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Analysis of Green Campus Initiatives Led by Voluntary Participants of University Students

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ABSTRACT

Purpose: Since 2010, many universities in Korea have been implementing Green Leader Training Programs which are usually run by students themselves. In the last five years of 2015, the Green Leader Training Program under the sponsorship of Korean Association for Green Campus Initiative has promoted the practice of a green campus and many relative projects have been carried out in various fields. **Method**: We utilized the green campus component index established by the Presidential Committee on Green Growth in Korea and have analyzed 480 activities during the years of 2010~2015. **Result**: We found that many activities were classified into the environmental field(264, 55.0%). This was followed by university members' participation(130, 27.1%), community engagement(68, 14.2%), and university management(18, 3.7%). These results showed that the green campus initiatives were focused on the environmental field. The number of universities participating from 2010 to 2015 were 20 in the metropolitan area and 15 in the non-metropolitan are. In the metropolitan area, 81.7% of green leader activities were conducted at universities in Seoul, and those in non-capital areas were active in the Middle region(51.3%) and Yeongnam region(48.7%). On the other hand, there was no activity in the Honam region, and it shows that there was a noticeable differential by regional groups.

KEYWORD

그린리더
그린캠퍼스
자발적 참여
한국그린캠퍼스협의회

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1. Introduction

1.1. Background and Necessity of the Study

Today, as universities grow in size and the number of members increases, they become organizations that directly or indirectly affect the environment [1]. Given this trend, universities also need to make voluntary efforts to create a sustainable society [2]. Research on the sustainability of universities has been carried out in Korea and abroad including a study to link the Fisher[3] environmental management system (ISO 14001) with the administration of the university in relation to the green campus operating system and a comprehensive study to institutionalize green campuses through a case analysis of Ball State University, USA [4]. Research has been going on steadily, such as strategic research for eco-campuses through case studies in Malaysia, Sharp[6]'s study of institutionalization methods for sustainable environments on campus, and Ryan et al.[7]'s study on methods to promote sustainability in higher education regarding the improvement of sustainability of universities in the Asia-Pacific region.

In the United States, several activities have been conducted by the Association for the Advancement of Sustainability in Higher Education (AASHE), which was established in 2006. By sharing information provided by this, each university has established an organic system [8]. One example is the Sustainability Tracking Assessment & Rating System (STARS), which assesses the university's degree of education for sustainable development. In addition, more than 2,000 participants from 13 countries gathered at the AASHE Conference in 2016 for a research presentation for sustainability campuses. Also, an average of twelve webinars are held each year by selecting webinar applicants on the theme of sustainability campus management [9].

The International Alliance of Research Universities (IARU), founded in 2006 by 10 universities from around the world, including Yale University in USA, Oxford University in England and University of Copenhagen in Denmark, established the Campus Sustainability Initiative. In addition since 2009, each campus annually publishes sustainability reports including energy use and greenhouse gas emissions, and produces and distributes its own Green Guide for Universities [10].

Universities in Europe, the US, Canada and the Asia-Pacific region are involved in the creation of green campuses, such as with green building construction that is efficient in energy and resource utilization, and ISO 14001 certification [1]. At the University of Copenhagen, green campus activities were conducted through

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energy saving in laboratories, offices, lecture halls, green campus promotional stickers and posters [11].

Many universities in China are changing to green campuses through education for sustainable development, on-campus energy monitoring, energy analysis and management system development, and eco-friendly building construction [12]. Shenyang University is conducting energy saving projects such as using renewable energy like geothermal and solar heat, and using energy saving lamps (LED). In addition, the university has established environmental education curriculum and collaborates with Japanese universities on environmental issues[13].

In Korea, interest in education for sustainable development (ESD) is growing. In addition to a study on the importance of green campus management factors [14], there is analysis of the current status of university campus energy management for low carbon green campuses [15], change of university campus responses to new environments through the case of Cheongju University [16], sustainable university campus planning index studies[17] and a study to develop the green campus evaluation framework [18]. Research on the environmental perception of college students has been steadily progressing since 2006 [19, 20, 21]. However, there has been criticism that education for sustainable development and environmental education are continuing to be discussed at the partial and personal level, and that comprehensive public debate has not been achieved [22]. Since the meaning of education for sustainable development and the green campus is being added in higher education, it is necessary to shift paradigms to examine the role and meaning of the university's education for sustainable development in connection with early childhood education, elementary and secondary education, and social education to promote education for sustainable development in higher education[23].

Universities are spaces that consume energy and release pollutants just like any organization in society. They consume considerable energy in various spaces such as classrooms, laboratories, libraries, restaurants, and cafeterias. According to domestic data, the number of domestic universities that consumed more than 2000 TOE (Tonne of oil equivalent) per is gradually increasing from 45 in 2000, 76 in 2007, and 119 in 2015. Energy use was 130,000 TOE in 2000, 240,000 TOE in 2007, and 338,000 TOE in 2015 which is an increase of 160% over the past 15 years. Compared to the 71.6% increase in total energy consumption in Korean buildings, the increase in energy consumption in universities is much higher [24].

Universities are emerging as the major sources of greenhouse gas emissions as domestic universities' energy consumption increases year by year [25, 26, 27]. However, efforts to cope with climate change through energy saving are still insufficient. To cope with these problems, eight universities in Korea have been conducting various activities such as launching the 'Korean Association for Green Campus Initiative' in November 2008 [28]. The university green campus activities include greenhouse gas reduction efforts such as low-carbon transportation, carbon storage capacity enhancement, and the reduction of environmentally harmful emissions [29].

In order to create a green campuses, universities need to save energy resources, reduce greenhouse gas emissions through management, education, research, and community cooperation, and cultivate future green leaders with 'sustainability' as their core value. Efforts need to be practiced for the entirety of activities [30]. Accordingly, it is time to make various efforts based on the voluntary nature of universities.

1.2. Purpose

This study analyzed the performance of the Green Leader Training Program conducted in 2010 by the Korean Association for Green Campus Initiative in order to analyze the current situation and cases of green campus operation by voluntary participation of university students in Korea and abroad. The Green Leaders Development Program, organized by the Korean Association for Green Campus Initiative, is an annual program started in 2010 to activate green campus campaigns and foster university student leaders to lead this movement.

In this study, the cases of foreign countries stated as theoretical background were referenced, but the Korean Association for Green Campus Initiative collected and analyzed the cases of the universities participating in the Green Leader Training Program and applied each evaluation factor.

The purpose of this study is first to analyze the contents of the university student-led program by evaluating the Green Leader Training Program conducted during 2010～2015 by the green campus evaluation index [31]. Second, to identify the importance of individual evaluation elements in green campus activities and third, based on this, it is to derive the necessary elements to activate the green campus operation.

2. Theoretical background

2.1. Green Campus Status and Evaluation index

2.1.1. Korea

The domestic green campus activities were started by forming a voluntary group of universities and spread through systematic support projects of the Ministry of Environment. As of the end of 2016, the Korean Association for Green Campus Initiative (2008.11), Gyeonggi Association for Green Campus Initiative

(2010.3), Busan Association for Green Campus Initiative (2010.10), Chungbuk Association for Green Campus Initiative (2011.11), Low Carbon Green Campus General Council (2012.8), and Seoul Association for Green Campus Initiative (2013.6) have been established[30]. An agreement has been concluded to promote the initiative between the related departments such as the Committee on Green Growth, the Ministry of Environment, and the Ministry of Education, Science and Technology and university (college) groups (2011.7).

Table 1. Green Campus Evaluation Index

Category	Sub-Category	The Details
Environment	Sustainable energy	- Using renewable energy - Energy saving program
	Resource recycling waste management	- Purchase eco-friendly products - Recycling food waste - Waste classification Discharge and recycling
	Water (sustainable water resources)	- Using rainwater and dehydration - Water saving program
	Air (low carbon emission)	- Air pollution prevention facility - Vehicle Restrictions - Reduce greenhouse gas emissions
	Sustainable space management	- Secure green space - Environment-friendly building / space management - A flawless environment
University Members' Participation	Curriculum	- Establish and operate lectures on sustainable development
	Research projects	- Conduct research projects on sustainable development
	Student participation	- Environmental club and student council activities - On-campus green campus project / program participation
	Faculty participation	- Faculty green campus building participation program - Faculty awareness program
University Management	Planning	- Green campus construction plan - Establish sustainable university management plan
	Operational guidelines	- Guidelines / statements for green campus construction
	Information exchange	- Information disclosure through homepage, report
	Related organizations	- Green campus department
	Continuous monitoring	- Conduct monitoring after execution of plans - Conducting environmental audits
Community Engagement	Local residents participation	- Public education promotion program - Campus events for local residents (lectures, events)
	Build cooperation	- Collaboration between universities at home and abroad - Establishment of public institutions, corporations, NGOs, and governance systems in Korea - Research, education and service programs for sustainable regional development

Source : Presidential Committee on Green Growth, 2012

A green campus is defined as "a comprehensive concept that is active in terms of saving energy and resources and practicing zero carbon emissions through management·education·research·community cooperation, with sustainability and low carbon as core values" [32]. According to the long term development plan for green campuses, 'Green campus' is categorized into 1) sustainable university management, 2) environment-friendly campus, 3) participation of school members, 4) cooperation and engagement with the community. Detailed contents are also stated. In addition, based on the four categories of environment, university members' participation, university management, and community engagement, detailed contents were presented [33].

The category of 'environment' is composed of five evaluation factors: sustainable energy, resource recycling and waste management, water resources, air, and sustainable space management. 'University members' participation' consists of four evaluation factors: curriculum, research projects, student participation, and faculty participation. 'University management' consists of five evaluation factors: planning, operational guidelines, information exchange, related organizations, and continuous monitoring. 'Community engagement' is composed of two evaluation factors, local residents participation and build cooperation. Thus, the green campus evaluation factor consists of four categories and 16 evaluation factors.

2.1.2. Oversea

In other countries, green campus activities can be divided into the United States, Europe, and Asia-Pacific regions. The focus will be on the United States and the United Kingdom, which systematically summarize the green campus evaluation index.

As of the end of 2016, the United States is running the American College & University Presidents' Climate Commitment (ACUPCC), which has 597 university presidents involved and is building a greenhouse gas inventory to promote reducing greenhouse gas emissions[34]. In addition, they established a 'program of action' where each university sets CO_2 reduction rates and practices. Since 2007, they have operated the Sustainability Tracking Assessment & Rating System (STARS) through AASHE. It consists of 4 ratings including Platinum, Gold, Silver and Bronze. Based on this, the green campus implementation level is assessed. In the United States, 778 educational institutions, including Yale University, New York University, and UCLA, are participating in STARS [35].

Evaluation criteria of AASHE's STARS consists of the five areas as shown in Table 2: 1) Academics 2) Engagement 3) Operations 4) Planning and administration 5) Innovation and leadership. There are two items in Academics, curriculum and research, and the scores are 40 and 18, respectively. There are two items in Engagement, campus engagement and public engagement.

The scores are 21 and 20, respectively. Engagement has two items. There are 9 items in Operations: air&climate, buildings, energy, food&dining, grounds, purchasing, transportation, waste, and water. The scores are 11, 8, 10, 8, 3-4, 6, 7, 10, and 6-8 points respectively. There are 4 items in Planning and administration: coordination&planning, diversity&affordability, investment, wellbeing&work. The scores are 8, 10, 7, and 7 respectively. There are 2 items in Innovation and leadership, exemplary practice and innovation. The scores are 0.5 and 1 each.

Table 2. Evaluation Criteria of AASHE's STARS (AASHE, 2016)

Category	Details	Score
1. Academics	Curriculum	40
	Research	18
2. Engagement	Campus Engagement	21
	Public Engagement	20
3. Operations	Air & Climate	11
	Buildings	8
	Energy	10
	Food & Dining	8
	Grounds	3-4
	Purchasing	6
	Transportation	7
	Waste	10
	Water	6-8
4. Planning & Administration	Coordination & Planning	8
	Diversity & Affordability	10
	Investment	7
	Wellbeing & Work	7
5. Innovation & Leadership	Exemplary Practice	0.5 each
	Innovation	1 each

Table 3 shows scores and ratings for each university according to STARS. The scores and rating for each university were selected by university based on the dates submitted in 2016 [36].

Table 3. STARS Scores and Grades for Each University (AASHE, 2016)

Name	AC	EN	OP	PA	IL		Score	Rating
S University	46.81	36.30	47.61	25.63	4.50		81.02	Gold
M University	45.88	34.38	33.33	21.79	3.50	→	70.52	Gold
A University	41.09	31.85	45.28	21.63	4.00		75.35	Gold
Each part is scored independently								

Another green campus evaluation system in the United States is the Green Report Card system. The organizer is the Sustainable Endowments Institute (SEI) and uses grades from A to F. The Green Report Card is currently available through the 2011 edition, and the S, M, and A universities rated by STARS are also certified on the Green Report Card. Table 4 shows the grades and overall grades for each evaluation area [37].

Table 4. S, M, A University Green Report Rating (The College Sustainability Report Card)

Name	AD	C&E	F&R	GB	SI	TR	ET	IP	SE	Overall grade
S University	A	A	A	A	A	A	C	A	A	A-
M University	B	A	A	B	A	A	F	C	F	B-
A University	A	A	A	B	A	A	B	A	F	B+

In the UK, the Green League has been active since 2007 and was organized by People & Planet, the largest student movement network. The Green League began by collecting environmental information from 120 universities in the UK to secure university environmental information transparency and encourage university policy-makers to raise their knowledge of the environment [38]. The evaluation items of the Green League are divided into policy, management, and performance categories, and there are 13 sub-categories. Each year, the Green League awards are given based on the scores obtained by each university. Table 5 shows a list the top universities in Green League 2015 [39].

Table 5. Green League 2015 Ranking (People&Planet)

Rank	Name of University	Score
1	Plymouth University	83.0
2	University of Worcester	76.7
3	Manchester Metropolitan University	73.1
4	Nottingham Trent University	72.6
5	City University London	70.3
6	University of Gloucestershire	69.6
7	Bournemouth University	69.1
8	University of Wales Trinity Saint David	68.8
9	Edinburgh Napier University	68.3
10	Glasgow Caledonian University	67.8

In Japan, the Eco League, founded in 1994, established the executive committee of Campus Climate Challenge (CCC) to announce eco-campus rankings starting in 2009. Eco-campus rankings are evaluated according to three categories, CO2 emissions (energy use), environmental measures, and environmental education. The awards distinguish national and public universities from private universities. In addition to simply scoring, feedback on the scoring results allows each university to identify what has been done and what needs to be supplemented. The number of universities participating in this system is increasing every year [40].

2.2. Green Leader Training Program

The Korean Association for the Green Campus Initiative, established in 2008 as an inter-university consultation body, has been working on a green campus long term vision study, establishing the foundation for promoting green campuses, developing practical programs for reducing energy use and

greenhouse gas emissions of universities, developing green human resource development programs, and the establishment and operation of cooperative networks to promote green campuses. In addition, they promote campus environmental improvement, curriculum reorganization, on-campus environmental evaluation, joint research on new and renewable energy and green technology, and projects with the community.

The Korean Association for the Green Campus Initiative organizes a green campus promotion committee for each member university to systematically promote the green campus movement. Also, they help members of the university understand the concept of a green campus and participate in practice through green campus competitions, energy saving and environmental protection activities, and summer green leader training camp. In addition, they promote international links in order for domestic universities to cooperate with foreign universities to play a leading role in realizing love for the environment, life, and sustainable development[41].

2.3. Case Study Method

In this case study, the target is Green Leader activity administered by the Korean Association for the Green Campus Initiative. Statistical analysis was used together with literature analysis of the Green Leader Training Program 2010~ 2015 along with frequency analysis using Excel. To this end, the status of Korean and overseas green campuses was reviewed to analyze the projects conducted by Green Leader by year, sector, and university. In addition, the results according to the Green Campus evaluation index were examined to analyze the degree of cooperation with the administrative groups, such as the student council and universities, in order to compare the results of the past five years. Table 6 shows the list of universities participating in the Green Leader Training Program of the Korean Association for the Green Campus Initiative. The location of the university, the metropolitan area and the national university are identified.

As shown in Table 6, 34 universities and 35 campuses participated in the Green Leader Training Program from 2010 to

Table 6. Participating Universities for Green Leader Training Program by Year

	2010	2011	2012	2013	2015
1	Kangnam Univ., Gyeonggi	*UNIST,* Ulsan	Kyunghee Univ., Seoul	Keimyung Univ., Daegu	Keimyung Univ., Daegu
2	Keimyung Univ., Daegu	Dankook Univ., Gyeonggi	Dankook Univ. Gyeonggi	Dankook Univ., Gyeonggi	Korea Univ., Seoul
3	Korea Univ., Seoul	Sangji Univ., Gangwon	*Pusan National Univ.* Busan	Dongguk Univ., Seoul	Paichai Univ., Daejeon
4	Kwangwoon Univ, Seoul	Seoul Women's Univ., Seoul	Busan University of Foreign Studies, Busan	Dongduk Women's Univ. Seoul	Sangji Univ., Gangwon
5	Kookmin Univ., Seoul	Sookmyung Women's Univ.,Seoul	Sangji Univ. Gangwon	Myongji Univ, Seoul	Seoul Women's Univ., Seoul
6	Dongguk Univ., Seoul	Shinheung Univ., Gyeonggi	Seoul Women's Univ. Seoul	*Pukyong National Univ.* Busan	Shinhan Univ., Gyeonggi
7	Myongji Univ., Seoul	Yonsei Univ.(Seoul), Seoul	Sookmyung Women's Univ. Seoul	Sangji Univ., Gangwon	Yonsei Univ.(Wonju), Gangwon
8	Sogang Univ., Seoul	Yonsei Univ.(Wonju), Gangwon	Shinheung Univ. Gyeonggi	*University of Seoul*‡, Seoul	Yeungnam Univ., Gyeongbuk
9	Yonsei Univ.(Wonju), Gangwon	Yeungnam Univ., Gyeongbuk	Yonsei Univ.(Seoul) Seoul	Seoul Women's Univ., Seoul	Jungwon Univ., Chungbuk
10	Yeungnam Univ., Gyeongbuk	Ewha Women's Univ., Seoul	Yeungnam Univ. Gyeongbuk	Sookmyung Women's Univ. Seoul	*KAIST,* Daejeon
11	Jungwon Univ., Chungbuk	Jungwon Univ., Chungbuk	*UNIST,* Ulsan	Shinheung Univ., Gyeonggi	KOREATECH, Chungnam
12	Chungnam Univ., Daejeon	KOREATECH, Chungnam	*Incheon National Univ.* Incheon	Yonsei Univ. (Seoul) Seoul	*Korea Maritime and Ocean Univ.* Busan
13	KOREATEC, Chungnam	*Korea Maritime and Ocean Univ.* Busan	Jungwon Univ., Chungbuk	Yeungnam Univ., Gyeongbuk	
14		Hongik Univ, Seoul	*Chungnam Univ.*, Daejeon	*Incheon National Univ.* Incheon	
15			*KAIST,* Daejeon	Jungwon Univ., Chungbuk	
16			*Korea Maritime and Ocean Univ.,* Busan	*KAIST,* Daejeon	
17				*Korea National University of Education* Chungbuk	
18				Hankuk University of Foreign Studies Seoul	
19				*Korea Maritime and Ocean Univ.* Busan	
Total( )†	13 (*0*)	14 (*2*)	16 (*6*)	19 (*6*)	12 (*2*)

Note : Shaded cells indicate the universities located in Seoul metropolitan area. †National universities are indicated in italics. ‡University of Seoul is maintained by a municipal fund.

2015, 13 universities in 2010, 14 universities in 2011, 16 universities in 2012, 19 universities in 2013 and 12 universities in 2015, the total number of 74 universities. Among them, private universities accounted for 78.4%, a total of 58 universities, while national universities accounted for 21.6%, or 16 universities, of all participating universities.

3. Case Study Contents

3.1. Case Study Contents

3.1.1. By year

This study collected and analyzed the final report of the Green Leader Training Program administered by the Korean Association for the Green Campus Initiative. 13 universities participated in 2010, the first one, 14 universities in 2011, second, 16 universities in 2012, third, 19 universities in 2013, fourth and 12 universities in 2015, fifth. The Green Leader Training Program was not implemented in 2014, so the fifth Green Leader Training Program was implemented in 2015.

3.1.2. By evaluation factor

The final report was analyzed by evaluation factors in connection with the green campus evaluation index. For the 'environment' category, it was analyzed using five evaluation factors: sustainable energy, resource recycling and waste management, sustainable water resources, low carbon emission, and sustainable space management. For 'members' participation', it was analyzed using four evaluation factors: curriculum, research projects, student participation, and faculty participation. For the 'university management' category, it was analyzed using five evaluation factors: planning, operational guidelines, information exchange, related organizations, and continuous monitoring. And for the 'community engagement' category, two evaluation factors, local residents participation and build cooperation, were used. In addition, the details included in each evaluation factor were compared and analyzed with each university's green campus activities.

4. Results

4.1. By Participation Sector

Table 7 shows the results of analyzing the participation category based on the universities listed in Table 1. The activities in the 'environment' category showed the highest, 264 cases, including 40 cases in 2010, 38 cases in 2011, 57 cases in 2012, 77 cases in 2013 and 52 cases in 2015 followed by 'university members' participation', 130 cases including 14 cases in 2010, 24 cases in 2011, 30 cases in 2012, 23 cases in 2013, and 39 cases in 2015. There were 68 cases in 'community engagement', including 9 cases in 2010, 4 cases in 2011, 19 cases in 2012, 19 cases in 2013 and 17 cases in 2015. The activities in the 'university management' category showed the lowest, 18 cases including in 2 cases in 2010, 1 case 2011, 1 case in 2012, 0 case in 2013, 14 cases in 2015. Figure 1 shows the analysis results by year, and Figure 2 shows the ratio of participation by sector in five years.

Table 7. Results of Participation Sector by Year

Year	Environment (ratio,%)	Participation (ratio,%)	Management (ratio,%)	Community (ratio,%)
2010	40 (15.1)	14 (10.8)	2 (11.1)	9 (13.2)
2011	38 (14.4)	24 (18.5)	1 (5.6)	4 (5.8)
2012	57 (21.6)	30 (23.0)	1 (5.6)	19 (28.0)
2013	77 (29.2)	23 (17.7)	0 (0.0)	19 (28.0)
2015	52 (19.7)	39 (30.0)	14 (77.7)	17 (25.0)
Total	264 (100)	130 (100)	18 (100)	68 (100)

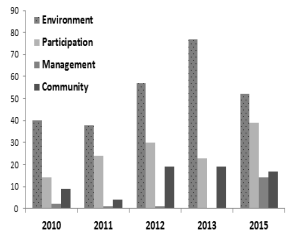

Fig 1. Comparison of Green Leader Activities by Year

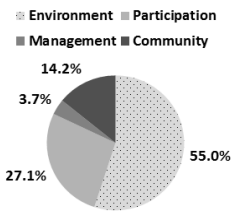

Fig 2. Ratio of Categories by 5 years

As shown in Figure 2, the highest ratio of programs implemented from 2010 to 2015 was 'environment' (55.0%) followed by 'participation' (27.1%) and 'community engagement' (14.2%), and 'university management' (3.7%). The results for each year are shown in Figure 3. As shown in the results for each year, 'environment' is the highest and 'university management' is the lowest due to the nature of the Green Leader activity, a program run by students.

The personnel and participating students who reviewed the final report of each university's Green Leaders Training Program agreed on the importance of the following four points. First, students should be encouraged to participate voluntarily in the green campus activities. Second, campus facilities problems should be solved together with the university as students are not able to lead. Third, student council should be involved actively and be able to participate in on campus decision making and fourth, students should be able to expand their participation by activating online activities such as social networks.

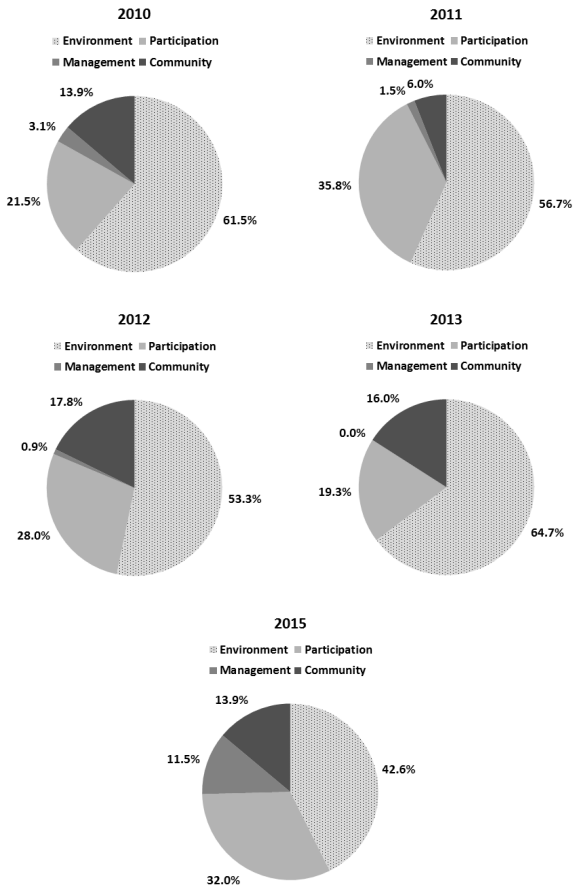

Fig 3. Ratio of Categories by Each Year(%)

4.2. By Evaluation Factor

4.2.1. Environment

Resource recycling waste management (47.3%) was the most important evaluation factor in the environmental category. The most frequent activity at each university was to set a paper recycling bin to collect the reusable papers and then produce notebooks and distribute them. For general garbage, there were many universities where recycling was not done properly or there were not enough trash cans for garbage. The Green Leader worked on installing garbage cans or putting name tags on them to specify the type of garbage to increase the recycling rate.

In addition, the Green Leader collaborated with the student council and volunteer groups to organize bazaars and collect used goods to practice the Conserve, Share, Exchange, Reuse. movement. Since small electrics and electronics contain harmful heavy metals, there were some universities that carried out movements to collect used mobile phones on campus to recycle them. Other waste related activities included group purchasings of green products such as tumblers, making soaps using waste cooking oil, and making eco bags using banners.

Sustainable energy accounted for 34.1% of the environment category. The most simple project was to attach a saving sticker. The words that students can see and act on were added and they were attached in restrooms, on fluorescent lamp switches, and computers etc. It was a project that was relatively inexpensive and easy which seemed to be easy for the students at each university to proceed with. There is a lot of energy consumption because the university does not shut down the computers after using them. In order to reduce power consumption, the Green Leader conducted activities to reduce power by installing a green touch program. In addition, energy saving exercises were actively encouraged by installing a phrase that prompts the user to save power on the desktop and screen saver. Sustainable space management was 12.5% in the environment category. Activities include putting air purifying plants in libraries, setting up smoking areas, and creating birdhouses to harmonize with nature. Water accounted for 3.4% of the environment category. Activities include production and installation of a direct water treatment system and activities to identify the current status of greywater. Air accounted for 2.7% of the environment category. Activities include carpooling, on campus bus service, etc.

4.2.2. University members' participation

The evaluation factor, which accounted for the largest percentage of the participating sectors, was student participation, 81.5%. Although the food waste campaign may be considered to be waste in the environment category, it is classified as student participation in that the reduction of food waste is carried out by the participation of the students. In order to encourage the students' practice, it was organized by forming an environmental club or giving out cafeteria vouchers for those who practiced.

Most of the activities for reducing the use of disposable products were conducted using incentives. In particular, activities such as encouraging the use of metal chopsticks and mugs instead of disposable wooden chopsticks and paper cups have been enacted. In addition to this, there was an environmental poster competition and Green Leader promotion seminar to spread its intention and activities and environmental books that students requested were equiped in the on-campus library.

Among the university members' participation category, the curriculum accounted for 10.0%. A participating university in the Middle region carried out its own camp for 40 hours composed of theoretical lectures and student-led workshops. In addition, freshman mentees was selected for green activity awareness education and green behavior instruction for 3 months. After that, a follow up program based on the data was presented. In addition, discussions and club activities on the Green Campus were promoted.

Among the university members' participation category, research projects accounted for 4.6%. A university in the metropolitan area has directly realized the active response with climate change through building a greenhouse gas inventory by students. Another university in the metropolitan area planned an environmentally friendly field trip where the environmental service team reduced the amount of disposable garbage by using metal chopsticks instead of disposable chopsticks and spoons. More effective eco-friendly activities were attempted beyond the spoon and chopstick idea, which was a first trial.

Among the university members' participation category, faculty participation accounted for 3.9%. In a university in the Yeongnam region, about 300 faculty members and students gathered in the library plaza to make a 'declaration of designation of a non-smoking area', which was a great help for health and to clean up the campus environment. During the event, there was non-smoking charter, reading of the declaration, the unveiling a non-smoking sign, and the distribution of non-smoking fliers. In addition, in order to settle this for the future, there was an announcement for the active non-smoking supporter and the clinic center plans. Also, a day without cars was carried out.

4.2.3. University management

The university management category consists of five evaluation factors: continuous monitoring, planning, information exchange, operational guidelines, and related organizations. The category of planning, operational guidelines and related organizations showed 0% activities. Continuous monitoring accounted for 38.9%. Unlike the environmental club, which was run by the participation of general students, this was monitored by the Green Leader directly. Also, another difference is that the monthly use was compared in cooperation with the university.

Among the university management category, the information exchange for 61.1%. Green campus and Green Leader activities were promoted through online clubs and social networking services (SNS). There were many cases in which a communication and discussion atmosphere was created by informing people of the status of energy and resource saving.

4.2.4. Community Engagement

The community engagement category consists of two evaluation factors, local residents participation and build cooperation. Among them, the local residents participation accounted for 54.4%. The most popular activities were public education promotion programs. The subjects of the general public were limited to young children and elementary school students, and it was conducted through on-site learning. The curriculum was created to convey environmental pollution easily and activities such as planting plants by directly touching the soil were conducted.

Also, booths were set up at university events and other events to encourage more people to participate. Various events were carried out such as making coffee air fresheners, making cotton candy using a self-generator, a signature-seeking campaign for the environment, and making useful microbial (EM) soap. The cooperation category accounted for 45.6%. A university in the metropolitan area opened a recycling lecture in cooperation with a nearby cultural center.

A university in the Middle region sent an official letter to the middle and high schools to write scholarship requests regarding donations made through booths at university events in cooperation with the educational service group scholarship foundation. Another university in the Middle region promoted the National Park Green Point system to encourage all people for the cleanliness of the nation. A university in Yeongnam region conducted preliminary investigation on local resident's illegal lead weight use for fishing in breakwaters due to their lack of information, produced questionnaires to enlighten their awareness, and conducted direct public relations activities.

Figure 4 shows the results by evaluation factor. The waste category in 'environment', student participation in 'university members' participation', information exchange in 'university management,' and local residents participation in 'community engagement', which held a dominant position, with percentages of 47.3%, 81.5%, 61.1%, and 54.4% respectively.

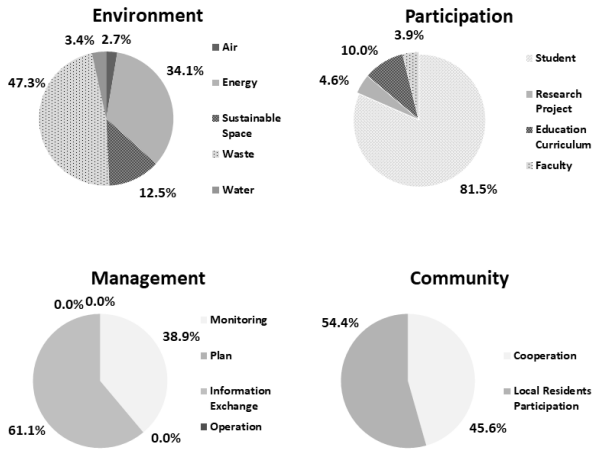

Fig 4. Results of Green Leader Activity

5. Results by University

The number of projects conducted within the category according to Table 1 were evaluated to identify project progress by university and year. As a result of comparing and evaluating each university, it confirmed that the Green Leader activities were most performed in the 'environment' category and 'university members' participation' category.

Table 8. 2010 Green Leader Project by Each University

2010	Environment	Participation	Management	Community
Kangnam Univ.	1	1		
Keimyung Univ.	7	4		3
Korea Univ.	2	2		1
Kwangwoon Univ.		1		
Kookmin Univ.	1			
Dongguk Univ.	7		1	
Myongji Univ.	2	1		2
Sogang Univ.	1			
Yonsei Univ. (Wonju)		1		
Yeungnam Univ.	5	1	1	
Jungwon Univ.	9			
Chungnam Univ.	3	1		2
KOREATECH	2	2		1

Table 9. 2011 Green Leader Project by Each University

2011	Environment	Participation	Management	Community
UNIST	2	2		
Dankook Univ.	2	3		
Sangji Univ.	3	1		
Seoul Women's Univ.	3	2		2
Sookmyung Women's Univ.	3	2		
Shinheung Univ.		3	1	
Yonsei Univ. (Seoul)	1			
Yonsei Univ. (Wonju)	4	3		
Yeungnam Univ.	4	2		
Ewha Women's Univ.	4	1		
Jungwon Univ.	2	1		2
KOREATECH	2	1		
Korea Maritime and Ocean Univ.	4	3		
Hongik Univ.	4			

Table 10. 2012 Green Leader Project by Each University

2012	Environment	Participation	Management	Community
Kyunghee Univ.	5	2		1
Dankook Univ.	6	1		
Pusan National Univ.	4	1		
Busan University of Foreign Studies	3	3		
Sangji Univ.	4	2		2
Seoul Women's Univ.	3	2		1
Sookmyung Women's Univ.	3	2		
Shinheung Univ.	2		1	1
Yonsei Univ. (Seoul)	2	4		1
Yeungnam Univ.	6	2		
UNIST	1	2		3
Incheon National Univ.	4	2		1
Jungwon Univ.	3	3		3
Chungnam Univ.	2			3
KAIST	3	3		1
Korea Maritime and Ocean Univ.	6	1		2

Table 11. 2013 Green Leader Project by Each University

2013	Environment	Participation	Management	Community
Keimyung Univ.	5			
Dankook Univ.	9	3		
Dongguk Univ.	4			
Dongduk Women's Univ.	5	1		1
Myongji Univ.	1	1		
Pukyong National Univ.	2			1
Sangji Univ.	3	2		1
University of Seoul	1			1
Seoul Women's Univ.	3	2		3
Sookmyung Women's Univ.	5	1		
Shinheung Univ.	6			2
Yonsei Univ. (Seoul)	4	2		
Yeungnam Univ.	3	1		1
Incheon National Univ.	5	3		1
Jungwon Univ.	5	3		
KAIST	6			2
Korea National University of Education	5			2
Hankuk University of Foreign Studies		3		1
Korea Maritime and Ocean Univ.	5	1		3

Table 12. 2015 Green Leader Project by Each University

2015	Environment	Participation	Management	Community
Keimyung Univ.	14	14	1	10
Korea Univ.	10	1	1	
Paichai Univ.	4	2	3	
Sangji Univ.	4		1	1
Seoul Women's Univ.	6	1		2
Shinhan Univ.	3	3	2	2
Yonsei Univ. (Seoul)	2	5	2	1
Yeungnam Univ.				
Jungwon Univ.	1	5	1	
KAIST	5	5	2	
KOREATECH				
Korea Maritime and Ocean Univ.	3	3	1	1

In the 'environment' category, the waste category accounted for the highest, 47.3%, followed by energy, 34.1%, sustainable space, 12.5%, water, 3.4% and air 2.7%. In the 'university members' participation' category, the student category accounted for the highest, 81.5%, followed by the curriculum, 10.0%, research projects, 4.6% and faculty, 3.9%. In the 'university management', the information exchange category accounted for the highest, 61.1%, followed by monitoring, 38.9%. In the 'community

engagement' category, local residents participated was 54.4% followed by 45.6% of cooperation.

We have summarized the activities of Green Leader based on the results of Table 8 through Table 12 for the universities located in metropolitan areas such as Seoul, Incheon, Gyeonggi and non-metropolitan areas such as the Middle region (Gangwon, Chungnam and Chungbuk) and Yeongnam region(Gyeongnam, Gyeongbuk). According to this, from 2010 to 2015, a total of 34 universities and 35 campuses participated in the Green Leader Program. A total of 20 universities located in metropolitan areas and 15 universities located in non-metropolitan areas participated. The number of participating universities in the non-metropolitan areas was smaller than that in the metropolitan areas, but the number of green leader activity programs was slightly higher. Of 34 universities, 33 were four-year universities and one was a two-year colleges.

According to the results of this study, participation of universities in Honam (Jeonnam, Jeonbuk) was very low. One of the reasons is that unlike the Gyeonggi, Busan, and Chungbuk areas, there is no green campus-related regional council in the Honam area. As a result, it can be assumed that green campus-related information was not provided smoothly. However, it is a limitation of this study that the reasons were not clarified through survey or in-depth interviews with university officials.

Table 13. Analysis of Green Leader Projects by Sub-Category

Category	Sub-Category	2010	2011	2012	2013	2015	Sub-Total	Ratio(%)
Environment	Air	2	1	0	2	2	7	2.7
	Energy	9	12	17	35	17	90	34.1
	Sustainable Space	11	2	4	7	9	33	12.5
	Waste	18	21	34	30	22	125	47.3
	Water	0	2	2	3	2	9	3.4
	Total	40	38	57	77	52	264	100
University Members' Participation	Student	13	20	23	19	31	106	81.5
	Research Projects	1	1	0	2	2	6	4.6
	Education Curriculum	0	3	5	1	4	13	10.0
	Faculty	0	0	2	1	2	5	3.9
	Total	14	24	30	23	39	130	100
University Management	Monitoring	1	1	1	0	4	7	38.9
	Plan	0	0	0	0	0	0	0.0
	Information Exchange	1	0	0	0	10	11	61.1
	Operation	0	0	0	0	0	0	0.0
	Related Organizations	0	0	0	0	0	0	0.0
	Total	2	1	1	0	14	18	100
Community Engagement	Cooperation	8	1	5	6	11	31	45.6
	Local Residents Participation	1	3	14	13	6	37	54.4
	Total	9	4	19	19	17	68	100

The following is a summary of the opinions of the person in charge or the participating students through the contents of the Green Leader Training Program of each university. First, the promotion of awareness about the seriousness of climate change and environmental problems will lead to the spread of awareness about green campuses, which will stimulate students' voluntary green campus activities. Second, special lectures, seminars, and campaigns should be continuously held in the university to improve awareness of green campuses. Third, for a university lacking support for the Green Leader, a system to guide and support student activities is needed by government agencies such as the Ministry of Environment and the Ministry of Education and non-profit organizations such as the Korean Association for the Green Campus Initiative.

6. Conclusion

The Green Leader Training Program was conducted through the participation of university students at domestic universities. It showed various activities to cope with climate change at each university and it is believed that it became an opportunity to inform the importance of environmental preservation and energy saving on university campuses.

During the five years of the Green Leader Training Program, 13 universities participated in 2010, 14 universities in 2011, 16 universities in 2012, 19 universities in 2013, and 12 universities in 2015. A total of 74 universities participated with 16 universities participating once out of four times, 6 universities participating twice, 6 universities participating three times, 3 universities participating four times, and 3 universities participating five times.

In terms of activities in the five year period, the ‘environment’ category was the highest, 264 cases (55.0%) in Green Leader activities at national universities, followed by 130 cases (27.1%) of ‘university members’ participation’, 68 cases (14.2%) of ‘community engagement’, and 18 cases (3.7%) of ‘university management’.

In the ‘environment’ category, ‘waste’ (47.3%) and ‘energy’ (34.1%) accounted for 81.4%, while in ‘members’ participation’ category, ‘student’ accounted for the highest, 81.5%. In ‘university management’ category, ‘information exchange’ (61.1%) and ‘monitoring’ (38.9%) were two factors. The ‘community engagement’ category consisted of ‘local residents participation’(54.4%) and ‘cooperation’(45.6%).

As a result of categorizing the universities by the region participating from 2010 to 2015, the participation ratio of the metropolitan universities was high. In the ‘environment’ and ‘university management’ category, the universities in metropolitan area were similar to those in the non-metropolitan area, but in the ‘community engagement’ category, the universities in the non-metropolitan areas were more active. In the metropolitan area, 81.7% of Green Leader activities were conducted at universities in

Seoul, while those in non-metropolitan area were active in the Middle region (51.3%) and Yeongnam region (48.7%).

In order to revitalize climate change activities on a regional basis, cooperation and consensus should be formed with local communities. Therefore, in the future, the Green Leader Training Program should be conducted in a direction to establish a cooperative system so that activities within the campuses can be connected with the community. Also, taking into consideration that there was no university participation from the Honam region and the participation rate of 2-year colleges was very low, it is necessary to take measures to encourage the participation of these universities in the green campus model university project of the Ministry of Environment and to promote public relations.

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