbourne and the University of Western Australia. ISCN practices a holistic approach to sustainability, which integrates all three dimensions (economic, ecological, and social) equally in the research, teaching, and operational areas of a university. In accordance with the ISCN-GULF Sustainable Campus Charter, ISCN members are committed to individually specify their sustainability goals and to report on this with transparency and regularity [11]. This can certainly contribute to the realization of the universities' sustainability commitments and help to promote the sustainability process.

Especially in North America, initiatives for (ecological) sustainability in higher education can be found. In the context of the "Greening the Campus" movement in North America, two networks formed in 2005 and 2007 exert great influence on the North American higher education sector simply by the sheer size of their membership rosters. The "Association for the Advancement of Sustainability in Higher Education (AASHE)" is one of these two networks. AASHE strives to implement SD as an integrated approach that considers the ecological, the social and the economic dimension of SD at the university level and provides its organization, of 859 member schools, with the "Sustainability Tracking Assessment & Rating System (STARS)" [9]. Another network, established in 2007, is the network of "American College & University Presidents' Climate Commitment (ACUPCC)". Unlike AASHE, ACUPCC concentrates on the ecological dimension of sustainability and expects its 677 members to take the appropriate climate protection measures to ensure the realization of a truly climate neutral school. The two networks cooperate in promoting sustainability at the university level [12]. However, the aim of ACUPCC to counter climate change focuses only on the ecological dimension, but according to international consensus based on a reading of sustainability in the tradition of the Brundtland report, SD at universities has to take all three dimensions into account and integrate them into their areas of action.

The integrated concept of SD in the tradition of the Brundtland report is also becoming an important topic in tertiary education in the Asia-Pacific region. The "Network for the Promotion of Sustainability in Postgraduate Education and Research (ProSPER.Net)" was formed in 2008, with 18 leading universities, colleges and schools that share the desire to shape a sustainable future in higher education and research at the postgraduate level [13]. The shift from the ecologically dominated sustainability approach towards an integrated three dimensional concept of SD can also be observed at German universities.

2.2. Sustainable Development at the University Level in Germany

In a joint statement entitled "Universities for Sustainable Development" in 2010, the German Commission for UNESCO together with the *Hochschulrektorenkonferenz* (Committee of chancellors and principals of German universities, colleges, and schools), expressly requested universities to focus on the principle of SD and to develop "Education for Sustainable Development as a constituting element in all areas of activity" [1].

Although several schools did make commitments to the "COPERNICUS Charter" as early as the 1990s (including the Technical University of Kaiserslautern), to date only a few isolated examples of SD implementations by institutions in the German landscape of higher education can be observed. Furthermore, apart from a few studies undertaken, a comprehensive review of these limited sustainability activities of German universities is still lacking. One study by the Federal Ministry of Education and Research (BMBF) entitled "UNI21—Higher Education for Sustainable Development" (2004) provides the first overview of the sustainability activities at German universities. It mainly documents examples of "Good Practices" in various fields of action at the university level.

Another study by the UNESCO research group on "Higher Education and Sustainability" published the brochure "Higher Education for Sustainable Development" in January 2012. This brochure highlights diverse sustainability activities undertaken at German universities that have also been announced by external communications and presents them as examples of good practices [14]. The findings of this working group combined with findings of the "Sustainable Technical University of Kaiserslautern" project, draw the following picture of sustainability activities at German universities. Germany has a total of 421 institutes of higher education. These 421 institutes of higher learning are divided into 108 universities and 313 universities of applied sciences [15]. According to several recent studies of these 108 universities, the only ones that have published sustainability reports that take into account all three sustainability dimensions are the University of Bremen, Carl von Ossietzky University in Oldenburg, and Leuphana University in Lüneburg. In addition to these universities, several universities of applied sciences have also started to publish sustainability reports.

The sustainability reports from the universities in Bremen and Lüneburg are more comprehensive in their structure than the sustainability report from the University of Oldenburg. Bremen has already published its second report while Lüneburg has issued three reports to date. These sustainability reports include well-formulated goals and specify future actions (e.g., reduction of CO_2). This ensures that sustainability-related activities are integrated in a sustainability program that can be continuously improved and expanded. The sustainability report of the Leuphana University in Lüneburg conforms to the principles of the Global Reporting Initiative (GRI), an internationally recognized standard for preparing sustainability reports. Several other universities have published environmental reports, but these neglect the holistic, three dimensional approach to SD. These schools include, for example, the University of Freiburg and the University of Osnabrück. As part of implementing SD in organizations, not only has a reporting mechanism to be in place, but also a management system.

If SD is understood to be a transformative process, where institutions must individually define and implement the content, universities that can produce an "Eco-Management and Audit Scheme (EMAS)" or those that have been certified according to "ISO 14001" are among those universities that can make a contribution to environmental sustainability.

Currently, 15 universities in Germany have introduced a balanced environmental management system that provides for a continuous improvement plan. These include FU Berlin, University of Bremen, BTU Cottbus, TU Dresden, Leuphana University of Lüneburg, and the University of Tübingen [16]. SD in the sense of the Brundtland report comprises all aspects that contribute to an environmentally sound, socially just, and economically efficient society. Consequently, in the university environment, SD can be viewed as an interdisciplinary subject, to be integrated in the areas of research, teaching, and operations if the university wants to successfully monitor and shape its social responsibility with respect to SD.

Overall, many SD activities can be observed in diverse areas of the German higher education sector, although these initiatives are often focused on the environment [17]. These activities are for the most part initiated and implemented by motivated employees from the various stakeholder groups at the university. This can include the incorporation of sustainability-related subjects in the university mission statement by the university leadership, research projects carried out by individual researchers, courses or lectures. Furthermore, this can also include projects organized by student associations, or measures related to sustainability and pushed through by the university administration. However, there is still a lack of awareness of SD, especially of all three dimensions of SD, and not just the ecological one. This lack of awareness is a reason why the SD implementation still falls behind. Another obstacle in implementing SD into universities mentioned by the UNESCO research group and the internal expert working group that participated in the "Sustainable Technical University of Kaiserslautern" project can be the financing of the sustainability process that should be coordinated by a management plan.

In summary, it can be said that any systematic process to date for implementing SD at the universities in Germany has been the exception. Consequently, there is no generally accepted, comprehensive sustainability concept for universities and this will likely remain true in the future because German universities have very different structures. However, at a political level, there is an increasing demand and because of this some individual contributions to SD at the university level have been funded. In this regard, the first initiatives by the individual federal states of Baden Württemberg and Hessen are noteworthy. The state of Hessen for example, is the first federal state to have provisions for sustainability strategies in its joint agreement of objectives with its 12 state run universities and universities of applied sciences for the years 2011–2015 [18].

In summary in comparison to efforts in other countries, for example, in the USA, the implementation at German universities is still just in the early stages, even when the focus of implementing SD is on the ecological dimension and neglects the social and economic dimension of the above mentioned integrated and holistic approach of SD.

3. Requirements for a "Sustainable University"

A university can contribute to SD in a variety of contexts. In terms of the integrated approach to SD, a sustainable university must act sustainably in all areas—economic, ecological, and social.

Section 3 presents a methodology in the sense of a management tool used to analyze and derive the specific fields of action from the general requirements of SD in the various areas of a university such as teaching and research. The methodology is based on the development of sustainability strategies in

different contexts [19]. First, the areas of action relevant to sustainability at a university are defined on the basis of their main functions and their operational organization. These areas of action provide universities with various starting points for implementing the SD process. Then appropriate fields of action are assigned to each area. The individual fields of action are then analyzed to yield the indicators. These indicators help to define the *status quo* at a university within the sustainability process and provide information about whether the sustainability targets have been achieved. Additionally, these indicators can be used to compare sustainability activities at the universities.

3.1. The Sustainable University's Areas of Action

SD can be viewed as a process that is to be described in detail within a defined environment. The initial starting point and specific framework conditions must always be taken into account. At the research level, various areas of action are defined that may differ with respect to content, regional or cultural characteristics, and approach followed by the university [20]. Furthermore, the areas, fields, and indicators sometimes differ because different content has been specified in the detailed SD plan.

From a functional perspective the action areas "research" and "education" according to their core functions can be defined for universities. As modern service providers, universities also may take sustainable actions in the area "operations" and serve as examples for society as a whole. The sustainability process of a university should be organized along its three general functional components "research", "education" and "operations" in order to systematically implement sustainability and to improve the efficiency of sustainable measures.

Beyond this, as an actor within society, the university has influence on society. Therefore the area of action "outreach" includes sustainable contributions of universities at the local, regional, and global levels [21]. Since the mid-1990s, the relevance of these four areas of action has been emphasized in the scientific debate and consequently their content has been developed and specified in the context of SD. Depending on the respective goals and objectives, other areas of action may be identified. For example, a fifth area of action "models, strategy, and organizational basis" is important to support and to maintain the sustainability process. In order to raise awareness for SD, this field of action must be integrated and communicated in all areas. It should be noted that while universities must act within a structure that is imposed from an external source, they also have great freedom of action in the arrangement of their duties. Although the institutions of higher education are only one actor among many, considering their key role in education and research, they possess great potential for shaping a sustainable society [22].

According to the integrated sustainability model, universities should align their core functions "research" and "education" as well as their "operations" and their role within society with the SD concept. Specifically, this can take place using these five areas of action which are presented in detail in the next section and specified by defining the related fields of action. The evaluation of an area of action in terms of SD is also achieved using the fields of action, *i.e.*, indicators.

3.2. Sustainable "Models, Strategy, and Organizational Basis"

A university mission statement that documents clear objectives of SD provides authoritative information and an internal framework for action for all employees and, as a result, strengthens their

identification and morale. Such a model, if communicated to the outside, can raise the public profile of the university as the institution commits itself to SD. The adoption of these goals can be used as an initial impetus for the sustainability process. The sustainability process should be accompanied by the participative development of a strategy, in which specific goals, programs, projects, and corresponding provisions for goal attainment are formulated. The review of pre-existing sustainability activities and their assignment to an area of action within the university environment can serve as a starting point for strategy development [23].

Projects and provisions have to be evaluated on a regular basis to monitor the efficiency of the strategy and the goals, and to develop better measures, if required. In this way, the individual potential of a university for SD can be systematically developed and applied. An organizational basis for SD at the university can be established if the university culture experiences this continuous development process, and supports the necessary increase in awareness and motivation of each individual in the various areas of action. The area of action can be specified using overlapping fields of action to support the framework conditions and to encourage an awareness of SD at a university in structural terms:

- SD model or vision
- SD in the mission statement
- SD in the annual report
- Sustainability strategy
- Communication about SD
- Sustainability reports
- Position/agency for sustainability coordination

In the state of Baden-Württemberg, for example, more and more positions for sustainability representatives are being created at the universities to coordinate the introduction of the sustainability processes. These additional jobs are funded temporarily by the government of Baden-Württemberg and do not have to be taken out of the approved university budget.

3.3. Sustainable "Research"

The German government's BMBF Framework Program for SD Research (FONA) which provides funding of more than 2 billion euros through 2015 and the proclamation of Science Year 2012—"Project Earth: Our Future" illustrate the relevance of research dedicated to SD in light of the complex, global challenges like climate change, scarce resources, and the loss of biodiversity, all of which have a regional impact [24]. Research for SD provides the possibility at disciplinary, interdisciplinary, and transdisciplinary levels to develop the innovative technologies and the system-oriented know-how necessary to shape SD. At the disciplinary level, there are many research topics, especially in the area of resource and energy efficiency, that have to be studied in engineering and the natural sciences [22]. A need for SD research also exists at the analytical level in other expert disciplines (generation of systems knowledge), at the normative level (development of goals and orientation knowledge), and at the operational level (production of design or transformation knowledge) [25].

All three levels of research pose challenges for interdisciplinary SD research because a coordination effort may be required among the different research cultures in the separate disciplines. Current structures in our research system do not pay enough attention to this fact. In the context of SD, the transdisciplinary approach takes on an ever increasing role. This approach studies the complex relationships between humans and the environment, and integrates both scientific and life's everyday problems in the research process as well as including the relevant practical actors [26]. Fields of action for specification and assessment of this area of action may include:

- In-house university definition of sustainability research
- Identification research for SD at the university
- Publication/communication of the identified sustainability research
- Percent of total research in sustainability research
- Percent of departments performing sustainability-related research
- Percent of courses performing sustainability-related research
- Funding for sustainability research
- Existence of interdisciplinary research structures and collaborative SD

3.4. Sustainable "Education"

Besides the generation of knowledge, another core task for a university is the transfer of knowledge. The research results should be conveyed to the next generation, to the scientific as well as the non-scientific audience. Together with ESD, universities as educational institutions have the task of providing people with knowledge and skills to enable them to participate in shaping a future that is economically, ecologically, and socially sustainable. There is still a great need in all expert disciplines to catch up if future leaders are to take notice and introduce this subject in their future professional activities. Besides raising the consciousness, the concept of "shaping competence" combines the acquisition of the required competencies [27]. This includes the following sub-skills, which are oriented towards the OECD concept of key competencies as shown in Table 1 [28].

Table 1. Assignment of sub-skills to the competence categories source: [29].

Competence categories defined by OECD	Sub-skills for shaping the future
Interactively use media and tools	Open minded and able to integrate new perspectives in learning
	Foresighted thinking and actions
	Ability to gain and apply interdisciplinary insights
Interact in heterogeneous groups	Ability to plan and work with others
	Ability to participate in decision making processes
	Ability to motivate others to act
Independent work	Self-principled and ability to reflect on principles of others
	Ability to plan and work independently
	Ability to show empathy and solidarity for the disadvantaged
	Ability for self-motivation and action

The Bologna Process and the transition to bachelor and master degree programs at universities in Europe should bring about a greater focus on competence in the education of students, although the

results to date are not optimal. The university curricula should include a combination of ESD and the idea of shaping the future in the content of SD subjects. The following major topics for ESD have been developed by the "United Nations Economic Commission for Europe (UNECE)" in its paper "UNECE Strategy for Education for Sustainable Development" [30].

- Peace
- Ethics and philosophy
- Citizenship, democracy, and good governance
- Human rights (e.g., gender equality)
- Alleviating poverty
- Cultural diversity
- Biologic diversity and varied landscapes
- Environmental protection
- Ecological guidelines and eco-system
- Management of natural resources
- Climate change
- Health
- Corporate responsibility (CSR)
- Production and consumer patterns
- Economies
- Rural and urban development

In the interest of ESD, these major topics can be integrated in programs at the primary, secondary, and tertiary levels of education. The area of action "education" at universities can be assessed by the following indicators, which are derived from an international study funded by BMBF [31]:

- Competence of the teachers in the area of SD
- Number of sustainability degree programs
- Competence in the areas of SD or ESD
- Continuing education classes for SD or ESD
- Number of courses related to SD (mandatory and optional electives)
- Reporting on the focus of the course catalog on SD

The possibilities of informal learning for ESD at a university can also be assessed in the area of action "education".

3.5. Sustainable "Operations"

As social institutions, universities have a social responsibility to focus their operations on the SD model. They can consider economic, ecological and social aspects in internal decisions and business processes and apply knowledge of sustainability related problems and solutions to their own institutions. In this way, university operations can be shaped and optimized for sustainability within legal, financial, and administrative frameworks. This area of action was at first dominated by the environment [32]. The economic and social dimensions are now becoming more and more important

and should be integrated in sustainable university management to promote the responsible utilization of all resources and other kinds of capital.

In addition to environmental protection, job security and employee satisfaction are major factors in the efficient use of the available financial resources. Consequently, the dimensions are not unconnected, existing in isolation from one another, but rather, they exert mutual influences. Environmental protection measures, for example, reduced energy consumption and financial cost savings can provide resources that can be invested in sustainable projects, e.g., sustainable education. When combined with family-friendly and other health and safety measures, the continuing education of employees can also add to human capital and strengthen employee identification with the university. Accordingly, the key resource of the university, namely its employees, is afforded sustainable support. To that effect, the following fields of action for this area are appropriate for study:

Ecological dimension:

- Building management
- Energy management
- Recycling and waste management
- Media and water management
- Greening of the premises
- Sustainable catering
- Sustainable procurement
- Mobility management
- Environmental protection reports

Social dimension:

- Workplace safety
- Health and safety management
- Equal opportunity policy
- Family friendliness
- Flexible work times
- Organizational culture (participation, communication, transparency)

Economic Dimension:

- Resource management
- Measures to retain and attract students (increase enrollments)
- Measures to retain and attract partners (raising external funding, also in the SD context)
- Human resources development (strengthen human capital)
- Measures to improve cooperation among the various university status groups (improve efficiency)
- Energy management
- Regional economic impacts

3.6. Sustainable "Outreach"

Due to their role in society, universities assume responsibility not just for the regional SD, but also beyond the region at an international level. Besides an immediate economic, social, and cultural influence at the local and regional levels, diverse channels are available to more broadly provide their SD knowledge and competencies. As centers for research and education, however, they have the potential together with other actors to contribute to SD in the region. These other actors may include regional businesses or the local municipalities in terms of Agenda 21 [33].

The knowledge transfer takes place in a society through formal, non-formal, and informal learning situations [8]. At the national level, the knowledge and skills for shaping the future is acquired from school while at an international level, there are appropriate exchange programs for researchers and students where knowledge is generated and transferred. International cooperation among universities can also be used to coordinate sustainability related activities as the challenges of the 21st century are of global importance. When students from developing countries are educated in an industrialized country, the universities can make a major contribution in the area of knowledge transfer in the context of SD. Additionally, universities can provide their knowledge to society via non-formal and informal channels of education, whether through continuing education and sensitization of employees to ESD or by communicating research results in the form of open house theme days for university visitors. The various possibilities for a university to achieve a sustainable "outreach" can be studied using this area of action [17]. A sampling of "outreach" fields of action is shown below:

- Cooperation with local and regional actors
- SD workshops, conventions, and conferences
- Network operations for SD
- Internationalization
- Public information events

The presentation and explanation of the five areas of action for SD at the university level illustrate the feasibility of using a methodology to develop a very sophisticated concept by assigning fields of action and appropriate indicators. As noted at the beginning of the section, the development of an indicator system is still pending. Areas of action are specified by the assignment of fields of action and may be further differentiated in the sustainability process and adapted to the starting situation of the university. The development of a concept of SD also requires that an assessment system be developed from the start. This facilitates the initial review and analysis of the current university activities related to sustainability, and subsequently the development of a sustainability strategy. Sustainability assessment systems have already been developed as a result of the more advanced state at the university level in some countries and are presented in the next section.

4. International Sustainability Assessment Systems for Universities

The following discussion introduces various sustainability assessment systems or conceptual models that are currently a topic of international debate and considers their relevance to the university sustainability process. We examine how well each of the sustainability assessment systems corresponds to the integrated three-dimensional concept of sustainability, what advantages and

disadvantages each one has, and to what extent each can serve to further the introduction and support of a university sustainability process, especially in Germany.

4.1. Relevance of Sustainability Assessment Systems

The first step in a systematic transformation process at a university is to perform a review of the ongoing sustainability activities. In keeping with an integrated sustainability approach, all sustainability-related activities at the university must be noted and assigned to the five areas of action introduced and discussed in Section 3. Using this data as a basis, an individual sustainability strategy can be developed. The successful implementation of SD at a university requires the formulation and achievement of specific sustainability targets. This implies participative programs, projects, and methods in addition to a requirement to evaluate them in terms of their effectiveness. Indicators can be used to check the progress made towards reaching the stated goals of the sustainability strategy on a regular basis. If the checks reveal that sustainability targets are not being achieved to a satisfactory degree, the sustainability process must be expedited through the use of more appropriate measures.

To this end, sustainability assessment systems have been developed and specifically adapted for the areas of action that apply to universities. An assessment system is initially helpful in systematically recording the *status quo* and then, on the basis of an analysis of strengths and weaknesses, in supporting the further development of the sustainability process [23]. Furthermore, when several schools methodically perform sustainability assessments in a similar manner, the results, processes, and areas of action are available for comparison, experiences can be exchanged, and conclusions can be drawn and developed for use in future approaches [34].

Because an overall national strategy for the integration of SD is lacking at the university level in Germany, sustainability assessments would represent a first step to a systematic process for implementing SD at a university. At those universities that have already integrated sustainability in teaching, research, and operations, such sustainability assessments will bring well-deserved recognition of their exemplary efforts. In this way, universities could use the results of the sustainability assessments and the appropriate certifications for transparent internal and external communications describing their SD efforts [23] and, in so doing, attract more cooperation partners and students.

The current sustainability assessment systems at the university level use the areas of action and fields of action introduced in Section 3 as a basis for assessment. The assessment itself, based on current research findings, determines the direct and indirect relationship different activities have to sustainability. These are mainly for regional use. An internationally recognized and standardized assessment system for the university level does not yet exist. One explanation for this, as mentioned before, is the different types of institution that exist in terms of tradition, size, and orientation. The German higher education system, for example, consists of universities and universities of applied sciences that differ in research and teaching. Another reason is the fact universities are social institutions that act within a regional and cultural environment, which can affect the priorities and goals of SD differently within each education system. This is why several different evaluation systems exist worldwide for checking and assessing the implementation of sustainability processes at the university level. According to each system, the choice of criteria and indicators as well as weights assigned in the assessment will vary [35].

The next section introduces four widely accepted sustainability assessment systems designed to assess institutions of higher education. All four systems may also be used simply as a tool for self-reflection on the part of the universities. However, only three of these four assessment systems actually certify the assessment. Below is a list of these systems shown in order of their chronological development:

- Sustainability Assessment Questionnaire (SAQ)
- Auditing Instrument for Sustainability in Higher Education (AISHE)
- Sustainability Tracking Assessment & Rating System (STARS)
- Alternative University Appraisal (AUA)

The four assessment systems pursue a process-oriented, integrative approach that is suitable for making a sustainability assessment for universities in different areas of concentration and at various levels. The involvement of the stakeholders in the assessment process at the school or in the data collection effort represents a participative element, which also meets the requirements of SD in the area of education and promotes the implementation of sustainability processes at universities [8]. A positive trend observed over time is that SAQ, AISHE 2.0, STARS, and AUA all follow an integrated approach with economic, ecological, and social requirements taken into account along with quantitative and qualitative criteria. The STARS and SAQ systems can evaluate the university as a complete entity, as an institution as well as in the individual areas of teaching and research. AISHE 2.0 and AUA, however, are able to evaluate only sub-sections of a university (for example, a faculty or a degree program) with respect to sustainability.

4.2. SAQ

SAQ was developed by the ULSF network between 1999 and 2001 to enable universities to self-assess and evaluate their contribution to SD. SAQ is a self-evaluation on the basis of a questionnaire and the corresponding guidelines designed to give universities the possibility to self-assess their contributions to sustainability in the following areas of action:

- Curriculum
- Research and scholarship
- Operations
- Faculty and staff development and rewards
- Outreach and service
- Student opportunities
- Institutional mission, structure and planning

In accordance with the participative approach, this evaluation should be conducted by 10–15 members of the stakeholders in the university. The response to the questions can be given individually or in groups. The results of the assessment represent a stock taking of the sustainability efforts of the university. Together with its stakeholders, the university can discuss and analyze the *status quo* on this basis and, if desired, jointly develop individual goals and methods for further integration of SD activities at the university [36].

The strength of SAQ assessment is the fact that it takes a process oriented approach that enables the participation of stakeholders in the sustainability process. One of the weaknesses noted, in addition to the lack of comparability with other universities, is that it is not easy to implement at large universities. For example, the choice of stakeholders can cause problems in acceptance when one of the stakeholders feels passed over or ignored.

4.3. AISHE

AISHE is a tool for performing sustainability assessments at the university level that was developed in 2001 under contract to the Dutch Committee for Sustainable Education at the University Level (CDHO). It is based on a quality management model that was developed by the European Foundation for Quality Management (EFQM) and subsequently expanded by the Dutch Institute for Quality Management (INK). The EFQM-INK model proceeds from the assumption that every organization, based on a criteria catalog, finds itself in one of five development phases. AISHE defines twenty criteria for the sustainability assessment that are assigned to the four phases (Plan-Do-Check-Act) of Deming's quality circle, an iterative process in a closed loop model. This assessment system can be used to evaluate individual courses of study and educational programs of faculties in the context of sustainability. AISHE in its original form, however, is not suitable for an evaluation of the university as an entity, because it focuses primarily on the specific education sector and the departmental curriculum [37]. The areas of action "research" or "operations" cannot be assessed by AISHE.

In an AISHE audit, 15–20 stakeholders initially evaluate the degree program on the sole basis of the defined criteria to determine what the current phase of development is for the program. This is followed by a joint presentation and discussion of results, with consensus building required to determine the current phase for each criterion. Ideally, this system should produce a definition of the desired target states. The mutual consensus on the actual states and the corresponding formulation of the target states are transferred to a graphic by means of a computer program to provide a visual presentation of the assessment. This assessment process can be repeated to evaluate the formulated measures in terms of their effectiveness in achieving the objectives. If a certificate is requested, two trained AISHE counselors perform the evaluation with the stakeholders for a fee.

The real strengths of AISHE as an assessment tool for ESD are the attestations from several research projects that have studied the model as well as its process-oriented participative approach and the fact that the model is compliant with the requirements for SD in the sense of the three dimensional concept. The visualization of results facilitates comparisons and the documentation of progress in the integration of sustainable education in the curriculum. Besides its complexity, a weakness of AISHE is its focus on evaluating the sustainability of educational programs or individual degree programs. Research, social sphere of influence, and university operations are ignored as major areas of action for a sustainable university in an AISHE audit [37]. To correct this shortcoming, AISHE 2.0 has been developed to provide an integrated assessment of sustainability at the university level which is currently undergoing the validation process. AISHE 2.0 is a modular assessment system for rating the sustainability at universities, colleges, and schools in the following areas of action:

- Identity
- Operations
- Education
- Research
- Society

The individual areas are evaluated using qualitative and quantitative indicators. AISHE has been used primarily at Dutch and Belgian universities to date for the certification of individual courses of study [38].

4.4. STARS

STARS 1.0 is an initiative of AASHE and is first and foremost an assessment system for North American universities, which was introduced as a 3-year process in 2009 with the involvement of universities and stakeholder organizations involved in university level education. STARS is under continuous development and improvements are incorporated in the latest version. STARS 1.1 was released in February 2011. In the meantime, a new pilot project "STARS International Pilot" has been developed so universities outside of North America can register. The number of participants is limited to 50 universities and the deadline for registration was 31 December 2012. The STARS certification price for AASHE members is USD 900 and, for non-members, USD 1400. STARS offers step-by-step instructions, from registration to how to transfer the required data for the four areas of action covered by the sustainability audit:

- Education & Research
- Operations
- Planning, Administration & Engagement
- Innovation

The system comprises 139 defined economic, ecological, and social indicators. In the first three areas, a maximum of 100 points is possible. Subsequently, with an assessment of the "Innovation" area, it is possible to earn up to four additional points to be added to the average number of points from the other three areas. Depending on the number of points awarded, the university is awarded a Bronze, Silver, Gold, or Platinum certificate which is then valid for three years. If the results of the sustainability assessment are not to be made public, the school has the option to choose the STARS-Reporter status. STARS provides universities with a system for evaluating sustainability that is both cost effective and saves time that otherwise would have to be spent on developing an individual sustainability strategy or preparing a single sustainability report. The only expense with STARS is for the collection of the relevant data. In February 2011, STARS had 226 US and 20 Canadian universities registered to participate in the process of a sustainability assessment [39]. This allows STARS to be used as a comparison between universities, although it is to be, noted that in STARS, only the positive ratings are released. In the event of a negative finding, the participating university can decide to choose only the STARS reporter status. In this way, only the participation in STARS is published, not the findings of the sustainability assessment.

4.5. AUA

AUA began in 2009 as a joint project by members of ProSPER.Net. ProSPER.Net is an association of universities and institutions in the Asia-Pacific region. The aim of AUA is to establish a learning community that wants to shape a sustainable future for university level education and, in the process, evaluate the schools in terms of their sustainability and improve the educational methods for SD. The idea of self-reflection for a self-evaluation was developed for universities, colleges, and schools and includes different fields of action for the area of education for sustainable development at the university level. This concept should serve as a framework at the university level for schools undergoing the evaluation process as well as serving professionals in ESD, who advise universities in the implementation of a sustainability process. The self-evaluation requires the fiscal data for the school starting with the year 2005, which can amount to a great expense. The university level sustainability assessment can generally be performed for the entire school or just in sub-sections of ESD, or as a combination of both assessment levels. The AUA assessment system always begins with the same questions of self-reflection, a review of the four areas of action:

- Governance
- Education
- Research
- Outreach

This system accounts for both qualitative and quantitative aspects. The AUA guidelines provide detailed information regarding the purpose and objectives of the questionnaire as well as instructions for the reply. The results of the self-assessment as well as the names of potential members for the AUA auditor committee are sent to the AUA administrative office. After an evaluation of the sustainability audit, a consultative process is scheduled with AUA auditors. The exchange of proven methods and practices for the operational implementation of ESD is further supported by a database, which is open to all and sustains the continuous process of SD at the university level. Since the AUA project was first started in 2009, it is now developing an auditors consulting model, with plans for further development as an auditors consulting system for sustainability in the higher education sector [40]. AUA is also process oriented and represents an integrated sustainability concept. Universities can even earn an AUA certificate. However, no direct comparison of the universities is possible in terms of their sustainability activities.

4.6. Comparative Assessment

As mentioned earlier, all four of the assessment systems can be initially useful to a university in evaluating its own activities in terms of their sustainability. This also applies to German universities. Based on the targets defined by the university, the sustainability assessment systems can be used for self-reflection to identify and correct any possible inadequacies. The results of the assessments can be used to develop a management plan for the implementation of SD into higher education institutions that consider the ecological, economic and social dimension of SD in all core functions of a university. In this way universities can use assessment systems to determine concrete measures and contribute to SD. The certification options offered by STARS, AISHE, and AUA help the universities avoid

suspicions of "green-washing". Due to its orientation on the Asia-Pacific region, AUA can be less interesting for German universities. In general, it can be stated that certification by one of these assessment systems is a relatively expensive matter for a German university, although the credibility of the sustainability process at a German university would be greatly enhanced. The decision to incur the expense of an external rating must be made by each university separately. The UNESCO working group for universities and sustainability in Germany is now discussing the development of an assessment system for Germany that will take into account the unique factors present in the area of German universities.

Considering that the implementation of SD at universities is not yet very advanced or mainly focused on the ecological/environmental dimension, the sustainability assessment systems can initially be used as an opportunity to take stock and assist in the formulation of a sustainability strategy that addresses all dimensions of SD and all areas of action at a university. In the future, they can be used to monitor and compare the sustainability activities at the universities and to encourage competition among the universities.

5. Conclusions

Universities can have great potential regarding the exchange and implementation of SD. It has been discussed that this potential has only been exploited to a limited degree, despite the importance of SD. In contrast to the USA for example, where many elite universities have assumed a leading role in implementing SD, German universities appear to be very reserved. In Germany, very few institutions of higher education have a comprehensive sustainability plan that corresponds to all three dimensions of SD (economic, ecological, and social). There are also great regional differences in Germany with regard to activities of SD implementation. So far most activities are in the North. The sustainability plan should ideally include all areas of sustainability implementation discussed (e.g., "research", "education"). Besides "education" and "research", there are still the "operations" area and the "outreach" area to be integrated at the university level. One way to achieve this is systematically embracing SD, *i.e.*, in the mission statement or the university-wide strategic development plan. In this context, the different stakeholder groups at universities have to be included in the process in order to attain a high degree of acceptance and identification. The sustainability plan can also contribute to and strengthen a school's competitiveness which takes on a greater relevance in light of the growing intensity of competition among universities. Finally, the social responsibility carried by universities, colleges, and schools can be strengthened through the development and implementation of a sustainability plan.

The sustainability plan, however, must be monitored by a continuous evaluation or assessment process to confirm its effectiveness. To this end, evaluation methods have been developed. The use and acceptance of assessment systems, especially in the USA, is exceptional, while in Germany and most European countries, no generally accepted assessment system has been introduced, or discussed. German universities can use these well-accepted assessment systems as an introduction of a sustainability process and to monitor SD implementations.

All four general, but relatively complex assessment systems (SAQ, AISHE 2.0, STARS, AUA) as well as the methodology in the sense of a management tool presented in Section 3 can be useful

as the first step in reflecting on the sustainability contribution of the university and as a structured assessment of the areas of action. This means they can be used to evaluate SD implementation at early stages. The results can provide a variety of models for a customized and viable sustainability strategy.

However, German universities are still at their early stages of SD implementation, which also opens up the possibility of developing an evaluation system especially tailored for the needs of German higher education institutions.

Author Contributions

The authors have equally contributed to the article.

Conflict of Interest

The authors declare no conflict of interest.

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