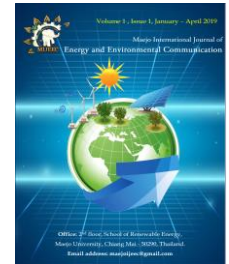




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REVIEW

Smart and green university campus

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ABSTRACT

Many devices connected to the internet are able to generate valuable data that can help create technologically connected smart and green university campuses. These campuses can electronically monitor activities, including student attendance, security operations, campus lighting, and classroom usage that administrators, staff, and faculty members can use to make better decisions about how to operate more efficiently, effectively, and safely. University campuses have a responsibility not only to provide a quality education for students but also to provide a safe place to learn and operate with an appropriate allocation of resources applying with smart system with reasonable approaches.

1. Introduction

Institutions are finding they need to develop an overall strategic technology plan based on their own unique mission, needs, and culture. The Smart campus development, like smart cities, aims to be an anticipatory projection of the construction of an intelligent university campus, able to autonomously adapt its operations and its missions to face the major issues in climate, ecology and digital technology. Green Campus is our way of thinking and operating, allowing us to utilise interdisciplinary research and teaching activities innovatively to reduce environmental load.

We have to monitor, measure and regularly review the development of our environmental protection and reserve sufficient resources to ensure continuous improvement. According to Maas and Liket (2011), impacts generally refer to the effects caused by an organization or an intervention that occur outside the organization in society or the natural environment. Campus landscape is an important part of campus life, because it is regarded as a physical manifestation

of the value of a university. Green campus is a concept to build sustainable living practices that are environmentally friendly in educational institutions around the world. This is an enhancement of traditional environmental management systems which tend to be management driven. The Green-campus programme identifies the campus as a community and places significant importance on the inclusion of all sectors of the campus community in its environmental management and enhancement.

“SMART” means

- Smart
 - Smart grid
 - Smart city
 - Smart phone
 - Smart agriculture
 - Smart aging
 - Smart home
 - • • •



- “IT and IoT” based technology applied equipments, machines, things, systems • • • • •

Figure 1. Applicable smart system

Applicable smart system approaches displayed in Figure 1. The Brundtland Report defined sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (United Nations 1987). Therefore, it is important to ensure that the world will continue to have sufficient water, materials, and other resources for its living systems. It also means that any development should entail the proper balance of economic, social, and environmental conditions. This paper aims to conceptualize impacts of higher education institutions on sustainable development, complementing experience and literature reviews by broadening the perspective from several activities and the environment.

2. Smart campus systems

A smart campus can help improve three important factors: experience, efficiency, and education. The design and implementation of a student information system and user interface is to replace the current paper records. Student information systems provide capabilities for registering students in courses; documenting grading, transcripts, results of student tests and other assessment scores; building student schedules; tracking student attendance; and managing many other student-related data needs in a school. It can help reshape how students study, how they learn, what they learn, and how they interact with an institution; smart campus methodologies following:

- Build an intelligent digital campus
- Make or university safer and smarter Increase efficiency, save money, and improve experiences for students and staff
- Data-driven decisions. With smart-campus technologies, managing facilities, lighting, parking, and transportation is more intelligent than ever
- Cashless & paperless based on ID card
- Universities innovate faster than cities
- Facial recognition has made its way into the university campuses
- Exploring universities from a distance
- Immersive augmented reality (AR) learning experiences inspire students
- Artificial intelligence (AI) powered digital AI-powered digital assistants answer students' questions
- Universities pour millions into green tech and smart initiatives
- Using 5G to turn campuses into innovation hotspots
- Higher education as a driving force of innovation

Research in the smart campus area is still growing, where every researcher defines the concept of smart campus with a less thorough perspective that has not been conical in the same conception of the concept.

In the last few decades, higher education has become more accessible than ever, and the number of students just keeps growing. These profound changes are happening at a time when innovative technologies are reshaping all facets of our lives, from how we generate energy and commute to how we find and present information. As centers of learning and excellence, higher education institutions can't afford to fall behind in the use and development of these new technologies. In fact, campuses today resemble smart cities of the future, and they're undergoing a high-tech makeover using a variety of cutting-edge technologies.

Facial recognition tech is already replacing ID cards, immersive technologies such as AR and virtual reality (VR) are attracting prospective students and offering new ways to learn, digital AI assistants are helping students with organization and time management, and 5G internet is delivering ultra-connected campuses. Clearly, higher education is undergoing a massive transformation, and we're witnessing the emergence of smart campuses.

Some worry: Cashless & paperless campus life based on ID memory card, Intellecturized Automated facilities are convenient and comfortable, however students will be getting lazy and less learner even though they know a lot how to use devices and equipment, however “no creativity & originality” may be hard to be born education program should be offered to make up for shortcomings of this issue.

Creativity for originality: Education to motivate up and develop & grow creativity for originality. Campus cleanup program, University goods to create original university goods; and not only to teach and learn, but also develop and grow creative original good, only one in the world.

A Smart campus education system consciously adopts educational management practices and instructional processes to foster systemic changes. With this, learners can surmount every challenge of the information technology era. Cell phones give students access to tools and apps that can help them complete and stay on top of their class work. These tools can also teach students to develop better study habits, like time management and organization skills.

Traditional Education is good, but the Smart Education is very good. The capabilities of the younger generation define the quality of a nation's social, political and economic future. A new generation of smart campuses comprising of intelligent education systems aims to increase the capabilities of next-gen students with the help of visualization, which plays a major role in understanding and learning. Intel university is smart university management software that builds visual aids such as videos and other static and moving images, to deliver some of the most comprehensive content to augment children's interest so that they retain what they learn for longer periods of time.

There is no limit to the way we can use technology. Digital advancements are constantly changing lives to make them easier and a School Management System that has all the

elements of ease of learning is on its way to capturing the creativity of young minds. By itself, technology has several uses within education.

Stay in touch with mentors and teachers to see the progress of a child. Important communication can be facilitated through the Smart School Management System to keep all parties involved in the life of a student, informed and engaged. Answers to a range of questions are available at the click of a button. Find student assignments, projects, and other materials through powerful search engines encompassed within the campus management software. Access to technology broadens minds and encourages good decision-making due to the variety of information available. Where traditional classroom systems are considered boring, the smart campus management system aims to change all that and inculcate fun into the classroom. Students stay excited to learn.

The initial campus smart system is highly futuristic and prepares the child for the next generation challenges while imparting skills for a future workspace. Progressive classrooms always procure materials that utilize smart technology to facilitate comprehensive learning. Advanced smart classes actually encompass the newest of technologies to impart education. Instead of writing boards and markers, a computer or laptop is used to represent multimedia. The optical projector reflects learning objects on a screen. A microphone is used to make required announcements and other visual presenters such as a document camera and visual overheads are used to magnify or project two-dimensional or three dimensional-objects for learning. Smart boards and smart LCDs with an interactive pen display connected to a computer's USB or RGB port are used with digital inking facility. Besides all of this equipment, the smart school also uses advanced school management software to facilitate constructive and progressive student-parent-teacher-transport communication.

3. Green campus systems

A green university is an educational institution that meets its need for natural resources – such as energy, water, and materials – without compromising the ability of people in other countries as well as future generations to meet their own needs. Global warming, biodiversity loss, or plastic pollution in the ocean are global environmental problems that threaten life on planet earth. Already today, these challenges negatively impact agriculture through loss of pollinating bees, water safety through droughts and human health through micro-plastics in food.

As an institution of research and learning, your university can play an important role to help us address these problems. This is why it's important that it becomes a green university (Leuphana University Lüneburg, 2020). The green and sustainable campus concept is not something new to many country universities, but well-organized and coherent

activities to effectively “green” campuses are not that common, and efforts are minor in comparison to the potential of these universities. This definition requires your university to strive towards the following goals:

- All students get in touch with sustainability topics through their studies or extra-curricular activities;
- Zero CO₂ emissions by purchasing renewable energy, promoting public transport or insulating buildings;
- Zero waste by maximizing recycling, composting leftover food, reusing water, or purchasing cradle-to-cradle products;
- Maximum biodiversity by purchasing organic food, creating campus gardens or banning toxic chemicals.

Green buildings have four major benefits in their design and construction over standard buildings. Firstly, environmental benefits usually stand out as the main reason for the design and construction of green buildings (Orr, 2004). In this summary, the term “green building” has been used broadly. The term “green building” is used to describe a building that is energy and resource efficient, produces less waste, makes less pollution in its surrounding environment, and promotes a healthier environment to its occupants than a regular building. Ecofriendly environment procedure expressed in Figure 2.



Figure 2. Ecofriendly environment procedure

4. Methods and Material Approach for Reuse

RE × (use and cycle) “bicycle”: for the actual implementation of this program, a certain amount of budget must be prepared and invested in introducing the related tools equipped with a numerical. Table 1 shows how much pollution you prevented from biking 10 miles (Source: www.earthforce.org).

Bike riding uses minimal fossil fuels and is a pollution-free mode of transport. Bikes reduce the need to build, service

and dispose of cars. Cycling 10 km each way to work would save 1500 kg of greenhouse gas emissions each year.

Table 1. Pollution prevented from biking 10 miles

Pollutant	Problem	Amount saved
Hydrocarbons	Urban Ozone	29.00 grams
Carbon Monoxide	Poisonous Gas	220.00 grams
Nitrogen Oxides	Urban Ozone and Acid Rain	15.00 grams
Carbon Dioxide (CO2)	Global Warming	8.00 grams

Annual bicycle management procedure presented in Figure 3. Campus clean up oration procedure displayed in Figure 4. Bicycle use and re-use management in the university campus can be develop with these programs following:

Program step 1

- Announcement of warning by the University in public
- Collection and storage of abandoned bicycles and put in a designated stockyard with roof (This space should be newly considered and prepared).
- The bicycle should not be exposed outside.

Program step 2

- Identification and segregation of bicycle based on running or repairing condition (ex. Can be used, need minimal repair, Use as spare parts).
- Bicycles under bad condition should be used for spare parts supply.
- Bicycles under good condition should be stored for reuse.
- Bicycles with minor fixing, repair, adjustment and assurance of essential function should be as bicycle.

Program step 3

- Spare parts removed from bicycles under bad conditions should be collected, classified and stored in another section, which can be purchased or supplied with cheaper price almost equal to nothing on demand of students who need it.
- At least One personnel will be designated for the responsible safe keeping.

Program step 4

- Engineering students are strongly requested to join this program for the individual viewpoint as one of the

curriculum to provide the opportune to integrate their knowledge, skills and voluntary spirit for cooperation.

Program step 5

- The repaired or good conditioned (ready to use) bicycles can be avail to all the students for as low as \1000 yen (330 Baht)
- The amount of money collected can be used as reserve fund for the university or used to cover the fee for purchasing the spare parts to support the student’s activity.

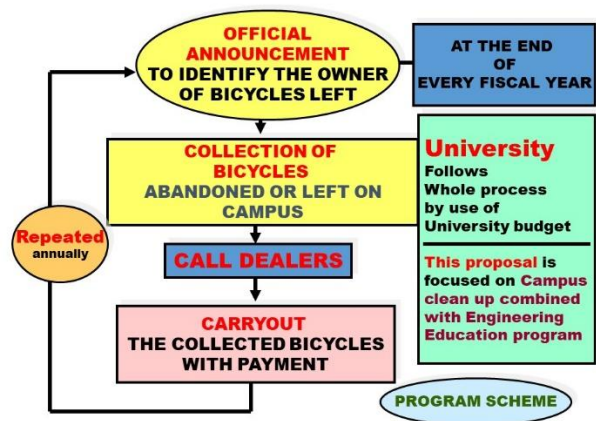


Figure 3. Annual bicycle management procedure

Through this program student will be benefited:

Obstacles to negotiate

- All National Universities were forced to change into Autonomous University.
- University is now in poor financial condition. It is requested to save money and find the fund how we can manage the university.
- University is strongly requested to manage by themselves.
- Very few university people know and experienced the autonomous system introduced even for highly ranked people.
- Efforts to think seriously about how university can negotiate and overcome the problem for further progress and improvement.
- University decision maker should make it possible with strong leadership and responsibility of his/her own.

Role and requirements of university leader

- No use if the proposed Idea cannot be applied to achieve the target purpose.

To make the proposed idea possible, it depends on the university leader's decision and responsibility.

- The leader is strongly requested to have his/her own information data in decision making.
- Spirit of "Love University" is needed.
- Eyes for judgment should be equipped enough to find out the proper human resources and to use their talent.



Figure 4. Campus clean up operation procedure

What should be prepared?

- Accreditation is needed as evidence to show the contents of program.
- Documents should be stored and kept for evaluation for further step of the program, especially for autonomous university.
- Even for The Tri-University program, it should be accredited.

- The author proposed the same program for developing the market of secondhand agricultural machinery, construction machinery and so on.
- Both of the people in supply and demand get benefits
- The concept of "reuse" should be recognized again for Sustainable Development.

5. Conclusion

This review paper and author personal experience was expressed with smart and green campus approach and benefits; furthermore, showed one example of campus clean-up program by "reuse" of abandoned bicycle combined with Mechanical Engineering education for students. This idea can be applied to even for Electrical and Electronic Engineering education for students. This program surely keeps the campus clean up, contributes for skill up and gives practical education for the students. The author proposed the same program for developing the market of secondhand agricultural machinery, construction machinery and so on. Both of the people in supply and demand get benefits. The concept of "reuse" should be recognized again for sustainable development.

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