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Zero Waste Strategy for a Green Campus

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Abstract When adopting the zero waste strategy for the implementation of waste management measures at a Higher Education Institution, the commitment in the institution is of fundamental importance, not only with solid waste, but with the sustainability issue under a circular economy perspective, which should gradually be incorporated to the different programs and routine actions from universities. Several directions can be taken in the construction of this path so that universities are managed under the sustainability's premises. In this article, the zero waste strategy for implementation of a circular economy program will be analyzed as a way to consolidate the process Green Campus. A qualitative and exploratory research was undertaken on green campus and zero waste strategies, mainly in universities. Although there is still a limited number of universities committed to zero waste actions, it was possible to appoint the benefits when implementing institutional programs related to sustainability and the fulfillment of the Sustainable Development Goals.

1. Introduction

When adopting the zero waste strategy for the implementation of waste management measures at a Higher Education Institution, the commitment in the institution is of fundamental importance, not only with solid waste, but with the sustainability issue under a circular economy perspective, which should gradually be incorporated to the different programs and routine actions from universities. Several directions can be taken in the construction of this path so that universities are managed under the sustainability's premises. In this article, the zero waste strategy for implementation of a circular economy program will be analyzed as a way to consolidate the process Green Campus.

2. About Green Campus

The process of "Greening Campuses" focuses on sustainable initiatives, such as improving efficiency, protecting and restoring ecological systems and enhancing the well-being of all members of the campus [1]. According to Hooi [2], this involves people, process

and place. People would be related to employees, the campuses users and frequenters, the culture to which they belong and their well being.

To reach Green Campus status goals, Darus at al.[3] suggest a better optimization of political social, technological, economic and environmental systems that are formed around education, social matters, research investment and technology and improvement of university infrastructure. Patel [4] adds that sustainable campi are projected to reduce global impact of the built environment in favor of human health and the natural environment through efficient use of energy, water and other resources, by protecting health of visitors, improving productivity of employees and reducing waste, pollution and environmental degradation.

According to Ribeiro [5], there are several interpretations for university green agendas. It is very usual to address green urbanism, green campus, eco-urbanism, green construction, high performance buildings, to describe the concept of Green Campus, showing that implementation initiatives vary from institution to institution.

Green Campus Programme in Taisce, an irish NGO, the Green-Campus Programme encourages a partnership approach to environmental education, management and action in third level institutions. The Programme primarily aims to ensure that members of a campus community can engage in a meaningful way to enhance sustainability on campus. It must be noted that the Green Campus Programme does not reward specific environmental projects or implementation of a new technology. Rather it rewards long term commitment to continuous improvement from the campus community [6].

Green Campus is a holistic programme that has the goal of making environmental awareness and action an essential part of the community's life. It can be considered a process to implement activities, policies, projects and programs to build a sustainable university campus, creating from its guidelines, targets to be accomplished. This process needs to contemplate several areas, from which these are highlighted: energy, water, urban environment, biodiversity and solid waste. Other important aspects to consider are the holistic vision in which a Green Campus should be built upon, and the engagement of all people within the organization, including people and the processes and places they belong to. This process initiates within the university borders, however it can go beyond, multiplying the activities in other environments.

The university campus is considered a propitious territory to create research and activities and can be used as a living lab to implement actions that will create opportunities to insert Sustainability discussions in the daily activities of teaching and this way, support the Green Campus process implementation.

3. About Zero Waste Strategy

In 1973 the Zero Waste strategy was proposed by chemical engineer Paul Palmer to eliminate material resource waste and improper disposal of recyclable materials in industry [7]. These principles were adopted by EPA (Environmental Protection Agency in USA) for anti-pollution norms, and also it has been used by environmentalists in civil society organizations. It became a social movement called Zero Waste and it is an answer from part of society to address the need to discuss the continuous and massive waste generation globally.

Currently Zero Waste strategy has been adopted as an instrument for circular economy by several different organizations. It passes the message to make the most of resources that can come from waste, such as recyclable dry materials and organic. Several

cities have adopted Zero Waste strategies to reduce the recyclable waste that used to be dumped in sanitary landfills or burnt in incinerators.

When adopting this strategy it is very important to understand the difference between waste and resources. Waste is usually discarded by mixing dry and organic waste in general, making it difficult to separate them later and usually are disposed of on landfills or incinerators. Therefore, all the waste that is separated correctly to allow its use in new processes, such as recyclable dry waste to mechanical recycling and organics to composting, can be called resources. This proposal intends to change the linear way of using resources and go for the circular model, very much discussed as the circular economy, using resources from cradle-to-cradle.

Canberra, Australia, was the first city to adopt this strategy in 1995, by approving a law (city without waste 2010) which passed through public consultation [8]. Today, several cities have adopted Zero Waste strategies to eliminate resources going to sanitary landfills or incineration, as well as incentivize a responsible consumption [9]. Also point to the holistic characteristic that Zero Waste strategies which has been under development also being adopted by the private sector, not only public bodies [10].

Since the 1980s, Higher Education Institutions have been adopting recycling programmes which are not always efficient for several reasons, such as absence of an administrative structure for environmental planning or an approved environmental policy or even for not measuring costs and waste [11]. On another hand, university campi are promoting spaces for new habits and changes, which can be resonated to society. Research developed in universities can be used in their management, using the university campus as a living lab and serving as an example to be replicated in cities. Most of universities have a complex infrastructure and social diversity as the cities around them.

University of Massey in New Zealand was one of the first to adopt a structured Zero Waste programme [12] and it led the NIZAC - Nexus for International Zero Waste Academic Collaboration. In Brazil, 3 universities in Santa Catarina, a state in the South (Universidade Federal de Santa Catarina - UFSC, Universidade do Estado de Santa Catarina - UDESC e o Instituto Federal de Santa Catarina - IFS) have created the NIZAC Brazil in 2018. An intention protocol was signed by their representatives and the University of Massey was present. The University of Campinas (UNICAMP) and PUC from Rio de Janeiro also joined the collaboration [13].

4. Waste Management and Circular Economy

The Zero Waste strategy promotes waste management in the perspective of circular economy. In Portugal, different legislation led to a paradigm shift: embedding waste prevention and management as a way to continue the life cycle of materials, constituting an essential step in returning useful materials and energy to the economy. Portugal's national plan for waste management (2014-2020) has the vision of promoting the prevention and waste management integrated with the product life cycle, centered on a trending circular economy and guaranteeing a greater efficiency in the use of natural resources. It is based on two strategic objectives: promoting the efficiency of resource use in the economy and preventing or reducing adverse impacts arising from the production and waste management.

5. Sustainability indicators and waste valorization

Higher Education Institutions play a leading role in society as they are responsible for

preparing a wide range of professionals who can have relevant roles in the most varied activities. Adopting sustainable practices means giving concreteness to the research and extension actions disseminated by the developed research, allowing to evaluate and improve the performance of the proposals [14].

Today's society is characterized by a diversified and continuous production of waste. Preventing wasted resources from being treated as waste is a fundamental step towards the circular economy. In countries like Brazil that have recyclable material collectors, waste can be segregated at the source into organic, recyclable and rejected portions, in addition to hazardous ones such as electronics, lamps and batteries. The National Solid Waste Policy (Law 12,305 of August 2nd 2010) guarantees the relevance of the work of these professionals in the segregation of recyclables.

In this sense, Brazilian universities, as major generators of waste, should adopt at least one cooperative of collectors of recyclable materials per city in which they have campuses. With an agreement, the adopted cooperatives would accurately report some of the performance indicators proposed by Cole [15], such as Quantity of Recyclables Collected, Quantity of Paper sent to the Recycling Industry, in addition to detailing the quantity of other recyclables sent to the industry and which materials still have no regional market value. Also points out that waste management must be evaluated by these indicators [15]:

- Total amount of solid waste generated (tons per year);
- Amount of solid waste generated by a member of the academic community (tons per capita per year);
- Amount of organic waste sent for composting or anaerobic digestion (tons per year);
- Amount of hazardous waste generated annually by members of the academic community (tons per capita per year);
- Amount of hazardous waste reused (tons per year).

The time scale for evaluating these indicators must be related to the measurement of the performance of educational actions promoted within the university community, plus these indicators proposed by [15]:

- Rate of waste generation reduction per member of the academic community (tons per capita per year);
- Rate of hazardous waste generation reduction per member of the academic community (tons per capita per year).

As the Zero Waste Program is implemented, the indicators must analyze the change in the university community's behavior in relation to the 5Rs of the circular economy (reduce, reuse, recycle, refuse and rethink consumption). Another point to be analyzed is the waste valorization. How can the waste be better used throughout this process? It is important to find a common ground so that it is advantageous for the different actors in this process.

Reports and studies point out that the paradigm shift towards circularity can bring benefits on many fronts. According to European Union's analyses, with investments in the Circular Economy, it is expected that by 2030 the European economy will be able to: achieve an additional growth of 7% of the gross domestic product (GDP); reduce consumption of raw materials by 10%; and reduce annual CO_2 emissions by 17% more than it would have been achieved by the current development pattern [16].

6. Zero Waste strategy and Green Campus

According to Moscone [17] In the *Waste Not, Want Not: A Student Manual for Creating Zero Waste College Campuses,* for the zero waste campus project to succeed, it is

critical that you know how to answer a few questions:

1. Is your college's recycling program a stand-alone entity?
2. Do you have a full-time person whose primary responsibility is recycling/waste management?
3. In what capacity is your facilities management and/or campus maintenance involved in waste management on campus?
4. Is there a full-time person that serves as a sustainability coordinator or manager?
5. What campus resources will you need in order to make your event happen?
6. Who in administration do you need to contact to get a campus event approved?
7. Who do you contact to reserve a space for an event?
8. Where are you getting funding for your project?
9. Is there a department on campus that will give you funding for your program?

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Working together as a group to find the answers to these questions will help to kick start a successful program, because you will know who you need to speak with to get the ball rolling! [17]

In Brazil, several public higher education institutions have within their administrative structure an area responsible for the issue of sustainability at the university. By creating this, the university assumes sustainability as a principle, commitment and practice. As a rule, these bodies are composed of specialists in the area and groups of professors invited to act in a collaborative and advisory manner when necessary. At these universities, this sector may be responsible for implementing these made commitments.

Despite the existence of this area, the participation of the institution's highest authority in the approval and analysis of the programs to be proposed by the specialists is of paramount importance. This approval must be made by the university council, which is the highest deliberation body and is responsible for exercising the superior jurisdiction of the university and drawing up its guidelines, in addition to the approval of programs among other items. It should be noted that this council is formed by a group from different segments of the university.

The approval of these proposals in this council is necessary, in order to disseminate the proposed program and validate the actions that will be implemented if approved, since the higher instance is responsible in partnership with this body, for the implementation of the commitments assumed when adopting the Green Campus and the Zero Waste strategy for its territory.

As this is a topic that generates great discussion within the university environment, it

is important that everyone has the knowledge and understanding of these concepts, especially when it comes to the Zero Waste strategy.

Por se tratar de uma temática que gera grande discussão dentro do ambiente universitário é importante que todos tenham o conhecimento e entendimento destes conceitos, principalmente quando se trata da estratégia do Lixo Zero.

It is expected that with the implementation of these processes there will be a cultural change in the university environment towards an increasingly sustainable environment. Thus, it is essential to create and implement indicators to constantly check the progress of these programs, in order to assess whether the proposed objectives and goals are being achieved.

Community participation is very important in this process, so the disclosure of the data must be transparent to everyone in the institution in order to motivate people to change their actions, whether in the university environment or not.

The incorporation of Green Campus as a plan to implement the Zero Waste strategy in the university's organizational culture creates the need for structural changes on the campus, so it is important to allocate part of the institution's financial resources for this purpose. This strategy has proved to be a robust instrument to lead this process of changing habits in relation to the consumption of renewable resources or not, allowing a transition between the management actions of the campuses and the main actions of the university such as teaching, research and extension towards sustainability in their territories.

7. Conclusions

Having already taken Green Campus as a methodology for implementing sustainability actions, the institution promotes a cultural change at the university that facilitates the implementation of projects aiming to become a zero waste organization.It should be noted that any proposed cultural change initially generates a fear in the people who are part of that environment. For this reason, this whole process towards a Green Campus with no wasted resources with the recyclable materials having an appropriate destination, must be transparent and clear to all involved, stimulating the participation of all who are part of the community directly or indirectly so that the goals are continuously reached.

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