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Integration of Sustainability with Contemporary Curricula & Understanding of Traditional Academia: An Analysis of the Existing Situation

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This study scrutinizes the extent to which sustainability concepts are incorporated into traditional academia in Pakistan. A mixed-method approach was adopted to examine the degree of sustainability integration in university curricula. Information was gathered using a multistage sampling technique. The study population consisted of BS, M.Phil. and Ph.D. students enrolled in seven departments of physical, chemical, biological, environmental, agricultural, and economic and management sciences among the top five universities in metropolitan cities in Pakistan. Interviews of VCs, Directors Q.E.C, ORIC, and HODs were conducted in the above-mentioned departments from top-ranked universities in Sindh, Punjab, and the Federal Territory of Islamabad. Quantitative data were collected by adapting the sustainability assessment questionnaire (SAQ) designed by The Association of University Leaders for Sustainable Future (ULSF), while qualitative data were collected through a self-developed interview sheet. The collected information was analyzed using (SPSS). The integration of sustainability concepts in the traditional disciplines of HEIs was investigated through the implementation of the chi-square test. Qualitative data were analyzed using thematic analysis. Research findings reveal that it was hard to find any induction of separate content as Sustainable Development or Education for Sustainable Development, in addition to the unavailability of an introductory sustainability workbook as an initiative in national universities. The study revealed that a number of sustainability-related topics were included, yet not under the umbrella of the development goals. The study's findings suggest that traditional academia need to focus on the revision of their curricula to streamline their scheme of studies with the emerging notion of ESD to walk along the HEIs of the outer world in the race of attainment of sustainable development goals for present as well as future generations. Practically, this study may contribute to the revolution of prevailing curricula.

1. Introduction

During this transitional era, when technological advancement strikes its zenith and the focus of the world is shifting from only the degree accomplishment towards the knowledge acquisition, skills, and values development that is compatible with not only the economic and social aspects of the society but should be more compatible with the environment. The transition of humanity from tangibles towards intangible/soft skills which have been emphasized in the literature (Jamil & Muhammad, 2019; Naseer et al., 2022). It has increased the freedom from spatial restrictions with the emerging concept of virtual work, specifically during the Covid-19 pandemic. The worth of the paper (degree, certificate, diploma) is declining day by day, and the responsibility of the academia, particularly HEIs, to revise their curriculum so that their graduates become more congruent with the environment, society, and economy, the three dimensions of sustainable development, is emphasized (Bukhari et al., 2020). The contemporary position of academia, particularly HEIs, has transformed from their traditional responsibility of knowledge transfer to information generation, leadership development, impact demonstration, and cross-sectoral leadership promotion because of the novel conception of sustainable development (SDSN, 2023).

Quality education is a prime concern for universal educational agencies to foster Sustainable Development (SD). The idea of SD emerged from the increasing global attention to ensure the preservation of the natural environment (Nevin, 2008). This concept was first defined by the Brundtland Commission in 1987. Development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs (Brundtland et al., 1987). UNESCO, as the leading agency for the promotion of sustainable development on the planet, interpreted ESD as enabling learners with awareness, abilities, ethics, and approaches to take thoughtful decisions and make responsible actions for ecological integrity, economic practicality, and a just society (Rieckmann, 2017). Furthermore, ESD encompasses all academic conceptualization policies and actions required to promote SD holistically from the individual to the community level while supporting the pathway towards the green side of the human development index and carbon footprint model(Tawil & Locatelli, 2015).

Seeing through the window of the ESD policymakers of the global educational leading agencies (UNESCO, SDSN, MESA, IAU, ULSF) focusing on the reorientation of curriculum to address global challenges and sustainability, curriculum is one of the key components of educational system as a vital change driver in a society. Curriculum plays a key role in the effectiveness and development of higher education (International Association of Universities [IAU], 2023) . Curricula in HEIs need more attention towards the learning process along with outcomes that should have provisions for creativity, innovation, sustainability, and learner's relevancy (Bovill, 2017; Bron, 2016; Knight, 2001). The literature also highlights the significance of academia for the promotion of sustainability in society by indicating the number of global actions taken by HEIs in advanced nations and UN agencies implementing the SD in curriculum and academic research, collaborator engagement, and campus operations in higher educational institutions (Ramos, 2015).

1.1 Research Objectives

1. To evaluate the extent to which sustainability concepts are incorporated into the curricula of traditional academic disciplines in Pakistani Higher Education Institutions (HEIs).
2. To assess the availability of dedicated Education for Sustainable Development (ESD) courses and introductory sustainability workbooks in Pakistani universities.
3. To examine the integration of specific sustainability challenges (including clean water, energy crises, biodiversity protection, and environmental degradation) within traditional academic disciplines.
4. To compare the status of sustainability integration across different universities and departments in Pakistan.
5. To identify gaps and opportunities for enhancing ESD implementation in Pakistani higher education curricula.

2. Literature Review

Advanced nations have developed and inducted sustainability schemes in higher education. Since the beginning of the new millennium, American higher education institutions have been developing courses that incorporate sustainability concepts into traditional disciplines (Calder & Dautremont-Smith, 2009). An increasing number of programs in the disciplines of agriculture, education, and business in several institutions around the country are being introduced (Deutsch, 2007)**.** Surveys and rankings in business and management science show a number of innovative programs in the Master of Business Administration that incorporate social and environmental dimensions in curriculum and research (Calder & Dautremont-Smith, 2009). Some HEIs in Sweden have integrated sustainability courses and programs (G. Finnveden, 2020). The development of sustainability-related curricula in the discipline of Information and Communication Technology (ICT), such as Foundations of Green IT, Engineering, Technologies of Green Communication, Technologies of Green Regulators, and Robotics under the framework of Green Projects, has been implemented in Russian and Ukrainian universities. Green skills have been also explored in literature (Pirzada et al., 2023). Moreover, a wide range of sustainability courses along with basic subjects in the discipline of mechanical and environmental informatics are also offered by Tokyo University of Technology (Klimova, 2017). The integration of labor/environmental rights, human rights, and corruption in the discipline of Commercial Law; Social Development, Peace and Wealth Distribution in Economic History; Health Issues and Social Aspects of Social Economy in Economics; Smart IT solutions that realize “green” in their operations in Informatics; and Business ethics and Corporate Social Responsibility (CSR) in the field of Business Administration has been seen in the scheme of studies of the Central University of Sweden (Macheridis & Paulsson, 2021).

Recently, while Pakistan has gained a key political, strategic, and geographical position on the world map and is striving towards economic stability and sustainability among the global economic community, the national academia and educational system are grasping a key role as a nursery of future leaders, economists, scientists, technologists, and teachers. Furthermore, the consideration of education as a vital pillar of society in the nation-building process is possible

only through a single educational system for every learner of any socioeconomic class with a similar curriculum, instructional medium, and the same evaluation strategies common for all of them (Abbas et al., 2022). Moreover, learners from every corner of society have impartial probabilities of receiving high-quality education. Pakistani educational institutions have captured the attention of the previous government. In 2018, the government's agenda was to launch a series of educational reforms to rectify discrimination in society (Tayyab et al., 2022). The Ministry of Federal Education was focusing on streamlining the Pakistani Educational system with the innovative notion of Education for Sustainable Development from a global perspective. The Single National Curriculum implemented by the state from primary to secondary school education reveals the efforts of the government to align the education system with the goals and targets of SDG-4.

However, an insight into the literature reveals that the status of sustainability in Pakistan is still in the first step of the SD ladder. This is poorly documented, and a lack of due attention has been observed in higher education institutions. HEIs must focus on implementing ESD in their curricula.

3. Research Methodology

A mixed method design was adopted to evaluate the level of incorporation of sustainability topics into traditional disciplines at degree awarding institutions in Pakistan. The population consisted of students in the 7^{th} and 8^{th} semesters of BS and scholars of M.Phil. and Ph.D. have completed their coursework in physics, chemistry, biological and environmental sciences, agriculture, economics, and management sciences departments of the top five universities in metropolitan cities of Pakistan. Five students from BS, M.Phil. and Ph.D. were selected as the sample of the study from the above-mentioned departments of QAU, PU, COMSATS, KU, and PMAAU, respectively, which constitute the total sample size of 525. The instrument was shared with the respondents by visiting the sampled universities all over Pakistan as well as by generating and sharing a Google form through different social media platforms such as WhatsApp groups, Facebook, and Instagram. Only 344 out of 525 questionnaires were returned by the respondents, exhibiting a response rate of 65%. The major reason for this ratio was the sudden outburst of the COVID-19 pandemic.

Quantitative data were collected by adapting a sustainability questionnaire from the students and scholars of the sampled universities designed by the Association of University Leaders for Sustainable Future (ULSF). The selection of the tool was done after validation and calculation of Cronbach's alpha for data collection. The tool was reliable, as the alpha values were higher than 0.7 for each item, exhibiting internal consistency. For qualitative data collection, an unstructured interview sheet was developed and after validation from expert opinions taken from five experts in applied sciences, economics, management sciences, and education departments of K.U, Iqra University, and I.U.B instruments were selected to gather information from VCs, ORIC & Q.E.C directors, and chairpersons of the above-mentioned departments of sampled universities.

4. Findings of the Study

The table1 illustrates the respondents' opinions from different universities about the extent to which a separate course on ESD was introduced. The chi-square test results (df = 12, N = 344, $\chi 2 = 22.430$, $p = 0.033 < 0.05$) indicate a moderately statistically significant difference among the participants' opinions from the sampled universities about the initiation of any subject matter regarding ESD in their institution.

Table 1: Induction of Course Dedicated as ESD in HEIs

Chi.Sq	Df	p-value
22.430	12	.033

Table No 2: Induction of Course Dedicated as ESD in HEIs

Universities	Induction of Separate Course as ESD				Total
	Don't Know	No	Little Bit	Adequate	
QAU	23%	50%	13%	13%	100%
PU	31%	64%	3%	2%	100%
COMSATS	29%	51%	7%	13%	100%
KU	16%	54%	20%	10%	100%
AAUR	29%	50%	14%	8%	100%
Total	25%	54%	13%	9%	100%

The table 2 portrays a deep insight into students' opinions regarding the initiatives taken by universities to introduce any course as "ESD." It reveals that out of 344 respondents (54%), the majority from all the universities negate the introduction of any kind of independent course or program of studies relating to ESD. The second largest population of respondents (25%) were unaware of the induction of ESD in their institution in all the universities except KU. However, a small percentage of the student communities of KU and QAUI (20% and 13%, respectively) argued that their institutes should introduce independent courses on ESD. Only a few participants from COMSATS and AAUR (13% and 08%, respectively) discussed the presence of any ESD course in their universities.

Table No 3: Publication of Introductory Sustainability Workbook

Chi.Sq	df	p-value
16.683	12	.162

Table 4: Publication of Introductory Sustainability Workbook

Universities	Publication of Introductory Sustainability Workbook				Total
	Don't Know	No	Little Bit	Adequate	
QAU	30%	58%	6%	5%	
PU	20%	50%	10%	19%	
COMSATS	13%	60%	13%	13%	
KU	17%	58%	10%	14%	
AAUR	11%	57%	7%	23%	
Total	18%	57%	9%	14%	100%

The table 3 illustrates the status of national academia regarding the publication of introductory sustainability workbooks in advanced countries. The Pearson Chi-Square statistics χ 2 (df = 12, N = 344, χ2 = 16.683, P = 0.162 > 0.05) revealed that there is an insignificant difference among the opinion of the respondents from different universities as the p-value (0.162) exceeds the chosen value of α (0.05).

The table 4 shows that the majority of the audience from all the visited universities (57%) believed that there was no introductory sustainability workbook in their institutions. The second highest majority of the respondents (18%) showed their unawareness about such kind of any book by clicking on the option of don't know.

Table No 5: University considerations about Sustainability problems

Items	Chi.Sq	df	p-value
Clean water	67.351	12	.000
Energy Crises	22.573	12	.032
Biodiversity Protection	35.329	12	.000
Sustainable Seed Varieties & Local Food Production	67.306	12	.000
Environmental Degradation	57.795	12	.000
Use of 3-R Principal like Reduce, Reuse, Recycle	21.181	12	.048

The above table displays the situation of Pakistani academia in the higher educational sector regarding the integration of sustainability issues, such as safe drinking water (Goal 6 of the SDGs), energy crises, biodiversity protection, plant protection, environmental degradation (Goal 13), local production of food and sustainable seed varieties, and the use of the 3-R principle in physical, chemical, biological, and environmental sciences. The χ2 statistics for clean water, biodiversity protection, local food production and sustainable seed varieties, and environmental degradation (χ2 = 67.351, 35.329, 67.306, 57.795, p = 0.000 < 0.05) implied that there is a highly statistically significant difference among the opinions of the respondents of the five different universities, as the p-values for all of them are less than the chosen value of α (0.05). However, the values for energy crises and the 3-R Principal (p = 0.032, 0.048) revealed a moderate statistically significant difference in the audience's opinions among the sampled HEIs.

Table No 6: University considerations about Sustainability problems

Universities	**Clean Water**				**Total**
	Don't Know	**No**	**Little Bit**	**Adequate**	
QAU	10%	8%	22%	60%	
PU	12%	3%	26%	59%	
COMSATS	13%	10%	17%	59%	
KU	9%	13%	29%	50%	
AAUR	4%	60%	19%	25%	
Total	10%	16%	23%	51%	100%
Universities	**Energy Crises**				**Total**
	Don't Know	No	Little Bit	Adequate	
QAU	13%	13%	31%	42%	
PU	39%	10%	27%	22%	
COMSATS	20%	12%	26%	42%	

KU	19%	18%	34%	29%	
AAUR	15%	12%	29%	44%	
Total	21%	13%	30%	35%	100%
Biodiversity Protection					
QAU	5%	22%	33%	40%	
PU	19%	12%	50%	19%	
COMSATS	7%	16%	51%	26%	
KU	11%	34%	41%	14%	
AAUR	6%	19%	56%	19%	
Total	10%	22%	45%	23%	100%

The table 6 reveals that the majority of the audience from all the universities, except AAUR, agreed on the inclusion of the major sustainability issue of safe drinking water in their curricula, while the majority of the AAUR respondents did not show agreement with the statement. Similarly, the majority from QAU, COMSATS, and AAUR seem to be satisfied with the adequate integration of topics dealing with energy crises, contrary to PU, where the major population remains unaware, and KU, where the highest number thought that a little attention was paid to energy crisis-related content in curricula.

Table No 7: Biodiversity protection of universities

Universities	**Sustainable Seed Varieties & Local Food Production**				**Total**
	Don't Know	No	Little Bit	Adequate	
QAUI	37%	37%	15%	12%	
PU	22%	17%	24%	36%	
COMSATS	9%	12%	35%	45%	
KU	16%	16%	29%	39%	
AAUR	14%	6%	12%	69%	
Total	19%	17%	24%	40%	100%
Environmental Degradation					
QAUI	7%	22%	25%	47%	
PU	21%	24%	21%	35%	
COMSATS	4%	23%	26%	46%	
KU	11%	27%	52%	11%	
AAUR	6%	17%	25%	52%	
Total	10%	23%	33%	34%	100%
Use of 3-R Principal Reduce, Reuse, Recycle					
QAUI	17%	15%	22%	47%	
PU	14%	19%	26%	41%	
COMSATS	12%	23%	36%	29%	
KU	11%	10%	17%	53%	
AAUR	8%	6%	37%	50%	
Total	12%	14%	29%	45%	100%

Regarding biodiversity protection, only QAU appears to be satisfied by selecting “Adequate” while the rest of the universities thought that a little focus was given to the

problem. However, for sustainable seed varieties, all the universities, major not all participants, click adequate except QAU, where the majority reflect unawareness and denial in their responses. Similarly, most universities agreed on the adequate insertion of topics for environmental degradation, except for KU, in contrast to the use of the 3-R principle, where HEIs seem to be satisfied, except for COMSATS.

Table No 8: The degree of inclusion of major global sustainability problems

Items	Chi.Sq	Df	p-value
Global Warming	23.264	12	.026
Resource Depletion	27.419	12	.007
Poverty Alleviation	65.862	12	.000

P- statistics ($p = 0.026, 0.007 \& 0.000 < 0.05$) elucidate highly statistically significant difference among the universities for the incorporation of global warming, resource depletion & poverty alleviation respectively. Contingency Table 4.2 reveals deep insight into the difference of opinion among the audience of the five top-ranked universities regarding the degree of integration of crucial sustainability issues of the era.

Table No 9: The degree of inclusion of major global sustainability problems

Universities	Global Warming				Total
	Don't Know	No	Little Bit	Adequate	
QAUI	13%	17%	37%	33%	
PU	7%	16%	21%	57%	
COMSATS	9%	15%	29%	48%	
KU	15%	22%	28%	35%	
AAUR	2%	8%	31%	60%	
Total	10%	16%	29%	45%	100%
	Resource Depletion				
QAUI	23%	10%	18%	48%	
PU	17%	12%	10%	60%	
COMSATS	31%	10%	9%	49%	
KU	10%	9%	20%	62%	
AAUR	14%	2%	10%	75%	
Total	18%	9%	14%	58%	100%
Universities	**Poverty Elevation**				Total
	Don't Know	No	Little Bit	Adequate	
QAUI	17%	13%	25%	45%	
PU	29%	16%	10%	45%	
COMSATS	33%	13%	15%	39%	
KU	5%	20%	43%	32%	
AAUR	4%	21%	14%	62%	
Total	17%	17%	24%	42%	100%

The above table reveals that the majority of respondents from almost all the HEIs, except QAUI, showed their consensus about the adequate assimilation of global warming,

whereas the majority from all visited universities were satisfied with resource depletion, and for poverty elevation, except KU, all seemed to be satisfied.

4.1 Qualitative Findings

It was inferred that the majority of the academicians concurred on the missing "ESD" in their institutional scheme of study in HEIs that support students' opinions regarding the fact. One school of thought states categorically that curriculum development is a complex mechanism; hence, we still do not have any proper course regarding sustainable development. Some others claimed that as HEIs follow the content outline provided by HEC, there is no program of study regarding ESD introduced by higher education commission.

Although ESD has not yet been introduced in national academia, a number of topics are being taught in different departments of applied and management sciences as well as economics addressing sustainable development goals but without any deliberate effort by the HEC and HEIs. Topics such as life below water, biodiversity conservation, biofuels, ecological conservation, wetland management, wildlife management, predictive mapping for quality water, biosafety, bioethics in biological sciences, green chemistry, aqua solvent, environmental biochemistry, water conservation and recycling, problems of present industry, energy and environmental engineering, renewable energy systems, air and water pollution control, sustainable engineering in chemical sciences, water resources, sustainability and modeling, condensed matter physics, sustainable energy development, nanotechnology, renewable energy resources, wind, solar and ocean energy in physical sciences, plant pathology, sustainable farming, agri-business, agro-environment, agricultural pollution management, and agricultural economics in the discipline of agriculture are the themes that may cover the sustainable aspects that fall under the framework of 17SDGs. Furthermore, the Faculty of Economics and Management Sciences also accepted the ignorance of academia regarding ESD in their curricula; however, they perceived that the subjects of environmental economics, developmental economics, business ethics, corporate governance, public policy, agricultural economics, human resource development, corporate finance, inclusive economic growth, sustainable tourism, CSR, operation management, supply chain management, and global marketing activity and how societal marketing is developed, seem to be addressing some global goals. However, there exists another school of thought among academicians who are against the immediate insertion of any kind of concepts regarding sustainability in the curricula of their respective departments, specifically, and in national academia at large.

The installation of any introductory sustainability workbook in national academia, as in advanced nations such as France, to empower the youth to deal with sustainability challenges holistically is lacking. Regardless of the current status, academia has future plans and paperwork for the inculcation of subject matter addressing SDGs in existing curricula but is uncertain about the time span because of the complexity, formality, and length of the course developmental procedure.

4.2 Discussion

The study reveals that, despite the global emphasis on integrating sustainability into higher education, Pakistani universities have made limited progress. While some sustainability-

related topics exist within disciplines such as environmental science and economics, they are not framed within the broader context of Sustainable Development Goals (SDGs). Dedicated courses, introductory modules, and structured efforts for Education for Sustainable Development (ESD) are largely absent. This aligns with the findings of Bukhari et al. (2020), who noted that curricula in Pakistan often lack a focus on the environmental, social, and economic dimensions of sustainability. In contrast, universities in countries such as Sweden, Russia, and Japan have integrated sustainability concepts into traditional disciplines through formal coursework and policy frameworks (Finnveden, 2020; Klimova, 2017; Macheridis & Paulsson, 2021). For Pakistan to align with global standards, HEIs must prioritize curriculum reforms and faculty development that focus on ESD. As UNESCO (2023) emphasizes, the curriculum is a vital tool for equipping students with the knowledge and values needed to address global challenges and promote a sustainable future.

5. Conclusions

To promote Education for Sustainable Development (ESD) in higher education, this study assessed the integration of sustainability concepts into existing curricula in Pakistani universities. The findings reveal a significant gap: most Higher Education Institutions (HEIs) in Pakistan lack the proper inclusion of sustainability across environmental, economic, and social dimensions. For instance, only about 5% of the B.Ed. curriculum addresses ESD (Kalsoom et al., 2019), and technology education curricula largely ignore sustainability, except in a few institutions.

Although universities often reference sustainable development, its practical implementation lags behind that in both developed and developing countries. No dedicated ESD courses exist in the national academia, and awareness among students, scholars, and faculty is limited. Despite some scattered topics on sustainability being taught, the overall integration of sustainability education is insufficient.

The study concludes that universities can influence society in two key ways: by educating individuals and participating in governance. Thus, HEIs are vital in advancing sustainable development. However, this role demands focused integration and implementation of ESD within curricula—especially in applied sciences, economics, agriculture, and management—to ensure a broader national and global societal impact.

5.1 Recommendations

1. Pakistani HEIs may integrate Education for Sustainable Development (ESD) into their curricula by introducing dedicated courses and aligning existing content with the Sustainable Development Goals (SDGs).
2. Faculty development programs and national policy support are essential for ensuring the effective implementation and institutionalization of sustainability in higher education.

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