

Domain ARCHITECTURE

DOCTORAL THESIES - RESUME -

REHABILITATION AND MODERNIZATION OF THE BUILT SPACE -TRANSITION TOWARDS A SUSTAINABLE CAMPUS OF ORADEA

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KEYWORDS

Rehabilitation and modernization of the built space, Updating the Oradea University Campus, Sustainable development, Energy efficiency, User comfort.

MOTIVATION FOR THE CHOICE OF THE TOPIC AND THE NATURE OF THE RESEARCH

In the context of climate change and the intensification of environmental concerns, urban development must be adapted to new, modern, and environmentally friendly requirements. Therefore, the implementation of a sustainable university campus is imposed both as a necessity and as a social responsibility. Campuses are centers of research and education that have a significant influence on the community in which they stand out, playing an essential role in promoting and addressing sustainable development.

Dealing with campuses from the perspective of the terms mentioned in the first paragraph brings practical and economic benefits. A sustainable campus can lead to significant energy and resource savings, as well as reduced maintenance and operating costs for buildings and other functions. Also, such a campus can attract students and professors interested in environmental issues and contribute to strengthening and increasing the reputation of the university. In addition, research on sustainable campuses can also have a significant impact on the academic community and society at large. The results of research in this topic are intended to be applied in many other fields and can constitute a solid basis for the development of public policies and practices oriented and centered on sustainability in other sectors.

Thus, the "Sustainable Campus" approach can be justified by its social, economic, and academic importance and relevance.

Through the architectural diversity of the Campus of the University of Oradea, through the rehabilitation and modernization projects, but also through the phased evolution of the location, it is possible to observe how the built space evolves and is updated according to needs, regulations, and constraints. The development also considers energy efficiency, increased indoor comfort for users and a positive impact on the environment. Active participation, in 2018, during the architecture internship, in the project development team "Rehabilitation, modernization, expansion and equipping of the educational infrastructure within the Smart Campus project – University of Oradea", coordinated by the architect Daniel Tivadar-Ianceu and, subsequently, monitoring the implementation of the project in the construction phase, gave me the opportunity to observe and analyze different design and construction solutions, depending on the constraints caused by a given built situation. Their historical documents and plans, images, projects, and conclusions contributed to the realization of the specific part of this work.

JUSTIFICATION OF THE THEME APPROACH

In 2015, the United Nations (UN) adopted the "2030 Agenda for Sustainable Development", continuously updated, with a view to eradicating poverty, combating inequalities and injustice, and protecting the planet by 2030. Among the 17 "Sustainable Development Goals" (SDG), the eleventh objective refers to sustainable cities and communities, with university campuses being considered an integral part of this objective.

At the national level, Romania approved in 2017 the "National Strategy for Sustainable Development of Romania 2030", which has as its general objective the promotion of sustainable development in all activity sectors.

In addition, the Ministry of Education and Research has adopted a series of measures and programs dedicated to the development of sustainable university campuses in the country.

Obviously, the phrase "Sustainable Campus" falls into both international and national concerns regarding sustainable development and environmental protection, being considered a priority direction in the current context of climate change and increasing concerns about environment protection.

THE IMPORTANCE AND CURRENTNESS OF THE TOPIC

Campuses are locations where young people spend a period of approximately 3-10 years of their lives, where they learn, experience, develop their identity, knowledge and they grow up. These spaces must not only be safe and comfortable, but also sustainable, in step with the times, to provide a complete educational experience and to train the next generation of specialists (or at least those interested) in the field of sustainable development.

University buildings and daily activities have a significant impact on the environment, on those who work on campus and on the surrounding community. Therefore, it is significant and mandatory that universities, like any other institutions, consider the influence exerted on the environment and create opportunities to reduce this impact through feasible, implementable, and effective measures (such as rehabilitation and modernization of buildings, reduction of CO_2 emissions, efficient waste management, exploitation of renewable energy sources, etc.).

By adopting a sustainable approach to the rehabilitation and modernization of the built space on campuses, universities can and must assume a decisive role in promoting sustainable development and in stimulating other institutions to follow their example.

RESEARCH OBJECTIVES

The main objective of the research is embodied in the analysis of the evolution of the built space, as well as in the description of the modernization works in Oradea's Campus, developed in phases, in different historical periods.



Site + Constructions (marked in red) built after 1910



Site (1982) + Constructions (marked in red) built after 1960



Site (1990) + Constructions (marked in red) built/relocated after 1990



Site (2023) + Military buildings (marked in red) entered the administration of the University

During the study, the evolution over time of the built space on the current site located on Universității Street 1, 4 and 6, is observed and described, by inventorying the different types of existing buildings and by describing the different types of interventions, applied to each type of building in part, contributing to increasing the sustainability of the entire Campus and, implicitly, of the entire city of Oradea. Moreover, awareness and civic responsibility is desired, through the project, construction, and optimal exploitation of the built space, all of which are oriented towards sustainability and energy efficiency. Both through the general part (which presents the current state of knowledge) and through the specific part (personal contribution), we want to understand the positive impact that the rehabilitation and modernization of the built space has on individuals, society, and the environment.

The present thesis supports information and enables decision-making regarding the capitalization of the built heritage and the improvement of the quality of buildings through appropriate and effective rehabilitation and modernization approaches.

The case studies are represented by buildings with the destination of educational spaces and consider the fact that they also have the role of raising awareness, educating, and making the population responsible for their responsible exploitation, resulting in long-term effects of how users will approach everyday life in terms of efficiency and energy consumption, respectively sustainability. In addition, these case studies are based on the project and construction works recently carried out in Oradea's Campus and on the observations following the completion of the works. The description of the different types of interventions and their detailing is carried out from the initial phase, considering subsequent architectural and urban planning degradations and parasitism, up to the specific and necessary rehabilitation solutions carried out in project or construction.

The projects and constructions on an existing built-up fund are approached differently compared to free construction sites, because they must comply with the norms and rules in force regarding the conservation of the built heritage, respect the limits and constraints imposed by the existing built space and ensure their integrity.

The second objective of this research is to summarize coherent and effective principles of transition of an existing urban complex, with the destination of Campus, into a sustainable urban complex, in which daily indoor and outdoor activities are carried out, in an appropriate way.

The third objective is to demonstrate that the transformation and realization of a sustainable campus is achieved both at the "micro" level, through interventions at the level of each building, individually, and at the "macro" level, through a global approach, through an integrated management.

The fourth objective considers the enumeration and inventory of buildings from the Campus, making a list by values, condition, and interventions.



Site (Includes main buildings and annexes)

RESEARCH METHODOLOGY

To achieve the objectives, a phased research plan was established, detailed below, each phase assuming a different methodological approach.

Phase I. Analysis of the field and the selected case study

This part of the research consists in studying the literature in the field of the transition of the built space (centered on educational spaces) to a sustainable one. I undertook extensive bibliographic research including on the historical evolution (over a century) of the Oradea university campus, both as an urban ensemble and at an individual architectural level. The analysis of information was carried out by studying scientific articles, books, other publications, existing documents in the National archives and the University's archive, European and international directives in the context of the study.

Both in the theoretical research of the literature and in the practical one of collecting information, methods of analysis and synthesis were intensively used with the aim of systematizing the most useful and relevant information in the field addressed, as well as the need to identify the tools and data available to analyze the process of sustainable development of the Oradea's Campus, made up of a complex architectural variety.

Phase II. Applied research

This stage involved a series of analyses and interpretation of the sustainable development strategies implemented or in the process of being implemented at the Campus level, at the same time carrying out a systematization and interpretation of the results obtained.

The information process is composed both of own observations from the site (from the Campus) and of scientific observations made in other research works or technical documentation. The representation of information is done respecting a logical structure and a chronology of the evolution of the Campus.

The research consists in the systematization and description of some principles regarding the transition of an existing urban complex, with the destination of a university campus, towards a sustainable urban complex.

Phase III. Reflecting on the results

The last stage required the corroboration of the knowledge acquired from the theoretical research with the conclusions on the rehabilitation and modernization projects carried out in the Campus to develop concrete solutions, with a view to the appropriate evaluation of the "Green Campus", as well as solutions for the development of a sustainable campus. Thus, the conceptual model of a sustainable Campus was created, including as a promotion factor both the conservation of the built space and the "green" and "healthy" infrastructure. Finally, a coherent approach solution is offered in the context of the circular economy, so that the result of the construction or the intervention on the existing building to be the one necessary for a sustainable Campus.

The research results offer new directions and design solutions for the sustainable updating of other university campuses, highlighting new perspectives in the management of sustainable university campuses, as a way of implementing sustainability in the higher education environment. The data presented gives those involved: architects, urban planners, engineers, and public administration a clear picture on the benefits due to the rehabilitation and modernization of the built space, also providing tools necessary to implement new solutions to reduce the negative impact of urban areas on the environment.

The innovative potential of the thesis is certain, the methodology of the implemented research generating a high relevance, both from a theoretical and a practical point of view, through the theoretical part in the field of sustainable architectural-urbanistic transition and the foundation of a methodological framework necessary to support decisions regarding the rehabilitation and sustainable modernization of the built space in the perimeter of the University of Oradea's Campus.

THESIS STRUCTURE

The doctoral thesis is organized in 8 chapters and 2 main sections, according to the "Indicative guide for the preparation of the doctoral thesis – UTCN": the general part (Chapters 2 and 3) and the specific part (Chapters 4, 5, 6, 7, 8).

Chapter 1, Introduction, motivates the choice of the topic, describes the objective of the research, and summarizes the structure and content of the chapters, presenting the research methods.

Chapter 2 consists of the research of the existing theory in the field of sustainability and presents "Aspects of sustainable development" from the perspectives of environment, architecture, urban planning, and energy efficiency. The events that were the basis for the

creation of the concept of "sustainability" in architecture and urban planning and the "energy efficiency" component in constructions, respectively the relationship between them, are presented. It will also be mentioned the need to protect the environment and describe energy certification systems and how they create a clear way for the investor, respectively the user, to understand sustainability features. The general part presents an up-to-date state of specialist knowledge, based on research works carried out in the field.

Chapter 3 correlates the development over time of the city of Oradea, insisting on the southern area of the city where the studied site is located, all in relation to the historical plans/maps, starting from its first exploitation, up to the most current expansion. The chapter makes the transition between the general part and the specific part of the thesis, through the historical-evolutionary presentation of the location of Oradea's Campus, in relation to the city. The dynamics of the campus is correlated with the evolution over time of higher education in Oradea and the urban context, analyzed based on historical maps. At the same time, the stages that marked the architectural and urban planning of its built space, which is in a continuous update, are described.

Chapter 4 was created based on the inventory, centralization and analysis of the architecture and urban planning projects carried out in Oradea's University Campus over time and represents the beginning of the specific part describing the "Composition of the Oradea's Campus", both based on the original projects and based on the interventions achieved to date, for various reasons. The buildings are divided into 4 categories (subchapters), characterized by different historical periods: buildings built after 1910 (former Gendarmerie School), buildings built after 1910 (former 3-year Pedagogical Institute), buildings built after 1990 (University of Oradea) and former military buildings (built in 1890 or 1930) taken over in 2002.

Chapter 5 includes part of the research published in the field of "sustainability" or of the "Oradea's Campus", in the form of articles (indexed in ISI Web of Science databases, respectively in BDI international databases), as the main author or co-author, during the elaboration of the thesis and brings back to the fore the importance of sustainability, this time within Oradea's Campus, describing both the importance of updating the educational infrastructure and the initiatives for a sustainable Campus. The importance of the continuous updating of the Campus is emphasized to accelerate the transition towards a sustainable Campus.

Chapter 6 presents recent case studies, design and implementation attitudes within the Campus and its update. The presentation of the case studies was possible following active personal participation, as a trainee architect, in the development of architectural projects coordinated by the architect Daniel Tivadar-Ianceu. These are focused on the rehabilitation, modernization, energy efficiency and partial conversion of the built space, contributing to the sustainability of the Campus. The proposed solutions consider the existing constructive circumstances and the need to expand the educational infrastructure.

Chapter 7 presents the practical works of the "Summer University" from 2022, which had as its subject "Rehabilitation of the built environment, Case study: University Campus in Oradea". The presentation of the projects within the "Summer University, 2022" was also possible thanks to the active participation into and guidance onto one of the projects, as an university assistant.

Chapter 8 is the last, and presents the final conclusions of the entire thesis, coming at the same time with proposals regarding possible future research directions, the subject addressed in this thesis being one that is constantly being updated.

General conclusions

The present thesis proposes a distinct approach to provide rehabilitation and modernization solutions, also providing necessary solutions to reduce the negative impact of urban areas on the environment, to facilitate the making of the most appropriate decisions in the management process of a sustainable development, dedicated to a university campus.

The extensive methodology adopted within this research allowed the identification of both the challenges of the high-performance sustainable development process of a Campus, with a complex architectural variety, as well as the tools necessary for this development, but also the description of effective principles and concrete solutions for the transition of an ensemble existing urban area, with the destination of university campus, in a sustainable urban complex.

The analysis of the historical evolution of the studied Campus and the detailed inventory of the buildings within it, both based on the projects in the elaboration of which I have participated, and based on the interventions carried out until now, led to the understanding of the transformations carried out over the years, in terms of it concerns the architecture and the relationship between the Campus and the city. The specificity of Oradea's Campus consists in the complexity and variation of the built space made up of buildings made in different historical periods - 1890 (military buildings), after 1910, after 1960, respectively after 1990, the architectural heritage of the University of Oradea being a significant component of the local cultural heritage and an exception in the landscape of university institutions in Romania.

Until 2010, the built fund of the current Campus evolved in part through the construction of new buildings, later, starting in 2012, within the development process of a "green" and "healthy" Campus, the University of Oradea integrated the targets of climate change mitigation established at international, European and national level, addressing integrated sustainable development strategies, which included education, research integration and environmental policy development, alongside campus conversion strategies.

The challenges identified in the development of a sustainable Campus address the location, buildings, respectively infrastructure and biodiversity through:

- arranging and equipping the site with a special respect for nature;

- creating a feeling of safety, healthy ambience and comfort in carrying out the entire activity;

- increasing the quality of life inside the campus;

- improving the services offered to students and teaching staff;

- the educational and didactic system, modern and excellent, provided by the research and innovation conditions created by the coherent and correct approach to technology transfer.

The Campus modernization process initiated and led to a framework that integrates strategies and complex solutions that include buildings with multiple uses: education (laboratories, amphitheaters, workshops, and lecture halls), student dormitories, storage spaces, offices, leisure and sports.

From the point of view of the infrastructure (buildings and their related utilities) of the Campus, several strategies were approached:

- the efficient use of the fund of existing buildings through rehabilitation (with or without conversion), the introduction into the university circuit of buildings abandoned over time and unused, along with their conversion and the application of the principles of a sustainable building to all interventions on existing buildings;

- efficient use of renewable energies;

- the establishment of an integrated system to ensure the heating of the buildings (pavilions) throughout the campus.

The case studies, presented in this thesis, represent rehabilitation projects (with or without conversion) and modernization, partially executed, of some buildings in the Campus.

The research results emphasize the defining elements, respectively the criteria for the certification of sustainable buildings and university campuses' location, being applicable and re-applicable for similar cases, constituting an incentive for both beneficiaries and investors.

Exploitation of renewable energy resources (geothermal water), from which the Campus benefits, through the use/reuse as a heating agent and domestic hot water (heating/cooling principle) has proven to be an effective solution for sustainable development, for this type of location, the Oradea's Campus being the first in the world to apply this method to buildings (older than 100 years), which have changed their destination.

With the intervention solutions on some of the Campus buildings and networks presented in the paper (rehabilitation, modernization, and energy efficiency), a 20% reduction in the specific energy consumption for heating alone was achieved, under the conditions of a relevant contribution (10%) of the education spaces gained through modernization, additionally offering a particularly encouraging perspective regarding future rehabilitations and modernizations.

These interventions on the existing infrastructure, described in the present material, highlight the transition of the Campus towards a completely sustainable one.

The results of the energy efficiency projects implemented at the Campus level, supplemented with theoretical models, led to the creation of a conceptual model of a sustainable Campus, offering current solutions of a coherent approach, in the context of the circular economy, so that the result of the interventions on the existing buildings is one of a sustainable building.

Personal contributions and future research directions

Through this doctoral thesis, in addition to framing the historical and sustainability evolution of the Campus, the personal contribution is reflected in new aspects compared to those presented in the specialized literature, namely:

- description of the rehabilitation and modernization solutions applied to some buildings in the Campus, some of which are historical monuments;

- the approach in the same work of buildings built in different historical periods and with different destinations;

- the presentation of conversion solutions that make possible the reintegration of former military buildings into the university circuit, by changing their destination;

- schematizing the main aspects that contribute to the construction of a sustainable building or to the transformation of an existing building into a sustainable building;

- the realization of a sustainable Campus concept, including as a promotion factor "green" and "healthy" infrastructure, both for new buildings and for existing buildings, offering a coherent approach solution, in the context of the circular economy, so that the result of the construction/ intervention on the existing construction, is that of a sustainable building.

Also, through the practical solutions presented, this doctoral thesis confirms solutions for a sustainable Campus by applying the principles stated in sustainable development policies at different levels. Regarding the case study brought to attention - the Oradea University Campus, among the future directions there is the combination of thermal and energy efficiency solutions and the introduction of renewable energies from various sources, in order to reduce energy consumption and CO2 emissions. At the same time, it is obvious the need to continue the approach in a vision oriented towards sustainability, respectively the intensification on the application of the principles and concepts synthesized for development in this sense. Moreover, it is observed that the architectural and urban prescriptions presented in the work can be taken over and adapted according to the specifics of any potential Campus, considering the types of interventions on the built space.

Future research directions consist in an update upon the general concept of urban development "Master-plan", because it no longer corresponds to the current situation. On the one hand, the Campus has not expanded and will not expand in the near future according to the proposals, and part of the works carried out (since 2018) took into account the available funding for the rehabilitation and modernization of the built space, as it was not possible to demolish and build new buildings in their place.

It is proposed to exploit the proposals presented, some new, others discussed, as follows: - the unification of some buildings by placing some "inner urban corridors", keeping a transparent connection with the outside. At the same time, the introduction of the "casing" concept, which takes into account the incorporation of several buildings into one, increasing energy efficiency, introducing flows and external spaces into the interior;

- the demolition of all the annexes and technical spaces, as well as their introduction into a single new building, with a technical role, like the L building, here referring to the thermal power plant that supplies the entire Campus with thermal energy, without the need to set up individual technical spaces in every building;

- checking the possibility of unifying some areas of the Campus with the public space, by dismantling the fences, so that the Campus becomes a natural park open to the city, accessible to the general public;

- the redevelopment of the alleys, through their continuity from one end to the other throughout the Campus, creating clear connecting axes between the entrance from Islazului/ Universității street (south) and Făgărașului street (north), respectively between Universității street (east) and the Hall polyvalent (Oradea Arena) on Traian Blajovici street (west), the latter connecting with Universității street 4;

- redevelopment of the green space by planting low vegetation where there are no buildings or paved paths. Abandonment of dry or worthless tall vegetation, with the intention of increasing the visibility of the buildings classified as a historical monument, at the same time preserving the concept of "park" appropriated to the Campus. The arrangement of the green space also has the responsibility of harmonizing the relationship between new and old buildings, so that the new ones do not visually attack the old ones;

- the modernization and expansion of urban furniture in the Campus through a park-like approach, by creating rest alveoli with benches in the "meeting" areas, by placing bike racks in the entrance areas of buildings, by placing trash cans in high traffic areas, etc.;

- exploitation of the parking lot in the area of Ceyrat/ Islazului street, possibly with its arrangement as an underground or as an overstory (and the arrangement of sports grounds on the last level) in order to eliminate the rest of the parking lots in the Campus and to exploit them as green spaces;

- exploitation with new constructions of the unexploited space between the sports fields and Islazului street;

- the continuation of the process of rehabilitation (with conversions) and modernization of the built space on Universităi Street 4, with the aim of bringing to the Campus (as much as possible) all the faculties that currently operate outside it, especially those that are found in morally degraded, non-rehabilitated and non-modernized buildings;

- like the "Master-plan", it is proposed to insist on the possibility of uniting the Campus, which is currently not unitary, being crossed by the Universității street with heavy traffic, which divides it in two. It is proposed to pedestrianize the street, with the exception of public transport, divert the car route and eliminate the parking spaces, giving the possibility of completing the Campus and its subsequent exploitation in a unified way. An alternative variant of joining would be through a footbridge suspended from the upper floor of two new (joined) buildings built on one side and the other of the street;

- the periodic calculation and publication of the carbon footprint with the well-defined goal of this Campus becoming a standard of sustainability from this point of view;

- prioritizing the rehabilitation of historic monument buildings because they are emblematic buildings, which can contribute to the greatest extent to the promotion of the entire Campus, of the University of Oradea and implicitly of the entire Oradea community.

Through personal contributions and proposals and at the same time through its entire content, the present doctoral thesis makes its contribution to the field of sustainable architecture, demonstrating the effectiveness of interventions to rehabilitate and modernize the built space, through current solutions that can also be implemented in other university campuses.

LIST OF PUBLICATIONS

Articles published in extenso in internationally or nationally rated journals

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