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Scientific articles

Arquitectura sustentable y su obligatoriedad en la enseñanza y construcción de la arquitectura, caso Universidad de Sonora

Sustainable architecture and its obligatory nature in the teaching and construction of architecture, Sonora University case

Arquitetura sustentável e sua obrigatória no ensino e na construção da arquitetura, caso da Universidade de Sonora

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Resumen

En este trabajo se analiza cómo la arquitectura ha contribuido a la contaminación mundial y ha ocasionado múltiples problemas de salud para las diversas especies que habitan este planeta. Se utilizó el método empírico-experimental para validar la investigación y propuesta, apoyado en el paradigma empírico-analítico y empleando fundamentos hermenéuticos, observación, interpretación y etnometodología. Esto permitió estudiar, analizar y concluir la importancia de una propuesta que compromete a autoridades políticas, universitarias, departamentales, arquitectos y demás personas relacionadas con la práctica arquitectónica para resolver este grave problema.

Palabras Clave: Arquitectura sostenible; enseñanza de la arquitectura; obligatoriedad de la arquitectura sostenible; contaminación; criterios constructivos.

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Abstract

This study analyzes how architecture has contributed to global pollution and has caused multiple health problems for the various species inhabiting this planet. The empirical-experimental method was used to validate the research and proposal, supported by the empirical-analytical paradigm, employing hermeneutical foundations, observation, interpretation, and ethnomethodology. This approach enabled the study, analysis, and conclusion of the importance of a proposal that involves political, academic, and departmental authorities, architects, and others involved in architectural work to address this serious issue.

Keywords: Sustainable architecture; teaching architecture; mandatory adoption of sustainable architecture; pollution; construction criteria.

Resumo

Este artigo analisa como a arquitetura contribuiu para a poluição global e causou diversos problemas de saúde para as diversas espécies que habitam este planeta. Para validar a pesquisa e a proposta, utilizou-se o método empírico-experimental, apoiado no paradigma empírico-analítico e empregando fundamentos hermenêuticos, observação, interpretação e etnometodologia. Isso nos permitiu estudar, analisar e concluir a importância de uma proposta que envolva autoridades políticas, universitárias e departamentais, arquitetos e outras pessoas relacionadas à prática arquitetônica para resolver este grave problema.

Palavras-chave: Arquitetura sustentável; ensino de arquitetura; arquitetura sustentável obrigatória; poluição; critérios construtivos.

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Introduction

Sustainable architecture is based on the development of construction projects that respect the environment and promote human well-being, minimising negative impacts on nature. This approach is fundamental from the very conception of the architectural project, given that the construction sector is one of the main causes of global environmental pollution, contributing to climate change, air pollution and the degradation of natural resources.

Bioenvironmental architecture emerges as a response to this problem, raising the need to rethink construction practices through the use of sustainable materials, efficient processes

and strategies adapted to the local environment. However, despite the growth of cities, current housing solutions have not managed to significantly reduce housing shortages, even in developed countries.

This is not a matter of ideological or aesthetic choice, but an urgent need. Sustainability must be a guiding principle in the teaching and practice of architecture, in order to raise awareness in society about its importance. As Vera Solana (2018) points out, atmospheric emissions, waste and noise pollution generated by the construction industry represent serious risks for the planet. Despite legislative and educational efforts, these initiatives are often optional, limiting their real impact.

The term "sustainable development" was coined by the UN in 1987, and in 1998 Mexico adopted specific standards for green architecture. However, these regulations are voluntary, which limits their effectiveness. In this context, we propose that sustainability cease to be an option and become a mandatory requirement both in academic training and in professional practice, with the support of governmental and academic institutions.

Finally, architects and architecture students need to take responsibility for creating sustainable solutions. This involves developing architectural criteria that use regional materials, rescue traditional techniques and promote strategies adapted to the environment, based on sustainable and bioclimatic methodologies. The task is not only to redesign how we build, but also to rethink our relationship with the environment to ensure a more sustainable future.

We define green, sustainable, ecological and bioclimatic architecture as those buildings that seek to reduce environmental impact, from their conception to their completion and maintenance.

We are currently experiencing the ravages of climate change in the world, and to combat it First, we must be aware of the problem in order to analyze it and develop methods and ideologies that help combat it. Sustainable Architecture is not a new trend, but a necessity, given the sustainability crisis we are going through, for practical purposes we will use the words sustainable and/or green with the same meaning. The challenge is for a change in action to truly occur. Architecture must include sustainability since at some point it was lost, finding it is the task. (Zambrano et al., 2020, pp. 751-779) , the architect Beatriz Garzón says that, if we start from the premise that architecture is a social work, bio-climatism should be emphasized, because it is aimed at the hygrothermal comfort of people , (2021, p.15) and like her, many other researchers concerned about serious global pollution alert us to the

serious problem. Architecture and the construction industry are responsible for a large part of this global pollution. Due to the materials it uses, the natural resources it requires, and the manufacturing and transportation processes necessary for the construction and maintenance of the works , we must rethink the way in which inputs for this industry are processed, manufactured and distributed, while at the same time analyzing the ecological havoc they cause, both in their processes and in the obtaining and distribution of the materials and inputs obtained, added to the lack of sensitivity of the architects and the authorities in charge of approving such projects and this is a very serious problem, we must raise awareness, raise awareness among new architects, teachers, architecture students, university, municipal and federal authorities of our reality, that we are part of the problem, but also by obligation and ethics we must be part of the solution.

This is why students, teachers, authorities and architects must develop architectural criteria considering the place where they will be built, thinking about using regional materials that are appropriate to the area, and taking care of and verifying the manufacturing processes , the transfers, the construction systems, and the design strategies appropriate to each place and project, based on a sustainable, green methodology. Rethinking and rescuing the techniques and materials used in vernacular architecture.

Historical Framework

Sustainable architecture is not a new concept; ancient civilizations already incorporated practices to protect natural resources and live in harmony with the environment. Even today, indigenous communities and isolated tribes practice an intrinsic respect for their environment, on which they depend for their livelihood.

The term "sustainable architecture" derives from the concept of "sustainable development", introduced by Gro Brundtland in 1987 through the report of the World Commission on Environment and Development. This concept seeks to meet current needs without compromising the possibilities of future generations. In 1992, during the Earth Summit, this commitment was significantly reinforced.

Over time, sustainability principles have been promoted in architecture through studies on the durability of materials, renewable energies and innovative construction systems. However, progress has been limited due to economic interests and lack of effective implementation in the construction industry.

Vernacular architecture, which uses local materials and techniques, offers a historical model of environmental respect. During the Middle Ages, buildings were built with respect for the surroundings and natural orientation. However, the Industrial Revolution introduced significant changes: although it allowed mass production and the transport of materials over long distances, it also led to deforestation and pollution.

In the mid-20th century, there was a renewed interest in sustainable architecture, thanks to technological advances such as nanotechnology, which has developed innovative materials with lower environmental impact. However, the true global implementation of these practices remains a challenge.

Aim

The aim of this research is to raise awareness among architects, builders, authorities and, especially, universities about the urgent need to adopt sustainable construction practices. It is imperative to close the traditional construction cycle and open a new paradigm that prioritizes sustainability to ensure the preservation of our planet.

Methodology

The direct observation method was used, as highlighted by Riera R. et al., 2016, p. 92, who point out that this approach allows for the analysis of processes in real time, identifying both their sources and their implications. This method was complemented by a creative approach, essential in solving complex problems, as addressed in *Creativity in the training of architects: the creative process and neurosciences* (Navarro, 2018, p. 25).

The analysis included:

1. Data verification and its causes.
2. Review of creative processes in design, selection of materials and sustainable strategies.
3. Evaluation of current practices in universities, regulatory authorities and the private sector.

Key findings:

- There is widespread awareness of problems caused by construction, but not enough corrective action is taken.

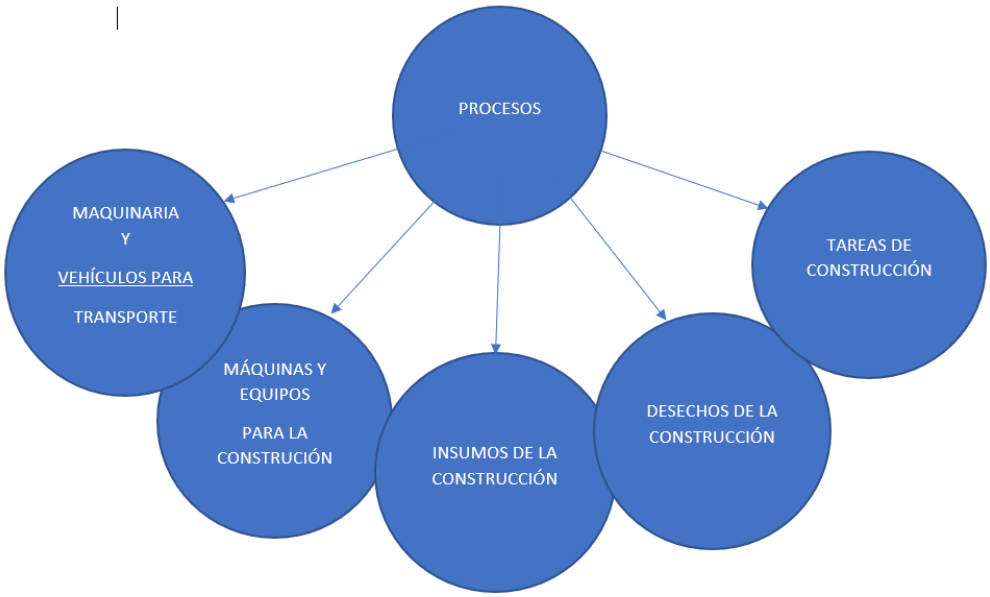
- Current regulations require minimum measures, such as green areas and ventilation, which are frequently breached or poorly implemented.
- It is urgent to prioritize the use of local materials, collect and reuse rainwater, and design construction strategies adapted to extreme weather conditions, such as those in Sonora.

observation shows us that, although the problems caused by the construction industry are known, both by the architects, the authorities responsible for construction and project approval, the universities that train new architects, and some part of society that requires and hires the services of an architect, in general terms they are aware of this problem, but they are not taking action to correct it. Architects carry out projects thinking about complying with regulations so that they are approved, and if they are contemplated, they require leaving spaces of a certain size that are ventilated and illuminated, that respect minimum measurements, that respect a percentage of the land for green areas, which in most cases end with a concrete or cement slab instead of being green areas, and that is where a requirement loses its meaning. For this reason, we insist that we must first be aware of the problem and that we, as architects, must propose materials and construction systems appropriate to the construction site; the recovery of rainwater and soapy water should be another mandatory rule to comply with. Investigate and analyze what resources we have, to optimize them, verify transportation distances, from the place of elaboration and manufacture to delivery to the construction site. Design strategies are fundamental, the appropriate orientation, the project itself, the proposed construction system, are fundamental so that our professional work and the construction industry can claim itself and stop polluting and, on the contrary, help to reverse the damage caused, turning our work into an opportunity to green our planet.

Sonora is a state with a large territorial extension, the 2nd largest in the Mexican Republic, where there are two characteristics that identify it: the lack of water and the extreme climate, reaching more than 50º on some occasions, so , knowing this, the first thing that should be done is to take care of the water, collect and reuse all the rainwater and soapy water, by means of treatment plants that allow us to reuse it and for extreme climates, use and prioritize green areas, plant trees that protect us from intense heat, give us shade and comfort, create micro climates to obtain a better place to live and construction systems, materials and design strategies appropriate to solve these two serious problems, we must take advantage of the characteristics of the place so that, with creativity we propose real solutions and within everyone's reach.

In all processes, care must be taken not to contaminate.

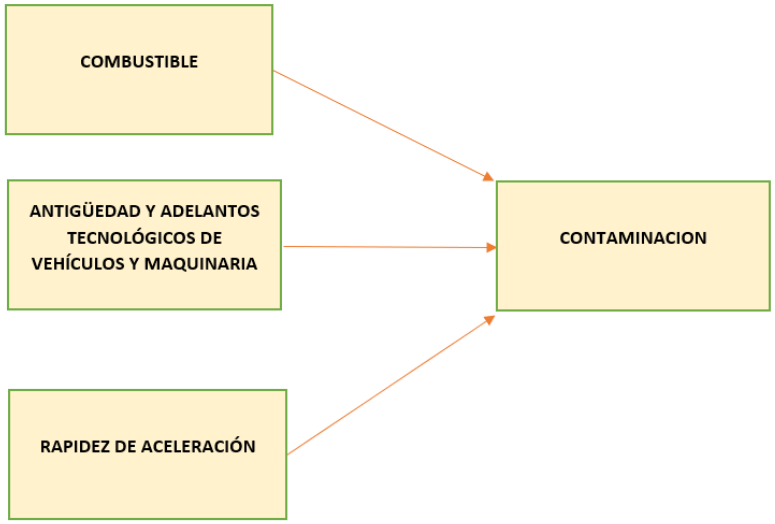
Figure 1. Contamination processes at the construction site



Source: Own elaboration

The use of machinery and vehicles to produce construction materials and supplies, as well as for their transportation, is an important factor to consider. Equipment that complies with established standards should be chosen, always ensuring that it is in optimal maintenance conditions. Waste is another factor to consider, because garbage should be able to be recycled and not be a danger to humans, animals, and the planet itself. In theory, this is or should be fulfilled, but unfortunately, in practice, this does not happen due to various factors such as economic factors, personal or political interests, or the lack of preparation and awareness of workers, professionals, industrialists, and universities that do not demand from their students, teachers, and the authorities involved that it is an obligation and not a choice.

Figure 2. Pollution from vehicles and machinery.



Source: Own elaboration

Pollution is caused by several factors that intervene in the construction process, one of them is the dust produced by construction, dispersing solid particles through the air, with the possibility of transporting contaminants of organic matter and metals, another way of polluting is the noise produced when building, transporting and producing the different inputs, creating an acoustically contaminated atmosphere, noise causes a psychological and physiological effect on the brain that affects it.

Construction produces atmospheric pollutants, solid particles, organic and sound during the construction process, these pollutants are called direct or primary and can be transformed, upon contact with the atmosphere, into secondary pollutants, and these are harmful to health, noise causes negative effects on the mind and body. Romero (2019, p. 5).

The machinery used in construction, such as backhoes, excavators, compactors, vibrators, asphalt pavers, hydraulic hammers, etc., cause different types of pollution, they generate noise, particulate waste, atmospheric emissions, consume energy, vibrations, and emit gases, which have a negative impact on the ecosystem, both on people and on flora and fauna, cause displacement of species, affect health, change the characteristics of the air we breathe, inhalation of gases, stress and damage to third parties.

The WHO, in the United Nations Environmental Programme, of 2014, determined that air pollution can cause or worsen the health status of the population, such as lung cancer, lung disease, heart disease and respiratory infections.

Document Review

For the document review, we analyzed the curriculum of the School of Architecture of the University of Sonora, the Municipal Construction Regulations, National Institute of Statistics and Geography INEGI, Cuéntame INEGI, Secondary Economic Activities: Construction [Internet], Civil Protection Regulations of the City Council of Hermosillo.

Architecture Study Plans at the University of Sonora

The analysis of the 2018 Curriculum of the School of Architecture of the University of Sonora (UNISON), based on competencies, reveals that the subjects related to sustainability are limited. There are three elective specialized subjects that partially address the topic: Energy Analysis in Architecture, Renewable Energies in Architecture and Selected Topics on Energy and the Environment. These subjects, available from the eighth semester, have a duration of 4.5 hours per week, but their optional nature restricts their scope.

In architecture workshops, considered the backbone of the curriculum, sustainable architecture is not explicitly considered as a purpose. This omission poses a significant challenge: if educational institutions do not fully incorporate these principles, it will be difficult to train professionals committed to sustainability**.**

Rules and Regulations

A review of municipal and state regulations shows that, although certain criteria related to sustainability are applied, these are insufficient. The regulations do not address the problem holistically nor do they require architectural practices that mitigate environmental impact.

For example, the Municipal Building Regulations include provisions on ventilation, lighting and green areas, but these are often poorly implemented or ignored. Furthermore, green architecture certification in Mexico is voluntary, which limits its widespread adoption.

Problems Detected

The construction industry generates a significant environmental impact:

- Resource consumption: It represents more than 60% of global electricity consumption, 35% of primary energy and 50% of greenhouse gas emissions (WHO, 2017).

- Waste: It produces around 135 million tons of debris annually, of which 90% could be recycled, but is not.

Globally, sustainable buildings could reduce:

- 40% of water consumption.
- 30% of energy use and gas emissions.
- 50% to 75% of waste generated by construction and demolition (WGBC, 2022).

According to data from the National Institute of Statistics and Geography (INEGI, 2009), the construction industry is one of the main drivers of the Mexican economy, but due to the great environmental impact it generates, it becomes one of the least sustainable in the world.

At the United Nations Conference on Environment and Development (Feb 29, 2024), the Rio Declaration on Environment and Development (1992) was presented, reaffirming the Declaration of the United Nations Conference on the Human Environment, adopted in Stockholm on June 16, 1972, and trying to build on it, here we show the first three principles:

1.- Human beings have the right to a world without pollution. The problem is not new, we have already been dragging it along and contributing to making it worse every day, so we must put an end to it.

2.- 99.5 percent of Mexico's population is exposed to levels of air pollution that pose risks to human health, according to the Latin American Economic Outlook 2022 report. Nov 7, 2022. According to the Climate Change Performance Index (CCPI) 2024, Mexico ranks 38th in the ranking, seven places below what it showed in 2023, and is among the lowest-performing nations.

3.- Pollution kills nine million people a year, twice as many as COVID-19 | UN News.16 Feb 2022

WHO warns about the impact of air pollution on health. The organization's data shows an alarming figure: 99% of the world's population breathes unhealthy air. The organization presented an annual report highlighting how the COVID-19 pandemic has slowed progress in health.19 May 2023 (BY NATIONAL GEOGRAPHIC EDITORIAL, published May 19, 2023, 11:12 GMT-3).

International Certifications

The most relevant international certifications include:

- LEED (Leadership in Energy and Environmental Design)
- WELL Building Standard
- Passive House
- BREEAM

Although these certifications offer a solid framework for assessing sustainability, they are not mandatory in Mexico. Their implementation is limited to exclusive projects, reinforcing the perception that sustainable architecture is a luxury.

There are others worldwide, but these are the important ones. As you can see, there are multiple certifications, and it's good that this is the case, but I repeat, they are not mandatory in Mexico or the rest of the planet. In everyday life, most of the constructions that are carried out do not have these certifications, only those that claim to be friendly to our planet, and this led us to investigate what the reason is, and we found that although the lack of awareness is one of them, the other is the economic factor. Traditional construction is cheaper, and many builders and clients themselves prefer it for that reason. Implementing, for example, a system for the reuse of rainwater, greywater and blackwater requires an additional cost, as does the implementation of solar energy and smart architecture. At the moment, it is expensive, and this leads us to an elite architecture, for the most privileged, those who can afford these necessary implementations, leaving the vast majority of the population unprotected. Therefore, in addition to implementing the mandatory nature of green architecture, it should be encouraged to build as it should be built, without polluting. Making it mandatory will result in lower prices for these products and systems, due to the amount that could be sold in this market. The authorities play a very important role in this, because they must verify and monitor compliance with these new requirements.

The choice of materials, construction systems and the application of passive elements in design and construction strategies is very important, it does not necessarily require an extra cost and only provides excellent results.

Miceli, A. (2021). *Sustainable architecture:* More than a trend, a necessity (p. 25), tells us that we must reformulate the role of the architect, the creative act of the perfect image to the sustainable place and we must include them in teaching and practice.

Proposals

Education:

Architecture schools must include mandatory teaching of sustainable architecture.

Curricula need to be redesigned to prioritize non-polluting practices.

Raise students' awareness of the problem, so that they and their future architectural proposals become part of the solution.

Regulations:

Proposals for the Implementation of Sustainable Architecture

In the face of the global environmental crisis and the significant impact of the construction industry, it is imperative to adopt sustainable architecture that is friendly to the environment and its inhabitants. This requires structural changes in education, regulations and architectural practices, as detailed below:

Education and Training

Teaching sustainable architecture should be compulsory in universities and schools of architecture, not optional.

Curricula must be redesigned to include sustainable practices at all stages of design and construction.

Colleges of architects must promote the importance of sustainability among their members, collaborating with authorities to demand its compliance.

Rules and Regulations

States and municipalities should update their regulations to include specific measures requiring sustainable construction, such as the reuse of stormwater and greywater.

Green architecture certifications should be mandatory for all construction projects.

Architectural Practices

Prioritise the use of regional materials and construction systems appropriate to the environment to reduce environmental impact.

Implement passive design strategies, such as thermal insulation and proper orientation of buildings.

Regulate the means of transporting materials and machinery to minimise polluting emissions.

These proposals not only promote a shift towards responsible architecture, but also seek to ensure a sustainable future for generations to come.

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Table 1. Survey conducted among Architecture professors at the University of Sonora.

	QUESTIONS	YEAH	NO
1	DO YOU THINK THE WORLD IS SUFFERING FROM CLIMATE CHANGE?		
2	DOES CONSTRUCTION AFFECT POLLUTION?		
3	ARE YOU AWARE THAT THE CONSTRUCTION INDUSTRY CONTRIBUTES TO POLLUTING THE PLANET?		
4	AS AN ARCHITECT, DO YOU BUILD SUSTAINABLY?		
5	DO YOU BELIEVE THAT SUSTAINABLE ARCHITECTURE IS NOT AN OPTION BUT AN OBLIGATION?		
6	AS A TEACHER, DO YOU TEACH THAT SUSTAINABLE ARCHITECTURE IS NOT AN OPTION BUT AN OBLIGATION?		
7	DOES THE TRANSPORTATION OF CONSTRUCTION MATERIALS CONTAMINATE?		
8	DO CONSTRUCTION WASTE POLLUTE?		
9	DOES THE PRODUCTION OF CONSTRUCTION SUPPLIES POLLUTE?		
10	SHOULD RAINWATER BE RECYCLED?		
11	SHOULD RAINWATER AND SOAPY WATER BE TREATED?		
12	IS IT CONVENIENT TO TREAT AND RECYCLE WASTEWATER?		
13	DO WATER TREATMENT PLANTS POLLUTE?		
14	WOULD YOU SUPPORT POLICIES THAT DEMAND SUSTAINABLE CONSTRUCTION?		
15	SHOULD ARCHITECTURE SCHOOL PROGRAMS INCLUDE SUSTAINABILITY AS A MANDATORY?		
16	ARE STONE WALLS THERMAL INSULATORS?		
17	ARE CEMENT CONCRETE BLOCK WALLS THERMAL INSULATORS?		
18	ARE EARTH WALLS THERMAL INSULATORS?		
19	ARE CLAY BRICK WALLS THERMAL INSULATORS?		
20	ARE CONCRETE WALLS AND ROOFS THERMAL INSULATORS?		
21	SHOULD EXTERIOR WALLS AND ROOFS BE THERMALLY INSULATED?		
22	ARE FOIL COVERS THERMAL?		
23	ARE THERMAL BLOCKS AN ALTERNATIVE?		
24	IS IT IMPORTANT TO CREATE MICROCLIMATES IN BUILDINGS?		
25	WOULD YOU USE EXOTIC VEGETATION TO ACHIEVE THIS?		
26	DO YOU THINK THAT ANY EXOTIC VEGETATION CAN ADAPT TO THE CLIMATE OF SONORA?		
27	DOES SONORA HAVE REGIONAL MATERIALS TO BUILD SUSTAINABLY?		

28	WOULD KNOWING METHODS AND MATERIALS OF REGIONAL VERNACULAR ARCHITECTURE HELP US?		
29	WOULD USING REGIONAL MATERIALS HELP PREVENT POLLUTION?		
30	CAN 21ST CENTURY ARCHITECTURE BE MADE WITH REGIONAL MATERIALS?		
31	SHOULD WE BE CREATIVE TO SOLVE THE PROBLEM OF BUILDING SUSTAINABLY?		

Source: Own elaboration.

Table 2. Results of the Survey conducted among professors of Architecture at the University of Sonora

QUESTIONS	10	20	30	40	50	60	70	80	90	100
1 %										
2 %										
3 %										
4 %										
5 %										
6 %										
7 %										
8 %										
9 %										
10 %										
11 %										
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22 %										
23 %										
24 %										
25 %										
26 %										
27 %										
28 %										
29 %										
30 %										
31 %										

Source: Own elaboration.

Percentages are represented in the responses to YES

Discussion

Various studies agree on the urgent need to address the environmental impacts arising from the construction industry. Romero Gil (2019) documents how activities such as earthmoving and the use of heavy machinery generate polluting particles that affect the ecosystem. Cabrero et al. (2021) link these emissions to serious health problems, such as lung cancer and heart disease, highlighting the importance of strictly regulating ecological regulations.

Interviews with authorities and academics confirm that although green architecture is included in the curriculum, its implementation is limited. For example, the head of the Department of Architecture noted that "some teachers do not give it the importance it deserves." This suggests the need to strengthen the mandatory teaching of sustainable architecture in universities and to establish regulations that encourage its practical application.

From a historical perspective, the impact of the Industrial Revolution marked a shift in architectural practices away from traditional sustainable methods. Although technological advances have made it possible to develop self-sustaining buildings, their high cost and lack of regulation limit their accessibility. It is essential to work together with universities, governments and industry to ensure that sustainability is the standard, not the exception.

We can observe in general terms the coincidence in the way of thinking, both of directors, teachers, authorities, researchers concerned about solving this problem, as well as of international and national organizations concerned about this issue, and perceive the serious problem that the construction industry causes and the pollution it causes, which has been causing for a long time, but particularly since the end of the 19th century, with the Industrial Revolution and the use of machinery for the production of supplies and materials, their transfer, the indiscriminate exploitation of fossil products, such as petroleum and its derivatives, such as plastics and materials that take hundreds of years to degrade, the inappropriate use of materials, construction systems, design strategies, in short, a big problem is what we have been causing to our planet, and that motivated us to this research so that together with those involved, we find the necessary solutions. First we must be aware of the problem and our responsibility in it, then we must find alternatives both in teaching, in laws, rules and regulations, officials and in the University, in the Department of Architecture, objectively review the study plan and adapt it to present needs in order to teach future generations the obligation we have to society, contributing with professionals aware of our

duty, to build sustainably in order to have better spaces in which to develop our activities, to protect our environment, our home, workplace, colony, neighborhood, town, city, state, and thus we can give back to society with our work what we received in terms of preparation and knowledge.

During the trade mission he heads to China, the municipal president of Hermosillo, Antonio Astiazarán Gutiérrez, visited leading companies in the recycling of hydraulic resources, the manufacture of electric vehicles and cleaning services. (El Imparcial. By GH Editorial Team June 26, 2024)

The mayor of Hermosillo presented 4 proposals for the benefit of society

1. Electric trucks for garbage collection
2. Saving and caring for water with energy efficiency and renewable and clean energy and water desalination plants
3. Free electric transportation for students
4. Greater security with technology

It is a good start, but we must, as a guild, as a university, as registered architects, infer that it is mandatory to build sustainably.

Conclusion

Architecture must evolve to respond to the current environmental crisis. We cannot allow the dualism between "traditional architecture" and "sustainable architecture" to continue. There will only be true architecture when all buildings respect the principles of sustainability, minimising environmental impact and promoting the well-being of users.

This study shows that change must begin with the training of future architects. Universities must redesign their curricula, integrating sustainability as a central and mandatory axis. Municipal and state regulations must also be strengthened to ensure that projects comply with sustainability criteria.

Future Lines of Research

1. Nanotechnology applied to green architecture: Explore the development of innovative materials that optimize the environmental performance of buildings.
2. Analysis of the impact of sustainable regulations: Investigate how the implementation of stricter laws influences architectural practice.
3. Development of innovation laboratories in construction: Create spaces to experiment with new sustainable methods and materials, promoting their integration into the market.
4. Urban growth projection: Study the patterns of urban expansion to design sustainable strategies that anticipate their long-term effects.

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