Universities as Sustainable Actors: A Case Study of the Environmental Plan of the University of São Paulo (USP) with Emphasis in the Actions of the Sustainable Building Working Group (WG)

Mariana Auad Proença and Roberta Consentino Kronka Mülfarth

Abstract The Universities have been acting in an impactful way in the implementation of sustainable actions within university campuses and as living labs for the universities, communities and cities. This paper presents a case study based on the Environmental Plan of the University of São Paulo (USP) with emphasis in the actions of the Sustainable Building Working Group (WG), as well as an overview of Sustainability Plans developed by universities in big centers worldwide. It is important to highlight how the universities are introducing sustainable issues inside campuses through the development of environmental plans by contemplating social, economic and environmental fields of sustainability. Some projects implementations and results demonstrate how environmental plans are important to promote better understanding on the importance of the environmental preservation and the construction and refurbishment of buildings through sustainable actions based on the environmental comfort of their users. Finally, through the case study of University of São Paulo (USP), this paper aims to serve as a base guide to anyone interested to know how environmental plans are being structured and implemented in universities.

Keywords Sustainability · Eco campus · Universities · Environmental plan

M. A. Proença (✉)
Architecture and Urbanism Faculty, University of São Paulo,
Rua do Lago, São Paulo 03178-200, São Paulo, Brazil
e-mail: marianaproenca.arq@gmail.com

R. C. K. Mülfarth
Department of Technology in Architecture, Architecture and Urbanism Faculty,
University of São Paulo, Praça Do Relógio 109/Bloco K Sala 309,
São Paulo 005508-050, Brazil
e-mail: rkronka@usp.br

W. Leal Filho et al. (eds.), *Towards Green Campus Operations*, World Sustainability Series, https://doi.org/10.1007/978-3-319-76885-4_20

1 Introduction: Sustainability or Environmental Plan Inside the Eco Campus Context

Nowadays, the sustainable development through the preservation of the environment and the conservation of the natural resources have become even stronger since that the natural resources have become scarce and the quality of life has become delicate. According to Kronka Mülfarth (2006) "over the past decade, the issues of sustainability has come to the fore and its principles are being incorporated by all actors in society reinforcing the need to promote deep structural changes in search of greater social equality, enhancement of cultural aspects, greater economic efficiency and less environmental impact on the equitable distribution of raw materials, ensuring the competitiveness of man and cities". Some ideas and actions to achieve a more sustainable environment started to be implemented in 1972 at the first version of The United Conference on Environment and Development (UNCED) held at Stockholm, Sweden. But, it was at its second meeting held in June 1992 in the city of Rio de Janeiro that the sustainable development was recognized as an important concept to be put into practice (Tauchen and Brandli 2006). Moreover, the universities around the world started to appear playing an important role, while promoting and implementing sustainable practices and also through the conception of the environmental policies.

Currently, sustainable issues are being considered in many areas of interest. One of them is recognized as Eco Campus, which has been addressed in the university context. The Eco Campus can be understood by its two strands. The first one is applicable in a practical form through the rebuild of the interactions between societies, encompassing economy, environmental, research, education and social aspects, by seeking the respect of life and preserving the resources of our planet. The second strand highlights the important role that universities are taking while addressing the sustainable issues by searching alternatives of rethinking and implementing lines of action related to these issues (König 2015).

Universities in big centers of the world are developing Environmental Plans as a practical form of structuring and application of the Eco Campus concepts. The main objective is to reinforce the role of universities as experimental living labs, as well as a vehicle of communication among other universities, the community and local governments, seeking to form better citizens compromised with the environment conservation.

The structures of the Environmental Plans are based on the needs of each university related to the implementation of sustainable actions driven by guidelines, objectives, indicators and targets. The Plans essentially propose a "zero carbon" campus model, but also focus on the buildings and their environmental impacts, the campus urban planning and the interaction of sustainability at levels of teaching, researching and culture. The implementation of these actions has been made by students, teachers and employees and in some cases involving the participation of the community and local governments.

Fig. 1 Collaborative work towards a more sustainable environment. Material developed by the authors, 2017

It's important to highlight the main role that Universities are taking as sustainable actors either through the introduction of the environmental issues into the high education or through the Plans, where actions are being implemented. Moreover, universities actions serve as an example for other universities, communities and the cities. The Fig. 1 illustrates that these Plans are developed through a collaborative work among students, professors, employees in some cases with the community and local governments towards a more sustainable environment.

Based on that, this paper will present a case study of the Environmental Plan of the University of São Paulo (USP) with emphasis in the actions of the Sustainable Building Working Group (WG), as well as an overview of Sustainability Plans developed by universities in big centers worldwide with the purpose of demonstrating as an example the development and design of an Environmental Plan.

2 An Overview of Sustainability Plans

As mentioned before universities around the world started to appear playing an important role, which consist according to Romero and Kronka Mülfarth (2017) "in their primary function of knowledge construction, has a duty to strengthen their roles as an intermediary between local government and society, not only in promoting discussion, but also as an important agent towards these changes". To put this role in practice universities in big centers of the world, organizations or governments are developing sustainability or environmental plans that seeking for goals that will promote environmental, community, social, and financial sustainability.

Moreover, as reported by Johnson et al. (2004) "Sustainability Plans can help identify what resources are necessary to sustain projects, encourage the development of partnerships, and support collaboration. Whatever the understanding of sustainability (different organizations' or governments' interpretation of sustainability will vary according to their priorities), sustainability plans are an important tool not only for diagnosis, but also to identify actions in pursuit of more sustainable benchmarks. Moreover, for universities, sustainability plans are important to not only organize actions, but also to establish goals".

Many universities in big centers worldwide are developing their sustainability plans based on concepts to achieve a healthier and resilient future through criterions that will "guide projects and plans in teaching and research to achieve goals in sustainability" (Romero and Kronka Mülfarth 2017).

Following are some examples of sustainability plans for Harvard University, City University of London and Polytechnic of Milano.

3 Harvard University

> The Harvard Sustainability Plan is the University's roadmap for building and operating a healthier, more sustainable campus community. The Plan aligns Harvard's decentralized campus around a holistic vision and sets clear University-wide goals and priorities based on the innovations and solutions that have been developed at our individual Schools and departments (Harvard 2015).

The Sustainability Plan of Harvard has been developed by a collaborative work among faculty, students, facilities, and operations experts along with the Harvard office for sustainability management. The Plan was defined concerning five topics, listed below, which are then analyzed according to three categories.

TOPICS

Emissions and energy: greenhouse gas emissions; energy reduction; and renewable energy.

Nature and ecosystems: landscape operations; campus design; conservation and education.

Campus operations: new constructions; building operations; transportation; climate preparedness and campus resilience; and procurement.

Culture and Learning: research and teaching; governance; external partnerships; communications; and community action.

CATEGORIES

Goal: University-wide resource reduction goals with a specific target within a set timeframe (Harvard 2015).

Standard: Operational standards to facilitate alignment across the University, ensuring that a consistent approach is being implemented. Standards are designed to allow flexibility for how they are implemented by individual Schools and administrative departments (Harvard 2015).

Commitment: A statement of commitment or recommendation for future research in areas where there was not enough information to set a specific numeric goal standard (Harvard 2015).

4 City University of London

> As a leading global university, committed to academic excellence, we have an important role to play in promoting sustainability, both locally and globally. We aim to fulfil this role by reducing our carbon emissions, ensuring that our facilities are built to the highest sustainability standards and reinforcing our commitment to behavior change and Education for Sustainable Development (City University London 2015).

Based on the principles mentioned above, an Environmental Management System was established through the Environmental Sustainability Policy that is accredited to ISO14001. The performance evaluation is based on nine key environmental aspects, listed below.

Energy
Water consumption
Waste
Construction and maintenance
Transport and travel
Purchasing and procurement
Sustainable food
Biodiversity
Stakeholder engagement

5 Polytechnic of Milano

> Città Studi Campus Sostenible is a project promoted by the Politecnico di Milano (POLIMI) and Università degli Studi Milano (UNIMI). The project aims to transforming the whole campus neighborhood into an urban area which can serve as an urban model in Milano with respect to life quality and environmental sustainability. The project is open to the participation and support of researchers, students and all campus citizens (POLIMI ISCN-GULF Sustainable Campus Charter Report 2014).

The main idea of the project is to create a living lab campus by promoting sustainability based on the following goals: *"test innovations developed by scientific research; to promote life style transformation and more livable spaces; to become a positive example for the entire city; to cope with the international network of sustainable campuses"*. And furthermore, a website was developed to organize technical meetings (thematic tables), encompassing students, academics and technical staffs for sharing proposals, ideas, and case studies through a collaborative work.

The project initially was structured focusing in four main themes: *people; energy; environmental; and mobility.* After that, in 2013 two new themes were created in addition: *city; food and health.* It's important to highlight that the sustainability themes were guided by the "ISCN-Charter principles and helped in organizing the management of the whole process and structuring the ISCN-report" (POLIMI ISCN-GULF Sustainable Campus Charter Report 2014).

The five themes eventually structured by three principles, are listed below:

THEMES

People and City: users, participation and identity/transferring research from labs into urban life

Energy: energy efficiency and renewable energies

Environmental: environmental quality

Mobility: transport terms accessibility and sustainable mobility

Food & health: sustainable lifestyle and sociocultural topics

PRINCIPLES

Building and their sustainability impacts

Campus-wide planning and target settings

Interaction of research teaching, facilities and outreach

6 The Case Study: The Environmental Plan of the University of São Paulo (USP)

The University of São Paulo (USP) was founded in 1934 and is consisted of 42 units distributed in campuses of eight cities of the state of São Paulo. Its quality as university is expressed as follows:

> The talent and dedication of the faculty, students and staff have been recognized by different world rankings, created to measure the quality of universities from a variety of criteria, particularly those related to scientific productivity (USP 2017).

For over 20 years the University of São Paulo (USP) has been introducing and developing sustainable actions. In 2009, a Working Group (WG) was created to implement an environmental management system based on the National Solid Waste Policy (NSWP). And, in 2012 the Superintendence of Environmental Management was founded with the main objective to promote the importance of environmental sustainability followed by the basics principles:

- To develop actions for the conservation of the natural resources from the university;
- To promote health and safety of the environment inside campuses;
- To promote the rational use of the resources and to teach based on the sustainability;
- To transform the University in a sustainable model for society.

Fig. 2 Sustainable timeline activities and actions. Material developed by the Superintendence of Environmental Management (2016)

After the creation of the Superintendence of Environmental Management a great number of sustainable activities and actions were published. The Fig. 2 illustrates a time line of all these sustainable activities and actions.

In 2014 a new management was created inside the Superintendence of Environmental Management by taking as goals:

- To reduce the carbon emissions from university campuses;
- To emphasize the role of the university as a living labs for the cities;
- To improve the sustainable actions into three spheres: actions inside USP; from USP to other Brazilian universities and from USP to the cities.

Based on that, in the same year of 2014 the Environmental Plan of the University of São Paulo (USP) was formulated and the Plan was structured placed on four phases:

- ***First phase: definition of the Sustainable Policies:*** it was concluded in November 2015 and developed through eleven thematic policies (administration, greenhouse gas emissions, energy, water, mobility, fauna, green areas, environmental education, land use, waste and sustainable buildings). This phase is complemented by the policy of management. For each one of the thematic policies were established Workings Groups (WG) structured by the faculty and technical people that had worked to develop this document based on: Subject and Implementation; General Provisions; Definitions; Principles; Goals; Guidelines; Management Tools; Administration Tools and Financial; Responsibilities and Prohibitions.
- ***Second phase: definition of the Environmental Management Plan:*** The second phase was structured by the Environmental Management Plan of each policy established by actions, goals and guidelines and it was concluded in

2016. The thematic plans were developed by a specific working group (WG) formed by students, professors and employees.

- ***Third phase: definition of the Environmental Master Plans with the 11 Thematic Chapters:*** Based on the second phase each campus will develop a master plan taking into account all the local ecological and urban diversity. This phase is planned to be finished in 2018.
- ***Fourth phase: sustainable programs of each school or department:*** All the actions and activities that will be defined by each school or department will be assisted by the Environmental Plan of USP and their phases.

The Fig. 3 illustrates all the phases of Environmental Plan of USP.

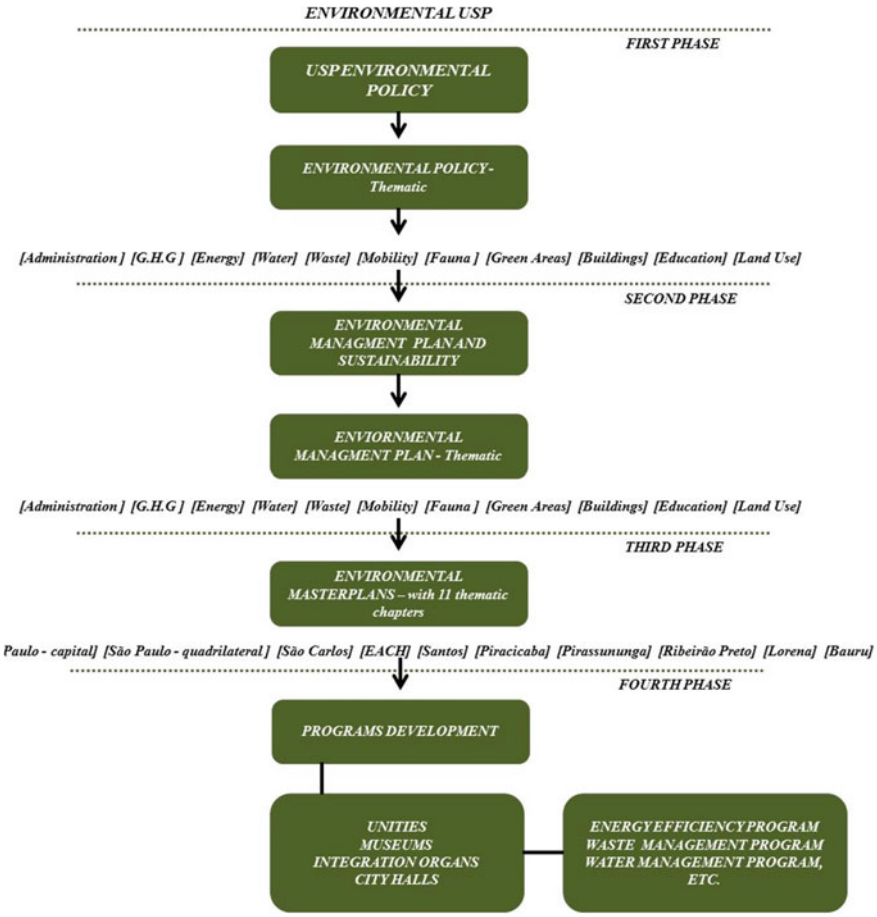

Fig. 3 Diagram of the fourth phases of the environmental plan of the University of São Paulo (USP). Material developed by the authors, 2017

It's important to feature that concurrently of the Environmental Management Plan another two projects were developed.

The GAIA (temporary name) platform: a web database that will share information about the consumption of water, waste and energy, (also all the data from environmental plan) from each one of the unities of the campuses.

The PAP (people learning participating—PLP): a program that promotes the sustainable education inside the campuses.

After the implementation of the Environmental Plan of USP some projects and actions have been implemented inside the campuses, as the Pilot Project called BOSSA, which is nowadays developing a research of post-occupancy of office buildings and their performances inside the campus of São Paulo. Furthermore, the Environmental Plan of USP was awarded excellence in 2016 by the International Sustainable Campus Network (ISCN),[1] in the category Planning and Management Systems for Campus.

It's important to highlight that all the development and implementation of an Environmental Plan is based on a collaborative work and has the main purpose to serve not only as a reference for other universities, but also to the city. If they can apply all the projects and actions inside the university it will be possible to be applicable in an urban vision: the cities.

In conclusion of this section on the Environmental Plan of the University of São Paulo, it had the intention to present the composition of this plan and a preview of what each of its phase represents. Moreover, this section aimed also to demonstrate that a university can be an example of a living lab to other universities, community and to the city in searching for a more sustainable environmental.

In the sequence it will be described the structure of the Sustainable Buildings Working Group (WG).

7 The Environmental Management Plan of Sustainable Buildings: The Performance of Sustainable Buildings Working Group (WG)

As described before, the Environmental Plan of the University of São Paulo (USP) has 11 thematic policies, and for each of them the Environmental Management Plan (Thematic) was developed by a specific working group (WG). For this chapter the Sustainable Buildings WG was selected to emphasize the work that was developed up to the conclusion the Environmental Management Plan of

[1]International Sustainable Campus Network (ISCN): "The International Sustainable Campus Network (ISCN) provides a global forum to support leading colleges, universities, and corporate campuses in the exchange of information, ideas, and best practices for achieving sustainable campus operations and integrating sustainability in research and teaching". (Extracted from: https://www.international-sustainable-campus-network.org/ Last access: 2017).

Sustainable Buildings. In addition, the sustainable buildings WG is serving as an example of an applicable methodology for the other WGs.

The sustainable buildings WG has the main purpose to promote the sustainability either into the new buildings of the campus, or prioritizing the refurbishment, retrofit and renovation of the existing buildings, at the same time preserving the natural resources such as the water, energy, etc. For achieving this main purpose some concepts were established, such as: *the development of an USP constructive environmental performance certification; the establishment of benchmarks for the evaluation of thermal efficiency, natural lighting, acoustics and energy and also the durability of materials used in construction; the use of operational instruments with national and international technical standards (USP Environment Management Plan, Sustainable Buildings Chapter,* 2016*).*

The development of the Sustainable Buildings Management Plan was made through a collaborative work formed by selective group of students, professors, employees and within the Superintendence of Physical Space, known as SEF.

To a better understanding of how the Plan would be structured, at first an analysis of the Thematic Policy of Sustainable Buildings was made, being composed of: *Subject and Implementation; General Provisions; Definitions; Principles; Goals; Guidelines; Management Tools; Administration Tools and Financial; Responsibilities and Prohibitions (USP Thematic Policy of Sustainable Buildings* 2015*).* Subsequently a survey of sustainable plans was made, considering specific universities around the world that are developing and implementing sustainable actions in their campuses and also for complementing some national and international laws and standards which were used as a reference for the definition of the actions, indicators and targets.

The Building chapter of the Environmental Management Plan was basically structured through four general objectives:

- ***First general objective***: *Building requalification; identify the necessity of buildings requalification for a better environmental performance.*
- ***Second general objective***: *Design; develop projects for new permanent and temporary buildings of high performance and environmental quality.*
- ***Third general objective***: *Construction; accomplishment of constructive processes of low environmental impact.*
- ***Fourth general objective***: *Post-occupancy of campuses buildings*; *Implementation of routine maintenance, use and operation of buildings for high performance and environmental quality.*

Some specific objectives complemented by actions, indicators, goals and members in charge were developed for the four general objectives. Regarding actions and goals, deadlines were defined that were specified as short, medium and long term, while for the indicators two types related to the quantitative and qualitative aspects were established. Furthermore, a method for ranking the actions was developed considering the prioritization of their implementation and their specific objectives. To conclude, for the members in charge, was selected a group formed

by: *The City Hall of the campus, the Superintendence of Physical Space—SEF, the Superintendence of Environmental Management—SGA, the Center for Cultural Heritage—CPC, the Directorates of Units and Museums, the Maintenance Teams and Museums, as well as the occupants of the buildings.*

Aiming to facilitate the reading of the structure described above and for helping the ones of the sustainable buildings WG in charge to implement these actions, a table was composed gathering all the related content. Such a table was also conceived to serve as a base guide for putting into practice all these concepts established. The Fig. 4 illustrates a diagram of the table structure.

It is important to emphasize that this thematic environmental management plan will also allow contemplating research activities through the development of master and doctoral projects that will help in the implementation of the objectives, actions and goals stipulated for this Plan.

An additional aspect to be pointed out is about the importance of having this plan as a reference guide for the refurbishment and construction of new more sustainable buildings through the achievement of satisfactory environmental performance. Actually, the guide is supposed to be a reference not only to the university, but also for other universities and inside an urban view, such as the city.

Regarding the Environmental Management Plan, two important aspects must be emphasized:

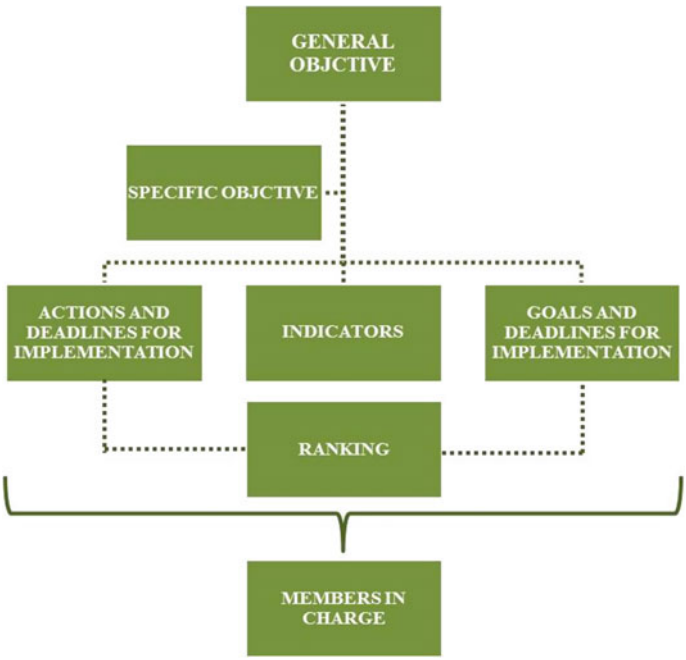

Fig. 4 Diagram of the structure developed for the table. Material developed by the authors, 2017

- The focus on the buildings maintenance: this aspect will be developed by prioritizing the so called passives ways of analyses, that is, through considering the study of acoustics, natural ventilation, natural lighting and processing of data measured in the spaces. It is important to point out that these analyses can serve as an excellent form of evaluation and comparison of the buildings conduct, seeking for improvement of its environmental performance.
- The environmental education of the buildings users: this aspect involves a better exploitation of the spaces and the resources of natural ventilation and lighting, as well the use of energy and water. To achieve a satisfactory environment performance of the buildings, it is also important to evaluate the perception of the users, by taking into account the consistent and conscious occupation of the spaces.

In conclusion, this section has described the work developed by one of the eleven WGs that are part of an Environmental Plan, having the purpose to implement sustainable actions inside the university.

8 Implementations and Results: The Development of Pilot Projects as a Strategy of the Environmental Policies

As mentioned before, the Environment Plan of USP at its the second phase has established the Environmental Management Plan of each area of activity, which is composed by: *management, greenhouse gas emissions, energy, water, mobility, fauna, green areas, environmental education, land use, policy management and sustainable buildings.* All of these thematic plans were developed by a specific working group formed by students, professors and employees, having been structured a methodology of application to stipulate their actions, goals and guidelines. It is important to highlight that the WGs have taken the work developed by the Sustainable Buildings Working Group as the main reference.

Alongside to the thematic environmental management plans, some pilot projects have been developed inside of various campuses of USP as a strategy of the environmental policies. Such projects are as follows:

- Law Faculty of USP: Living Coverage, which consists in the revitalization of the rooftop of the Law Faculty building by enabling different types of use.

This is the first building in the city to use native plants for the green rooftop and its being an example for other buildings.

- Campus of Pirassununga: Project Bike Path/“Let’s Go by BiKe” it is a project still in operation. It has been established for promoting the bike use through sharing them and by seeking for a more sustainable displacement. The main goal in the future is to extend this idea to the community.

This project is for stimulating students to use bicycle and inspiring the community.

- Campus of Ribeirão Preto: Genetic Bank/Institutionalization of the Bank in vivo of Genetic Diversity of USP/RP through academic-scientific and university extension activities. This project aims at supporting a proposal for the management of the in vivo Genetic Diversity, academic-scientific and university extension bank, to evaluate the functional state of the USP-PR Forest through ecological diagnoses. Moreover, this project aims to encourage actions to be made connecting the internal and external community;
- Campus of São Paulo: this lies of the development of the Olympic Radius—CUASO and the CienTec Technology Park. The basic aim is to promote outdoor environmental education activities, with focus on of the scholastic public in the basic education level.

Nowadays several education activities are being managing through the CienTec Technology Park by promoting the use of outdoor spaces as a way to expand teaching and researching practice.

- Campus of São Paulo: the BOSSA—CUASO project was developed to evaluate the behavior of the users of the campus by taking into account the perceptions of the environmental comfort, such as the usual practice of natural ventilation and lighting and also the use of the air conditioning into the administrative spaces of the existing buildings. It is important to point out that this project is based on the Environmental Policy of USP of Sustainable Buildings that has as one of the main focuses the education of the users. The project also envisage to extend these actions through the students at the didactic spaces.

This project is helping users to understand how they can achieve a satisfactory quality of the work environment. Furthermore it allows for introducing studies of measurement to help in collecting data to achieve a better performance for the buildings.

- Superintendence of Environmental Management (SGA) Electronic Magazine—USP: it consists of the Environmental Public Policy Magazine of the SGA on environmental topics. The basic aim is to contribute for elaboration and implementation of the public environmental policy in Brazil;
- Campus of São Paulo: the CEPEUSP - Performance Project—CUASO is related to the installation of water saves mechanisms, seeking for the conscious consumption of water, therefore reducing and by the assistance the costs management of the project.

This project is important for improving the conscious use of water inside campus.

- Campus of São Paulo: Shared Bike—CUASO, it is being developed with the purpose to facilitate the access inside the campus through sharing the bikes, and also the integration between the Butantã subway Terminal and the surroundings.

This project aims to stimulate the use of bicycles inside campus through the installation of 10 bike stations making available about 100 bicycles.

Finally, it is important to emphasize once again how universities are acting as sustainable urban actors through the implementation of environmental plans and how these plans are becoming practice. It is believed that once these ideas and conceptions are applied inside university it is possible to foreseen its extension to the cities, therefore reinforcing the important role that universities can take for promoting the sustainable development.

9 Conclusion: Universities as Sustainable Actors

The universities have been acting in an impactful way either in the implementation of sustainable actions within university campuses or as living labs for other universities, communities around and cities. Related to these aspects, this article aimed to demonstrate that Environmental Plans are being developed with the purpose of dealing with the environmental issues and also by structuring their actions to be implemented.

As a study case, the Environmental Plan of the University of São Paulo (USP) was chosen to be described as an example of how universities in big centers of the world are developing their sustainable actions. It is important to emphasize that this Plan has been implemented since 2014 and has already had some results through pilot projects, by research and the dissemination of issues that can impact in a good way the implementation of their actions. Also, it was described the performance of the Sustainable Buildings Working Group (WG) at the development of the Environmental Management Plan of Sustainable Buildings by demonstrating the structure established for the thematic chapter through a collaborative work among students, professors, employees.

Finally, through the case study of University of São Paulo (USP), one concludes that the Environmental Plan of USP with focus at the Environmental Management Plan of Sustainable Buildings may serve as a base guide to anyone interested to know how environmental plans are being structured and implemented in universities. Also, it is important to emphasize that based on the concrete results presented in this article, it is wind up that the environmental plans are indeed an efficiency form to promote, develop and put into practice the sustainable actions that universities are dealing as a way to achieve a more sustainable environment.

Acknowledgements We would like to thank everyone involved at the Sustainable Building Working Group (SBWG), Superintendence of Environmental Management of USP (SGA-USP), Superintendence of Physical Space of USP, (SEF-USP) and School of Architecture and Urbanism of USP (FAU-USP).

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Author Biographies

Mariana Auad Proença (M.Sc. Student) Master's degree student at School of Architecture and Urbanism of University of São Paulo (FAU-USP) and Bachelor's degree (2010) in Architecture and Urbanism at Mackenzie Presbyterian University (FAU-Mack). Member of Sustainable Building Working Group at Superintendence of Environmental Management of USP (SGA-USP), contributing to the development of sustainable policies of the University. Attended on WC2 University Network (World Cities World Class) Summer Symposium Berlin, representing USP at the Eco campus Group (2016). Currently attending the Latitudes Global Studio, a cooperation project between School of Architecture and Built Environment of University of Westminster and FAU-USP. Emphasis on architecture and urbanism fields, focusing on sustainability in the built environment, eco-campus, hospitals, landscaping and interior design.

Prof. Roberta Consentino Kronka Mülfarth (Ph.D.) is Associate Professor at School of Architecture and Urbanism of University of São Paulo (FAU-USP) since 2006. Ph.D. (2002) in Urban Environmental Structures at the same institution, a Master's Degree (1998) in Energy at the Postgraduate Interunit Program of University of São Paulo and a Bachelor's Degree in Architecture and Urbanism (1994) at FAU-USP. Technical Adviser at the Superintendence of Environmental Management of USP (SGA), and Coordinator of the development of Environmental Policies of USP and Sustainable Building Working Group at Superintendence of Environmental Management of USP (SGA-USP). Member of the WC2 University Network (World Cities World Class), representing USP at the Eco campus Group. Member of ISCN Advisory Committee (International Sustainable Campuses Network) since 2016. Experience in architecture and urbanism fields, focusing on Environmental Comfort and on researches related to environmental performance of built environment.