

Sustainable Development through Research and Higher Education in India

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Abstract Sustainable development based research and education is the back bone of a nation. Moreover, sustainable development policies highlight the role of education which has become the need of the day to create the awareness among the students, researchers and teachers as well as in local communities for environment protection. The present paper gives an overview regarding the role of research and higher education in the development of a country in sustainable manner. Attempts have also been made to summarise the status of higher education system in the country and various national and state funding agencies which are working for the R & D programmes in the country.

Keywords: sustainable development, research, Higher education, India

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1. Introduction

Sustainable development is a process which involves human's intelligence, decision making efficiency, planning and management skills, power of imagination, entrepreneurship, development and production with environmental safety etc. Usually, sustainable development is a human subject. The issue associated with sustainable development can be seen as one of the basics of any society. Therefore, so far its major field of concern has been for the environment, but its applicability has been extended to wrap almost each human attempt. The discussion is a principal element in education for sustainable development. Environmental education is the fundamental education to study the sustainable development. In other words environmental education can be able to make a path for education for sustainable development. Any researcher who is working for education for sustainable development can support the mode of life explained by value based interpretation of sustainable development. In the last decade, the education for sustainable development has been accepted as a main policy which is the utmost need of the day for each state or country. Moreover, the sustainable development has gained the due attention on international forum not only by researchers or environmentalists but also by the chiefs of several countries.

Initially sustainable development was discussed globally in UN Conference on Human Environment Stockholm in 1972. After that in 1987 UN World Commission on Environment and Development published a report on "Our Common Future" which was also popularised as Brundtland Report then concern for a sustainable development was came into consideration. In

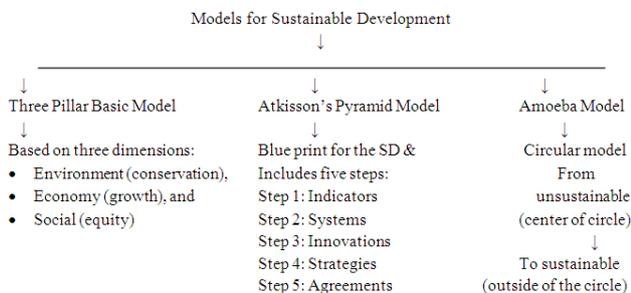
UN Earth Summit 1992, which was held in Rio de Janeiro, Brazil, a conscious thought was emerged for environmental problems along with solutions to resolve the problems and the requirement of a multidisciplinary approach was recognised. Again in 2000, the chief of various countries gathered to discuss the issue of environment conservation under the umbrella of UN. After Johannesburg conference in 2002 on sustainable development, 2005–2014 was declared as "Decade for Education for Sustainable Development (DESD)" by UN General Assembly accepting the significance of Education for Sustainable Development [1].

Sustainable development is a pattern of using natural resources in such a way which provides regular individual requirements considering the preservation of the environment for coming generations. After Brundtland Report sustainable development was defined as "Sustainable development is the development which meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. After Rio Earth Summit 1992, the role of education to avoid the ecological degradation was accepted as a result of Rio Declaration on Environment and development.

Education for Sustainable Development is an idea of education which aims to empower the individuals to assume liability to build a sustainable future. The thought of sustainable development touches aspects of the institutional and social framework. There has been increasing identification of the significant role of education in promoting sustainable development since 1992 Earth Summit in Rio de Janeiro. However, any individuals or organizations do not have all the knowledge to develop learning systems which are essential to maintain sustainable development in the specific surroundings [2,3].

2. Models for Sustainable Development

The correlation among economy, ecology and equality can be useful to develop a sustainable society. Some models are very much helpful to understand the concept of sustainability by gathering, sharing and analysis of the data. Three important models have been reported to recognize the sustainable development [4].



The multidimensional sustainable development indicators (MSDI) which hold the linkage among the economy of a community, environment, and society are given herein [4]:

MSDI	→	<ol style="list-style-type: none"> 1. Gross National Happiness (GNH): The four pillars of GNH <ol style="list-style-type: none"> (i) Sustainable socio-economic development promotion (ii) Conservation and promotion of cultural values (iii) Environmental conservation (iv) Good governance 2. Human Development Index (HDI): Measurement of <ol style="list-style-type: none"> (i) Life expectancy (ii) Literacy and education (iii) Standard of living 3. Ecological Footprint (EF): Comparison of human consumption of natural resources with Earth's ecological capacity to rejuvenate them 4. Happy Planet Index (HPI): An innovative measure of human well-being and environmental impact
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3. Challenges for Sustainable Development

Now-a-days sustainable development has become a key issue at state, national and international level concerning education policy since last decade. Various stakeholders recognize the sustainable development in different ways and search for different outcomes. There are some specific challenges in the implementation of sustainable development in higher education and can be understood as:

1. Lack or poor communication skills in higher educational institutes for the term sustainable development and also in its application.
2. Lack of trained professionals in higher educational institutes.
3. Requirement of inter-disciplinary research in sustainable development manner.
4. Collaboration, networking and coordination among different educational institutes.

While on the other hand, seven types of sustainability have been reported which would be necessary in research for sustainable development as given below [5]:

- i. Biological sustainability.
- ii. Environmental sustainability.
- iii. Social sustainability.
- iv. Cultural sustainability.
- v. Political sustainability.
- vi. Economic sustainability.

vii. Moral-spiritual sustainability.

4. Objectives of Higher Education Regarding Sustainable Development.

In the area of higher education, the research programme should be influenced by striving for sustainability. The objectives of higher education are to discover new tools to deal with big problems such as pollution, climate change, energy, biodiversity, environment conservation etc. The responsibility of higher educational institutions is to develop new methods and new approaches to explain the sustainability to everyone. Sustainability is a superb issue to bring together several different disciplines.

The role of higher education for sustainable development in different educational institutes is very important and should be focussed for the following objectives [6].

1. To recognize and follow the excellent case studies in higher educational institutes.
2. To build a clear vision of teaching and research in higher education for sustainable development.
3. To educate the decision makers and students about the hazardous aspects of current development.
4. Dissemination of knowledge of alternative paths of sustainable development through higher education.

According to UN, the main aim of education for sustainable development is to cover economic, socio-cultural and ecological aspects considering the global dimensions. The challenges which are value-based interpretation of sustainable development are required to represent with more emphasize. However, it is difficult to integrate the various aspects of sustainable development into higher education syllabus in the light of value-based interpretation. But, it may be simple after following the relevant professional practices and incorporating the ecological, economic, social and cultural elements of sustainable development in to research and teaching of higher education professionals [1].

5. Strategies to be Adopted for Sustainable Development in Higher Education

Some important strategies are necessary which should be adopted for the promotion of education of Sustainable Development in Higher Education system and can be described as below:

1. Analyse on the basis Questionnaire of sustainable development obtained from participants
2. Need of national coordination and supporting networks
3. Dissemination of policies and case studies outcomes
4. Capacity building in teaching professionals and students
5. Identify the leadership and award the good professionals

6. Higher Education for Sustainable Development

According to a general opinion the challenge of sustainable development should be taken up as an opportunity for the development of research and teaching as a necessary element. The education for sustainable development empowers the students and provides the direction for their mindset and aware for a sustainable future. Education for sustainable development is significant aspect of quality of education and it forms foundation of sustainable development and highlights the difficulties and interrelation of society, environment and economy of the country. Environmental education for sustainable development in higher educational institutes is very helpful to prepare a cadre of environmentalists who can promote it further by post graduate and research scholars and finally output may be useful for the government. There should be an interrelationship between technology and economic development. Moreover, the research in higher educational institutes should be field based. Besides, workshops, seminars and training programmes on sustainable development should be organized for college and university faculties and also for students to prepare a group of experts [7,8].

Today 20 years has been passed when Earth Summit was held at Rio de Janeiro in 1992 to consider the issues of sustainable development and after that Rio+20 has also been organized in 2012 for sustainable development. According to the Census 2011, the literacy rate is rising constantly and is estimated 82.14% for men and 65.46 percent for women. The National Environment Policy, 2006 of India represents the country's commitment to a clean environment in all development activities. The execution of policies with financial provisions possesses a key role during Five Year Plan. Some of the environmental challenges like deterioration of environmental quality, climate change and depletion of natural resources are emerging day by day rapidly. India, as a part of United Nations, is devoted to recognize the global development goals. India has signed the United Nations Framework Convention on Climate Change (UNFCCC) and acceded to the Kyoto Protocol in 2002. Moreover, the country has also become a signatory to the Convention on Biological Diversity (CBD) in 1993. Besides, India has been selected as host under Thematic Programme Network (TPN) for the Asian Regional Action Programme on "Agroforestry and Soil Conservation" by United Nations Convention to Combat Desertification (UNCCD). India is achieving the major goals for sustainable development through its higher educational institutes. However, in this direction we have to adopt novel approaches for environmental regulation and principles for sustainable development considering the institutional role in critical areas. Finally, new tools and more decentralized approaches are required for the sustainable development with crucial role of educational institutes specially of higher education [9]. Many faculties are working within 4 regulatory bodies under MHRD such as UGC, AICTE, Distance Education Council (DEC) and Council of Architecture (CoA), which are also dedicated for the sustainable development through higher education courses.

6.1. University Grants Commission (UGC)

To co-ordinate and maintain the standard of University education, the University Grants Commission has been

established in 1953. UGC has initiated Faculty Recharge programme for augmenting Research and Teaching Resources of Universities and also promoting entrepreneurship and knowledge based enterprises. The mandate of UGC includes the determination and maintenance of teaching, examination, and research in Universities, working as a link between union and state governments and institutes of higher education, also advising the government either central or state to improve the higher education in the country. The statistics of educational institutes in the country up to 31 December 2010 is given in Table 1 [10].

Table 1. Statistics of educational institutes in the country up to 31 December 2010 [10]

University/Institute/College	No.
Central Universities	42
State Universities	261
Private Universities	73
Institutes of National Importance	33
Deemed to be University	130
Institutes established under state Legislation	05
Total No. of Universities	544
Colleges in Higher Education sector	31,324

Besides this, the technical education in the country is being provided by central government funded educational institutes, state government funded institutes and self-financed institutes. There were 79 central government assisted working institutes up to 2010-2011 as given in the Table 2 [10]. The figures of enrolled students, teachers in colleges and universities in different faculties during 2009-2010 and awarded Ph.D and M.Phil. Degree's during 2008-09 are given in Table 3 [11].

Table 2. Centrally funded Institutes for Technical and Science Education [10]

Institute Name	No.
National Institute of Technology (NIT)	30
Indian Institute of Management (IIM)	11
Indian Institute of Technology (IIT)	15
Indian Institute of Science (IISc)	1
Indian Institute of Science Education & Research (IISER)	5
Indian Institute of Information Technology (IIIT)	4
National Institutes of Technical Teachers Training & Research (NITTTR)	4
Others	9
Total	79

Table 3. Figures of enrolled students, teachers in colleges and universities during 2009-2010 and awarded Ph.D. and M.Phil. Degree's during 2008-09 [11]

(A) Total enrolled students (2009-2010)	146.25 lakh
Students in Art faculties	42 %
Students in Science faculties	19%
Students in Commerce faculties	18%
Students in Professional faculties	21%
(B) Teaching faculties in Universities and Colleges (2009-2010)	6.99 lakh (85.6 % in colleges and 14.4% in univ.)
(C) Ph.D. degrees awarded (2008-2009)	10,781 (Faculty of Arts 3496 Ph.D. Degrees & Faculty of Science with 3317 Ph.D. Degrees)
(D) M.Phil. degrees awarded (2008-2009)	8,525 (Faculty of Arts 3524 M.Phil. Degrees & Faculty of Science 2374 M.Phil. Degrees)

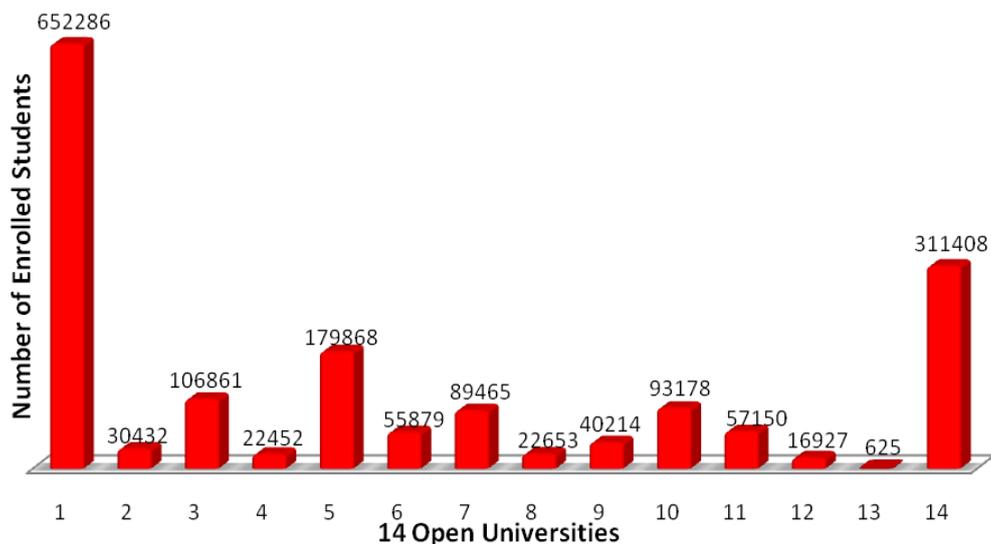


Figure 1. Students Enrolled in Open Universities of the Country in 2009-2010 year [12]

Table 4. Open Universities in the country [12]

Sr. No.	Name of Open University	Web Address
1	Indira Gandhi National Open University, New Delhi	http://www.ignou.ac.in/
2	Nalanda Open University, Patna, Bihar	http://www.nalandaopenuniversity.com/
3	Karnataka State Open University, Mysore, Karnataka	http://karnatakastateopenuniversity.in/
4	The Krishana Kanta Handiqui State Open University, Guwahati Assam	http://www.kksou.in/main/index.html
5	Dr. BR Ambedkar Open University, Hyderabad, Andhra Pradesh	http://www.braou.ac.in/
6	Vardhman Mahaveer Open University, Kota, Rajasthan	http://www.vmou.ac.in/
7	Dr Babasaheb Ambedkar Open University, Ahmedabad, Gujrat	http://www.baou.edu.in/
8	UP Rajarshi Tandon Open University, Allahabad, Uttar Pradesh	http://www.uprtou.ac.in/
9	Netaji Subhas Open University, Kolkata, West Bengal	http://wbnsou.ac.in/wbnsou/
10	Madhya Pradesh Bhoj Open University, Bhopal, Madhya Pradesh	http://www.bhojvirtualuniversity.com/#
11	Tamil Nadu Open University, Chennai, Tamil Nadu	http://www.tnou.ac.in/Home.aspx
12	Pt. Sunderlal Sharma Open University, Bilaspur, Chhattishgarh	http://www.pssou.ac.in/
13	Uttarakhand Open University, Haldwani, Uttarakhand	http://uou.ac.in/
14	Yashwantrao Chavan Maharashtra Open University, Nasik, Maharashtra	http://ycmou.digitaluniversity.ac/

6.2. Open Universities and Distance Education System

The distance education system has been started in the country with the establishment of Dr. BR Ambedkar Open University, Hyderabad in 1982. The total numbers of enrolled students were 1679398 during 2009-2010 year in various open universities of India as described in Figure 1 and their names are provided in Table 4, respectively. Besides this, 2107012 students were also enrolled in various Distance Education Institutions (DEIs) in dual mode Universities in 2009-2010 academic years [12]. Various courses including Environmental Sciences have been started by these Universities which will ultimately be served with the concept of sustainability. IGNOU, New Delhi and some state open universities have started the Research Programme in various disciplines.

7. Financial Assistance for Research and Higher Education

Indian higher education system possesses the 3rd rank in the world education system but the full economical benefits could not be achieved due to the mismatch between skill base and market needs. Establishment of NAAC is providing correct and positive symbols to generate and to promote awareness for the up gradation of quality of educational institutes, colleges and universities of India. Education is the backbone of a country. Higher education generally includes three stages or steps such as graduate, post graduate and doctoral programme. Besides this, higher education also includes technical, medical, engineering and other commercial degrees and diploma. Higher education plays a key role in preparing sustainable societies and holds the responsibilities to create the leadership in education system for sustainable development. The green concept in university and college campuses can be achieved by reducing the environment foot print, promoting the programmes for waste minimization through reduce, reuse and recycle (3 R) concept etc.

Research in higher education has an initial target to improve the quality as well as process of education. However, research is an essential and effective tool to lead a country towards the path of progress and prosperity. Therefore, the advanced research culture in higher education system is necessary to play an effective role in global competition.

Table 5. Ministries/Statutory bodies for Science and Technology promotion

Sr. No.	Ministries/Statutory bodies	Web address
1.	Ministry of Environment and Forest	http://envfor.nic.in/
2.	Ministry of Water Resources	http://wrmin.nic.in/
3.	Ministry of New & Renewable Energy	http://www.mnre.gov.in/
4.	Department of Scientific and Industrial Research	http://dsirwebsirhq.csir.res.in/webdsir/
5.	Council of Scientific & Industrial Research	http://www.csir.res.in
6.	Department of Science & Technology	http://www.dst.gov.in
7.	Department of Biotechnology	http://dbtindia.nic.in/index.asp
8.	University Grants Commission	http://www.ugc.ac.in/
9.	Indian Council of Agricultural Research	http://www.icar.org.in/
10.	Indian Council of Social Science Research	http://www.icsr.org/
11.	Indian Council for Cultural Relations	http://www.iccrindia.net/

Table 6. State Science & Technology Councils in India

Sr. No.	State Council Name	Web address
1.	Uttarakhand State Council for Science and Technology	http://www.ucost.in/
2.	Karnataka State Council for Science and Technology	http://kscst.org.in/
3.	Tamil Nadu State Council for Science and Technology	http://www.tanscst.nic.in/
4.	Andhra Pradesh Council of Science and Technology	http://www.apcost.gov.in/
5.	Madhya Pradesh Council of Science & Technology	http://mpcost.nic.in/
6.	Chhattisgarh Council of Science & Technology	http://cgcost.nic.in/
7.	Kerala State Council for Science Technology	www.kscste.kerala.gov.in/
8.	Gujarat Council on Science and Technology	http://dst.gujarat.gov.in/gcst.htm
9.	Punjab State Council for Science and Technology	http://pscst.gov.in/en/index.htm
10.	Sikkim State Council of Science & Technology	http://btisnet.gov.in/SubDicsscst.asp
11.	West Bengal State Council of Science and Technology	wbscst.org.in/
12.	Tripura State Council for Science and Technology	http://tscst.nic.in/index.html
13.	State Council for Science, Technology and Environment Himachal Pradesh	http://hpscste.nic.in/
14.	State Council of Science and Technology for Sikkim	www.sikenvs.nic.in

The funding agencies of the country are recognizing and promoting the emerging fields of research. Moreover, these councils or agencies are also encouraging the research in academics through the networking with other institutions and departments to open new windows of ideas. Some Indian ministries and statutory bodies are regularly providing the financial assistance to research and higher education through their programmes, projects in institutes, colleges and universities considering the concept of development with sustainability in the country (Table 5). Besides these organizations, State Science & Technology Councils are also providing funds to promote the research in higher educational institutes within the states (Table 6).

8. Research through Council of Scientific & Industrial Research Laboratories

CSIR is an autonomous body and a leading industrial R&D organization in India. It is working with a mission to provide scientific and industrial R&D which increases the economic, environmental and societal benefits for the people of India. Presently, CSIR has been recognised as one of the largest publicly funded organization of the world with its 37 international standard laboratories in the country. In the year of 2003 the Government of India has declared a new Science and Technology Policy which mainly focus on the requirement for examining social, economic and environmental consequences of S&T, emphasizes manpower build-up and advocates vitality in S&T governance by the participation of scientists and technologies.

9. Conclusion

After this brief survey on education and research in the country, it can be concluded that a lot of scientific programmes are being implemented by Govt. of India as well as state governments to promote the research and higher education standard. Since, the environmental protection has become an essential part of the curriculum of a country therefore national policies on environmental education have been made. Although departments of education and universities are able to expand the education for sustainable development but the network of several non government organizations (NGO's) can also participate to serve the purpose. Besides, education and research through distance learning can also be an option to strengthen ESD in higher education in the country.

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