

Sustainability perceptions in a technological institution of higher education in India

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Institutions of higher education serve as models for excellence in education. They also have an added responsibility in providing guidance to the community for social upliftment and environmental sustainability. The present study conducted in the Indian Institute of Technology Roorkee (IITR) examines the students' perception on the importance of sustainability to the campus. One hundred sixty-five students participated in the survey. The survey focuses on three broad categories, namely environmental, educational and research, and management factors. Environmental factors are more significant compared to management factors. Education and research is given less importance compared to environmental and management factors. Findings provide a useful extension to both the management and administrative strategies in decision-making process to improve the sustainability of the campus.

Keywords: Education and research, environmental parameters, green guidelines, management strategies.

SUSTAINABILITY as applicable to higher educational campuses is a process of developing and managing such campuses, through efficient use of renewable resources along with green practices¹. It is important to gauge the students' perception with regard to sustainability, within the immediate environment of a campus, so that they may be groomed to shoulder the responsibility towards achieving a sustainable environment. A clearer understanding of the need for sustainability and to some extent individual contribution towards a sustainable planet is increasing with the passing of time.

The present study analyses the students' perception on campus sustainability. To elicit this information, an on-line survey was conducted based on three broad categories, namely environmental, educational and research, and management factors.

Literature review

An adequate understanding of the concept of sustainability is important towards initiating, participating and advocating for appropriate sustainability behaviour. Sustainability perception differs from person to person^{2,3}. Young people have a strong affinity towards the environment and its problems⁴. They build up a social movement, which is known to operate outside the decision-making systems to both examine the status quo and

evolve their own solutions⁵. According to Wright⁶, the most restricting component in moving towards sustainability is lack of apprehension and awareness of sustainability issues amongst the university population. Universities are no more assessed solely based on their potential to provide quality instruction; rather, other factors and criteria, including their commitment to the advancement of society play a role in reflecting the true picture of a university⁷. Universities should involve a great number of stakeholders in sustainability activities and strategic preparation⁸. Campus community consists of potential leaders in the field of research, learning, teaching and sustainability and community engagement^{9,10}.

Studies have been conducted to understand the students' perception of sustainability, knowledge, attitudes and curricula^{11,12}. The University of Plymouth, UK conducted a survey on students ($n = 1889$) and the results showed that only one-third were either 'very familiar', or 'quite familiar', or 'quite unfamiliar/not at all familiar' with the term sustainable development¹³. Surveys were conducted at Universities in Alabama and Hawaii with the following objectives: (1) Are students concerned about the present/future? (2) What do students know about the sustainability? (3) Who is responsible for sustainability? Results of the study demonstrated that maximum number of students strongly agreed that they were responsible for the wasteful consumption of natural resources, but less than one-fourth of the respondents indicated that they know a great deal about sustainability and one-third indicated that they do not have experience about sustainability. Students strongly agreed that universities should focus on sustainability in campus planning, development and day-to day operations¹⁴. Yuan and

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Zuo¹⁵ carried out a survey ($n = 1134$) at the Shandong University in China, where bulk of students was aware of sustainability topics; they focused on environmental issues along with some social aspects. Earl *et al.*¹⁶ at Charleston College, USA ($n = 100$) showed that over half of the students had not heard of the term 'sustainable development'. Mostafa *et al.*¹⁷ at Sains University Malaysia in a survey on students' perception about a sustainable university found that students recommended four factors: (1) community outreach, (2) sustainability commitment and monitoring, (3) waste and energy, and (4) land use and planning as important for a sustainable campus. The present study aims to identify students' perception in Indian residential campuses.

Study area

The Indian Institute of Technology Roorkee (IITR) is one of the oldest engineering institutes in Asia. Earlier it was known as University of Roorkee (1948–2001) and Thomason College of Civil Engineering (1853–1948)^{18,19}. Total area of the campus is 365 acres. The Institute has a fully residential campuses with undergraduate (UG), postgraduate (PG) and Ph D programmes under 21 departments and 4 centres.

Sustainability profile of the institution

General practices in energy, water, waste, transportation, landscape and food are discussed, highlighting the sustainability initiatives. Bulk of the energy is being consumed for heating, cooling and in operating heavy machines in the laboratories. Alternative renewable energy resources like solar photovoltaic panels, solar water heaters are being used to generate energy. For saving energy, most of the existing fixtures have been substituted with compact fluorescent lights and energy star-rated devices.

Source of water for the entire campus is from tube wells. The water distribution system shows nine bore wells at different points. Water is lifted with the help of pumps to the nearby overhead water tanks and then distributed to the nearby areas.

Solid waste, including biodegradable and non-biodegradable waste, is gathered from various zones and then dumped in community bins and transported out of the campus. Food waste is used for feeding pigs in farms. Measures such as e-notices, providing limited stationary for printing and promoting both side printing are few initiatives adopted to reduce paper wastage.

The campus houses several departments, hostels, academic buildings and other supporting facilities. Total pedestrian area is 3.1 acres (0.8% of the entire area) and paved area is 50.70 acres (13.89% of the entire area). The institute has restricted the usage of motorized vehicles for UG (52%) and PG (30%) students, who constitute 82% of

the total student strength. Cycle rickshaws and electrical (battery-driven) vehicles are used to move around in the campus.

Open space in the campus is 78.50 acres, which is approximately 20% of the total campus area. Open spaces include managed green spaces, unmanaged green spaces and playgrounds. Many of the trees planted on the campus are endemic to the region. Avenue trees have flowering canopy. Various fruit-bearing trees like mango, jackfruit, black plums, mulberry, peach and lychee are also grown in the campus.

The campus serves as a habitat for rabbit, fox, snakes, peacock, vultures, mongoose, monitors and lizards. Increasing development activities in and around the campus have affected their habitat. However a few species like vultures, snakes, rabbits, mongoose and various species of birds are observed in the campus.

All hostels have their own mess and canteen. The institution has its own dairy, which supplies milk to all the hostels and other residential blocks.

Research methods

An on-line survey was conducted to analyse students' perception on sustainability. The survey link was published on e-notice of the institution, which made the questionnaire accessible to the entire student population.

Survey questions and methods

An on-line web questionnaire was developed in 2012. Questions included factors related to environmental, educational and research, and management strategies. The survey consisted of four sections (A–D). Section A explores the importance of campus sustainability. Section B evaluates the awareness of sustainability factors and their importance to campus sustainability. Section C establishes the interest of the students in participating in sustainability activities, if an extra stipend is paid. Section D lists few sustainability activities followed by open-ended questions to elicit a fuller expression of student views.

Respondents profile

Majority of the respondents are UG students. The third and final year students participated more than the first

Table 1. Number of respondents of the survey

Gender	F	Percentage	Programme	F	Percentage
Male	140	86	UG	85	52
Female	25	14	PG	45	27
<i>n</i>	165		Ph D	35	21

F, Number of students who responded.

Table 2. Survey results of part A

	Extremely important	Very important	Do not know	Somewhat important	Not at all important
Part A: How important is campus sustainability					
Male (%)	49	47	0	5	0
Female (%)	59	41	0	0	0
UG (%)	42	54	0	4	0
PG (%)	63	31	0	8	0
Ph D (%)	67	33	0	0	0

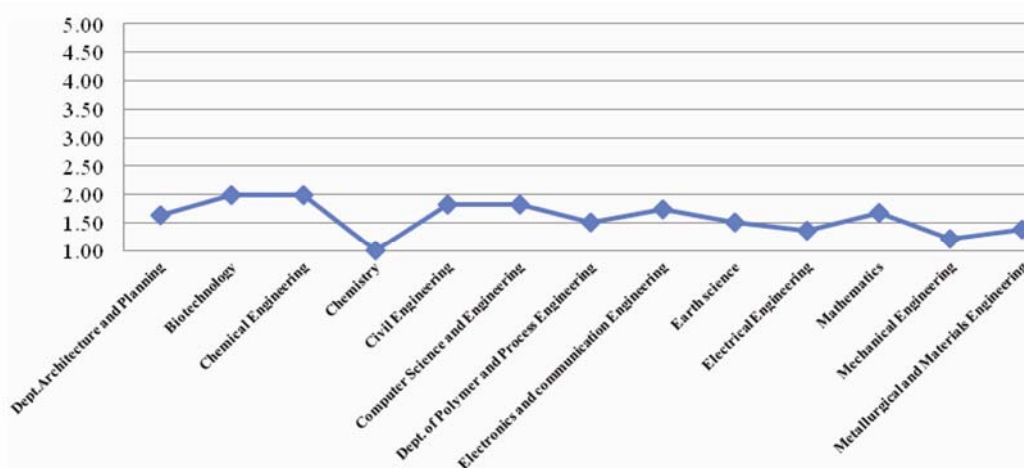


Figure 1. Cross-departmental comparison of responses.

and second year UG students (Table 1). Female participants were less in number compared to male students. Maximum responses received were from students of electrical and mechanical engineering departments followed by departments like architecture and planning, computer sciences, civil engineering and earth sciences.

Discussions and implications

Students are aware of sustainability factors and their importance. However, the total number of students who participated voluntarily was less (5.41%). Therefore, we need to enhance the awareness amongst students with regard to sustainability issues and their importance. Part A of the survey results shows that more than 90% of students agree that campus sustainability is either extremely important or very important (Table 2). Only a small fraction of the total respondents has an opinion that the sustainability is somewhat important.

The responses were measured on a five-point Likert scale ranging from 1 for extremely important to 5 for not at all important. The mean value was calculated; lower the value higher is the ranking. Cross-departmental comparison shows that students of chemistry department give relatively greater importance to campus sustainability than the others (Figure 1).

Part B of the survey was based on the environmental factors, education and research, and management strate-

gies. All questions were mixed to avoid bias. The results show that environmental factors are still a major concern for the students, rather than the factors like training programmes and green certificates. Under environmental factors, practices under waste and conservation of energy and water are important. Sustainable landscaping and green food are given relatively less importance. This indicates that students are more concerned about their immediate environment. Management systems obtained a reasonable level of attention from the students. Students perceive that financial support from the management for sustainability projects will be more beneficial to implement new projects. Purchasing recycled and green products will have a greater impact on achieving the sustainability targets. For instance, internal and external funds motivate society to conduct sustainability research²⁰. Students feel that management strategies like conducting training programmes for staff and faculty will help improve the sustainability awareness. It is interesting to note that students feel that the management can even involve them in campus sustainability projects and practices. Relatively less importance is given to factors like sustainability-related courses, green degrees and certificate, which shows that students are more interested in participating in sustainability activities.

Most students opine that if an extra stipend is paid, they will be more involved in sustainability activities. Students are interested in associating themselves with

Table 3. Survey results of parts B–D

		A	B	C	D	E
E	Sustainability factors					
E1	Constructing a green building (%)	63	24	2	10	1
E2	Giving priority for green food (locally grown and organically grown food) (%)	40	34	2	21	3
E3	Undertaking conservation measures by providing solar panels, CFLs, conducting energy audits (%)	71	24	1	4	0
E4	Reducing, reusing and recycling of waste available within the campus (%)	74	22	0	3	1
E5	Sustainable transportation practices (car-pooling, public transport, use of bicycles, walking and battery vehicles) (%)	60	26	1	12	2
E6	Water conservation practices (water metering, waterless urinals, etc.) (%)	66	27	0	4	3
E7	Wastewater management practices (recycle/reuse) (%)	62	30	0	6	2
E8	Sustainable landscaping (%)	31	41	9	18	1
E9	Use of renewable energy resources for generating energy (%)	58	32	1	7	2
R	Education and research					
R1	Continuing training programme, informative courses on renewable resources like solar, wind, geothermal (%)	29	42	2	25	2
R2	Providing green degrees and certificates (%)	17	36	9	36	2
M	Management systems					
M1	Financial support for sustainable practices (%)	50	37	2	10	2
M2	Partnering with local community/business for the purpose of broader sustainability practices (%)	35	42	7	14	2
M3	Giving preference for sustainability issues, policies and allotting funds for them (%)	38	42	6	14	0
M4	Involving students in green camps/practices (%)	49	38	1	10	2
M5	Providing student, faculty and staff training (%)	50	31	2	17	1
M6	Implementing green purchasing policies (recycle paper products, green products, etc.) (%)	64	28	1	6	1

A, Extremely important; B, Very important; C, Do not know; D, Somewhat important; E, Not at all important.

	Do not have interest	Low	Average	Above average	High
Part C: If an extra stipend is given for involvement in sustainability activities, how willing are you to work (%)	1	4	14	42	39
Part D: What do you think you can do for your campus to make it more sustainable					
Actively participate in green initiatives at campus or in the community (%)					36
Already doing many things/continue to do those things (%)					11
Participate in waste management practices (%)					25
Reduce consumption (%)					17
Take or teach green courses (%)					8
Use green transportation (%)					3

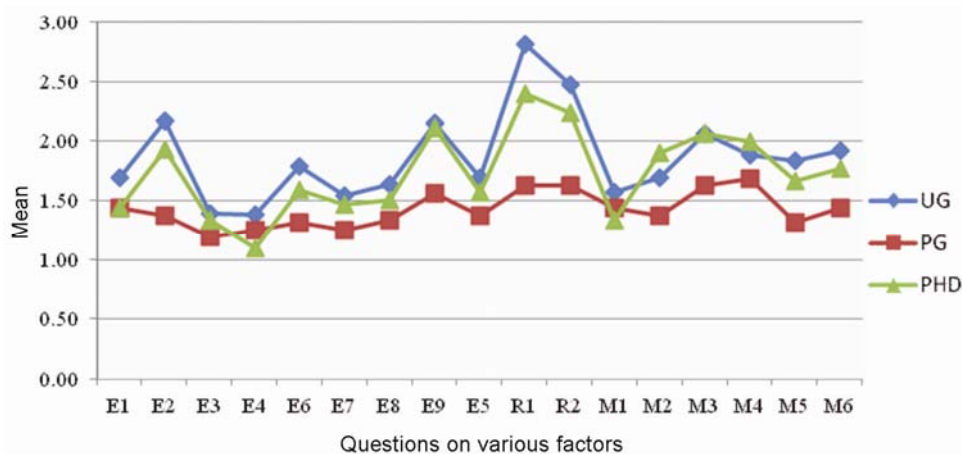


Figure 2. UG, PG and Ph D students' responses for Part B.

waste management practices than participating in teaching programmes (Table 3). Maximum number of students are interested in green initiatives and waste management

activities. Very few students are interested to participate in teaching programmes and transportation-related activities.

Female students shared a similar opinion on various sustainability parameters. Both male and female students give a maximum importance to factors like green buildings, energy, water and waste conservation practices than transportation and other factors. UG and PG students gave maximum importance to energy conservation measures and Ph D students emphasized more on reducing, reusing and recycling of waste. Less importance is given

to the education factors compared with the environmental factors. Management strategies are also emphasized to improve campus sustainability (Figure 2).

Based on the relative importance of all three factors, Table 4 provides the overall ranking. Environmental parameters are given more importance along with a few management factors. Education and research related to sustainability is given less importance compared with the

Table 4. Ranking of various factors according to the students' perception – IITR

		Mean	Ranking
E	Environmental factors		
E3	Undertaking conservation measures by providing solar panels, CFLs, conducting energy audits	1.45	1
E4	Reducing, reusing and recycling of waste available within in the campus	1.61	2
E6	Water conservation practices (water metering, waterless urinals, etc.)	1.68	3
E9	Use of renewable energy resources for generating energy	1.70	4
E5	Sustainable transportation practices (car-pooling, public transport, use of bicycles, walking and battery vehicles)	1.72	5
E1	Constructing a green building	1.80	6
E7	Wastewater management practices (recycle/reuse after treatment)	1.96	7
E2	Giving priority for green food (locally grown and organically grown food)	1.97	8
E8	Sustainable landscaping	1.99	9
R	Research and education		
R1	Continuing training programme, informative courses on renewable resources like solar, wind, geothermal technology, etc.	2.07	1
R2	Providing green degrees and certificates	2.18	2
M	Management systems		
M1	Implementing green purchasing policies (recycle paper products, green products)	1.80	1
M2	Providing student, faculty and staff training	1.97	2
M3	Financial support for sustainable practices	1.98	3
M4	Involving students in green camps/practices	2.08	4
M5	Giving preference for sustainability issues, policies and allotting funds for them	2.34	5
M6	Partnering with local community/business for the purpose of broader sustainability practices	2.42	6

Table 5. Students' opinion under various categories

Environment	Education and research	Management systems	Others
Buildings: use of green materials, green and social infrastructure	Compulsory course on sustainability	Purchasing recycled material	Students' awareness about green resources
Transportation: use of bicycles, electric cars, ban on the use of motorized and private vehicle	Teaching with innovative technology, resource management, green energy production at academic level	Reduce unnecessary replacement of machinery, regular maintenance of equipment; implement complete solar project	Sustainable development and environment friendly projects should be undertaken
Energy: minimize the use of air-conditioners, and maximize the use of day lighting; green energy production, use of solar panels, bio-gas plant, use of different sensors, etc.	Conducting seminars and sessions regularly	Strict action taken by the institution for wastage of resources, both by students and staff members	Student participation in greening activities
Water: use of wastewater, STP plant, rainwater harvesting, waterless urinals, use of CFLs	Green competitions, conducting quizzes; certificates for abiding by the 'green' living	More funds for sustainability research projects, implementing green policies and their implementation; use of facility management	'Green police' intervening in all unsustainable practices within the campus
Waste: adopting three R, paper waste, e-notice, reduce food waste	Curriculum should be changed so that it becomes of relevance in the present world	Use of eco-friendly containers in hostel mess	Change of personal attitude
Landscaping: avoid lawns, plant more trees, reduce the cutting of trees	Institute electives on various green energy topics.	Advisory guidelines for vehicular movement; implement feedback given by student and faculty	Green in practice, green life

other two factors. Yuan and Zuo¹⁵ conducted a similar study ($n = 1134$) and the results showed that sustainability curricula were given less importance compared to other factors. Part C of the survey results shows that, if the appreciation in terms of awards or monetary support is given to the students, then their involvement in sustainability activities will be more.

An open-ended question followed by Part D, was framed to elicit a fuller expression of views of the students. Responses from the students are given in Table 5. In total, 28% of the students shared their views and suggested a number of activities for the campus. Proposing a 'green police' concept to monitor all unsustainable practices, change in personal attitudes, living with green concepts, and developing sustainability guidelines, adopting the 3R concept were the suggestions given by the students.

Conclusion

The following points emerge from the students' perception on campus sustainability in IITR:

1. Growing awareness on campus sustainability has resulted into initiatives of sustainability practices in energy and transportation.
2. Number of students who participated in the survey is less compared to the overall student population. Male student participants are more compared to female students.
3. Maximum students admit the importance of campus sustainability. Students from chemistry department give relatively greater importance to campus sustainability.
4. Operational parameters of environmental factors are considered more important compared to the education and management parameters. Most of the education and research programmes highlight aspects of sustainability, whereas executing them within the campus is necessary.
5. Students are willing to participate in the campus sustainability activities, if an extra stipend is given to them.
6. Students have suggested a few innovative ideas like 'green police', change in personal attitudes, green living, 3Rs and development guidelines.

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