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Un acercamiento a la sustentabilidad de los desarrollos inmobiliarios verticales de Guadalajara

An Approach to the Sustainability of the Vertical Real Estate Developments of Guadalajara

Uma abordagem para a sustentabilidade dos empreendimentos imobiliários verticais em Guadalajara

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Resumen

Durante el periodo 2012-2018, se construyeron un total de 46 desarrollos inmobiliarios verticales en Guadalajara, Jalisco, entre estos, edificios de departamentos con amenidades, hoteles y corporativos. La sustentabilidad fue uno de los principales argumentos para su edificación.

Esta investigación tuvo por objetivo identificar los elementos sustentables que estaban incorporados a estas edificaciones y, más aún, conocer si dichos inmuebles contaban con una certificación de sustentabilidad. Para llevar a cabo este trabajo se realizó una investigación cualitativa de tipo descriptiva, en donde se utilizó la encuesta como instrumento.

Como parte de los resultados se encontró que estos desarrollos verticales están muy lejos de tener en su mayoría sistemas sustentables. Apenas unos cuantos cuentan con sistemas de ahorro de energía y de agua. De igual manera, solo una pequeña parte tiene integrado en sus construcciones calentadores solares, celdas fotovoltaicas y sistemas de separación de aguas grises y negras. Y finalmente, solo una minoría de estos cuenta con una certificación de sustentabilidad.

Palabras clave: certificación sustentable, desarrollos inmobiliarios verticales, eficiencia del uso de energía, eficiencia del uso del agua, muros verdes.

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Abstract

In the municipality of Guadalajara, Jalisco, during the 2012-2018 period, a total of 46 vertical real estate developments were built, among them, apartment buildings with amenities, hotels and corporations. The sustainability was one of the main arguments for the construction of this type of property.

The main goal of this research was to identify the sustainable elements that were incorporated in these buildings and even more to know if any of these buildings had a sustainability certification. To carry out this work, a descriptive qualitative research was carried out, where the survey was used as an instrument.

As part of the results it was found that these vertical developments are very far from having sustainable systems in their construction since only a minority had systems of saving energy and water. Similarly, just a small part had integrated in their buildings solar heaters, photovoltaic cells, and separation systems of gray and black rails. Finally, it was found that only a minority of these had a sustainability certification.

Keywords: sustainable certification, vertical real estate developments, energy use efficiency, water use efficiency, green walls.

Resumo

Durante o período 2012-2018, um total de 46 empreendimentos imobiliários verticais foram construídos em Guadalajara, Jalisco, entre estes, edifícios de apartamentos com amenidades, hotéis e empresas. Sustentabilidade foi um dos principais argumentos para a sua construção.

O objetivo desta pesquisa foi identificar os elementos sustentáveis que foram incorporados nesses edifícios e, ainda mais, saber se os referidos edifícios possuíam certificação de sustentabilidade. Para realizar este trabalho, foi realizada uma pesquisa qualitativa descritiva, na qual a pesquisa foi utilizada como instrumento.

Como parte dos resultados, descobriu-se que esses desenvolvimentos verticais estão longe de ter sistemas predominantemente sustentáveis. Apenas alguns têm sistemas de economia de energia e água. Da mesma forma, apenas uma pequena parte possui aquecedores solares embutidos, células

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fotovoltaicas e sistemas de separação de água cinza e preta. E, finalmente, apenas uma minoria deles tem uma certificação de sustentabilidade.

Palavras-chave: certificação sustentável, empreendimentos imobiliários verticais, eficiência no uso de energia, eficiência no uso da água, paredes verdes.

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Introduction

Currently, the city of Guadalajara presents significant growth in the development of vertical real estate projects, whether residential, corporate, commercial or mixed use. This phenomenon has brought about a transformation of the landscape: the traditional capital of Jalisco has given way to a cosmopolitan city - and with it also the increase of surplus value in certain areas of the city.

This rearrangement of the city responds to a strategy of urban reorganization, in which it seeks to take advantage of the infrastructure of horizontal spaces already created and at the same time avoid long transfers to people.

Also, along with the urban change, the vision of people has changed: they no longer prefer to have their house with a garden, but to have a space with a better quality of life, which provides them with the series of products and services offered by them. Vertical developments of mixed use through its amenities. This form of buildings allows people to acquire a new home and continue living in the area of their preference without having to travel to the outskirts of the city for lack of land.

Urban context of the municipality of Guadalajara

The boom in the construction of numerous vertical developments began in the municipality of Guadalajara during the period 2012-2018 (Salas, 2018). Table 1 shows the name of each of the projects implemented in this period of time.

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Tabla 1. Desarrollos verticales construidos dentro del municipio de Guadalajara durante el periodo 2012-2018

1.El famoso 1380	24. Alarcón Vertical
2. Alara Chapultepec 404	25. Nerea
3. Círculo Francés	26. Torre Neruda
4. Vista Americana	27. Uno Urban Life
5. Latitud Providencia	28. Espacio Minerva
6. Condominios Country Club	29. Sannia
7. Tre Alberta	30. Torre Zyon
8. Torre Country Hábitat	31. Central Park Edmonds International
9. Torre Tribeca Loft	32. Corporativo Allius By Lincoln Capital
10. Torre Trena	33. Central Park Corporativo
11. Torre Country Vistas	34. Midtown Guadalajara
12. Espacio Monraz	35. Hotel Vista Hermosa
13. Torre Hidalgo	36. Hotel Aloft
14. Las Margaritas Residencial	37. Hotel Baruk
15. High Tower Vertical	38. Torre Sora
16. Torre Sky	39. Torre del Parque
17. Galatea	40. Torre Estampida
18. Urbania	41. Obregón 1570
19. Torre Américas	42. Punta oeste
20. City Tower	43. Torre Bansi
21. Torre Q Country	44. Torre Montevideo
22. Parques Guadalajara	45. Parque San Rafael
23. Corporativo Country	46. Torre Casa Madonna

Fuente: Salas, Porras y Galindo (2018)

With regard to this type of project, more and more urbanists, architects and engineers defend the construction of vertical cities as forms of sustainable development, since they are considered to provide a reduction space four times greater compared to horizontal developments. , and that, consequently, offer a better use of the spaces, as well as a better utilization of the resources because many of these buildings involve the use of renewable energy sources, capture rainwater; in short, be one hundred percent sustainable and self-sufficient (Expok, 2014).

No doubt a building will be more sustainable if it has been planned from the beginning with criteria of sustainability in terms of electric power, drinking water, rainwater management, wastewater and solid waste, among others. Because it is considered that an architectural work is such if it captures all the water necessary for its operation from rain, in addition to treating and reusing it; and in terms of energy, if it minimizes the demand for electricity and heat by making use of renewable energy sources, which produce all the energy consumed by the building (Torcellini, cited in Huelsz and Sierra, 2013).

In the same vein, Hernández and Garduño (2009) consider that sustainable technologies for the operation and use of the building play a very important role in the technologies for sustainable urban development through new generation photovoltaic panels, passive water heating systems and wind power.

The World Commission on Environment and Development of the United Nations (UN) has defined sustainability as a development that aims to meet the needs of the present without compromising the needs of future generations. And taking into account the above, the Oxford Univertsity (cited in Hernández, 2008) established that sustainable design in architecture is a process in which the following principles are established:

- Respect the conditions and characteristics of the landscape and the context in the process of creating the building from the preparation of the plans, its construction and maintenance.
- Take into account the life cycle of buildings.
- Take into account the physical characteristics of the context such as climate, wind, soil and water in order to elaborate a project in accordance with advantages in thermal comfort, acoustics, visual effect and energy and water consumption.

- Take into account the basic architectural requirements such as programs or architectural items, surfaces, volumes, textures, colors in relation to the requirements of a sustainable type.
- Integrate the six main elements of resource management in buildings: the site, the energy of the building, the water in the buildings, the materials and the waste and waste generated in the process and throughout the life cycle of the buildings. buildings, which includes the life cycle of the materials.
- Sustainable design must be seen as a current need and for the future of regional development.
- Design responsibly and make buildings respect the environment, minimize the consumption of natural resources, reduce pollution, increase the comfort of users and reduce the waste generated in their construction.

Winitzky (2013), For its part, it calls sustainable architecture also as green architecture or eco-architecture, and defines it as a way of conceiving architecture, seeking to take advantage of natural resources in such a way that the environmental impact of buildings on the natural environment and on buildings is diminished. population. This approach aims to ensure that future generations enjoy continuous access to natural resources, creating a minimum environmental impact and implementing remedial and productive consequences for the natural environment, and integrate with the different ecosystems of the biosphere.

On the other hand, Usón (2012) recommends that to reduce the environmental impact caused by vertical developments is necessary to promote the use of renewable energy for the lighting system, the production of hot water and electricity of buildings so that they are reduced emissions to the atmosphere, since by relying less on classic fuels, the energy balance is improved. And it also recommends closing the water cycles by separating gray water, white water and black water and properly managing it.

In this context, within the elements of sustainable architecture we have the following systems.

Sustainable systems in vertical real estate developments

There are several sustainable systems for real estate developments, as was previously disclosed, but this research will only talk about those related to the use of energy, the use of water, walls and green roofs.

Rainwater collection systems

Water is an element of development and wealth in our society, determining for the progress of the human being, one of the most precious resources we have, represents one of the guarantees of human survival and the rest of biodiversity. However, the projects for their proper use and conservation that have been carried out have not been very important, since at present it has become one of the scarcest resources.

The collection of rainwater involves the collection, transport and storage of water that falls from the rain on a natural surface prepared by humans. This can be on house roofs, buildings, warehouses, concourses. The resulting water can serve any purpose as long as it has passed through appropriate filters; can be used in the cleaning of clothes, floors, toilets and irrigation; for more careful uses, although more complete filters are required, and for drinking as well, as long as it passes through purification systems (Adler, Carmona and Bojalil, 2008).

Schiller and Evans (2007) consider that within the elements that are taken into account for a sustainable building is the use of water, for which it recommends the installation of rainwater accumulation systems. This collection system allows the storage of water for irrigation and cleaning of outdoor spaces, and has the environmental advantages of reducing the demand for potable water for activities that require treated water, which reduces important economic costs, as well as decreases the discharge of rainwater to the public network and thereby avoids the risk of flooding.

Utilization of gray water

Grays are the wastewater that includes the waters of bathrooms, showers, washing machines, dishwashers, sinks, except those from the toilets. This type constitutes 80% of the wastewater and has a high level of biodegradation due to its low level of pathogenic elements and nitrogen. By recycling, it reduces the consumption of water in buildings by 50%. And while it is

not considered suitable for human consumption, it can be used in irrigation of green areas such as gardens, patios, green walls, street cleaning, toilet tanks, construction process, fish farming, boilers, water for cooling , water for cooling (Huerta, Jiménez y Prado, 2011).

The most suitable processes for gray water to be reused are those that combine aerobic processes with filtration and disinfection, since they are considered the most economical and viable.

Electric generation with photovoltaic solar energy

Solar energy is a very valuable resource that can be used. When this is done, the sustainable environmental characteristics of a building are efficiently improved. It is a clean energy which avoids the massive use of electricity and at the same time the generation of greenhouse gases. A photovoltaic system is a system that consists of silicon panels, batteries and converters. The electric current obtained by this type of system is a direct current and it is always converted into alternating current to feed the electrical systems of the building. At the same time, solar panels are made up of cells or solar cells that are made of crystalline silicon and, due to their composition, convert light into electricity thanks to electro-photovoltaic. The larger the solar panel, the more energy it will receive from the sun and the more energy it can generate.

Photoelectric metals, such as silicon, are those that, when light hits them, release electrons from their atoms; that is, it is the photons of light that release the electrons of this metal by giving them their energy, and these free electrons are the ones that produce the electricity: sunlight turns into electrical energy. That is why renewable energies do not harm the environment and are suppliers of electricity, while at the same time helping to have a better quality of life and the planet (Rodríguez, s.

Led light

LED light is formed by semiconductor devices that convert electrical energy into light without going through the production of heat, which decreases the effect of global warming. They are very durable, in addition to this type of light is adequate to meet the demand of new users of the electricity network, because, having a more efficient consumption, the same network can feed a greater number of users maintaining the same capacity of light generation (Arroyo and Jiménez 2014).

Water saving systems

In the context of sustainable constructions, thinking about the proper use of natural resources such as saving water, there are different water saving systems or devices, thanks to which, installed in taps, toilets and showers, 40% is saved to 60% water (Construmática sf). Among these, the following stand out:

- Tank discharge limiter: it is a tube that is placed on the flushing valve of the toilet that limits the discharge of water to two liters, since the device closes the valve automatically at that moment - if more water discharge is required the shooter more time.
- Filling limiter: it is a discharge mechanism that has an adjustable overflow pipe that prevents the tank from filling up to its limit.
- Flow switch for shower: allows you to resume the use of shower water without having to regulate the water temperature again, thus avoiding wasting water and energy.
- Mechanical flow switch: a device that closes or opens when pushing a lever that is under the tap.
- Flow reducer: reduces water flow as a function of pressure. These are placed in sink, sink and showers.

Solar water heater

The solar heater is a photothermal system that uses the energy of the sun to heat the water without having to use any type of fuel. It consists of a flat collector, which captures sunlight and transfers it to water. It also consists of a hot water tank where the water that has been heated is stored, and finally it has a series of tubes through which the water circulates.

When a solar heater is used to provide hot water needs, a clean and safe renewable energy is efficiently used, which contributes significantly to the reduction of greenhouse gases, which, as is known, cause climate change ; undoubtedly this improves the quality of the air, since it decreases the use of fossil fuels (Greenpeace, s.f.).

Energy saving systems

Lighting is one of the biggest energy costs of any building. Previously people turned on the lights and often forgot to turn them off. However, thanks to technological evolution, many of these aspects have been solved. Now people are no longer the determinants of the lights are on or not, technology has begun to work thanks to the development of independent and timed presence detectors to devices that regulate lighting. These make the lights go out when the presence of people in a room is not detected during a certain period of time, which has achieved, in cases where they have been implemented, huge reductions in charges for lighting.

Likewise, there are the lighting controls based on networks that control lighting areas, creating strips according to certain schedules on the independent controls or manual controls, thereby making it possible to turn off or turn on the lights throughout the building at a time determined. There is also the advanced lighting control system, which takes advantage of the power of digitization and granularity, which efficiently manages all the lights of a building from a single centralized location, as well as offers the opportunity to speed up the physical maintenance and operation (Smartlighting, 2015).

Green roofs, green walls or vertical gardens

One of the most efficient strategies to reduce the increase in temperature inside buildings is to use vegetation as thermal insulation, since it has been proven that the plants cool the environment inside them. In the same way, vertical gardens offer several advantages:

- ✓ Reduction of heat island effect due to evapotranspiration in the garden facades.
- ✓ Passive air conditioning of buildings by shading the walls of adjacent buildings.
- ✓ Improves air quality in cities as they act as filters that absorb some retained pollutants and airborne particles in cities
- ✓ They regulate the flow of rainwater and improve the quality of the water it collects thanks to the fact that the vegetation absorbs some polluting substances.
- ✓ Increase in biodiversity because the green walls are a refuge for various bird species and a large number of invertebrates.
- ✓ You have the opportunity to plant vegetables, fruits or other species.

- ✓ It provides an aesthetic benefit, since it beautifies the landscape, which generates a positive effect on the mood of the people (Fernández, Pérez, Quevedo, Pérez y Franco, 2008).

International certifications of sustainable buildings

A certification of the sustainability of a building is backed by a certification. In Mexico, although there are many, the certification with the greatest presence is the Leadership in Energy and Environmental Design (LEED). In 1994, David Gottfried, together with a group of private companies, founded in San Francisco, United States, the Green Building Council, developer of the LEED, which promotes the use of techniques and materials according to the environment with respect to the planning, design, location, construction, operation and demolition of buildings.

This certification system certifies that a building complies with the guidelines or standards of certifying bodies, based on the partial analysis of the life cycle and analysis of the building's performance. This certification is entered voluntarily. Having it provides added value to a building and supports it as sustainable, efficient and green.

Vallejo (2014) explains that the LEED is a set of standards regarding the use of alternative energies in buildings of medium and high complexity that seek to make energy efficient and water consumption, the sustainable development of the site and the quality of the environment of the interior of the building. The evaluation is based on the following categories:

- Sustainable sites: site selection that minimizes the impact on ecosystems or watersheds, control of stormwater runoff, reduction of soil erosion, light pollution and the effect of heat islands.
- Efficiency in the use of water: carry out a rational use of water inside and outside the building, use of efficient taps, wastewater treatment and reuse systems, green areas with low need for irrigation and rainwater collection.
- Energy and atmosphere: systems for reducing energy consumption, use of natural lighting, renewable and clean energy sources.
- Materials and resources: promotes the selection of seven products and materials produced, harvested, manufactured and transported in a sustainable manner, in turn, rewards the reduction of waste, as well as reuse and recycling.

- Interior air quality: strategies to improve air quality, access to natural lighting, exterior views and improvements in acoustics.
- Location and connections: promote pedestrian neighborhoods with efficient transportation options and open spaces.
- Green infrastructure and buildings: reduction of the environmental consequences of the construction and operation of buildings and infrastructure.

The levels of certification granted are as follows:

- ✓ Certificate with 40-90 points.
- ✓ Logo 2: Silver with 50-59 points.
- ✓ Logo 3: Gold with 60-79 points.
- ✓ Logo 4: Platinum with 80 points and more.

Once the previous theoretical framework was addressed, it was considered important to know the sustainable elements of the vertical developments that have been built in the municipality of Guadalajara in the aforementioned period, and also consider the possible implications for the environment .

Overall objective

Identify the sustainable systems that have vertical developments built in the municipality of Guadalajara during the period 2012-2018.

Particular objectives

- Determine the sustainable elements in terms of saving energy that have vertical developments built in the municipality of Guadalajara during the period 2012-2018
- Distinguish the sustainable elements in terms of saving water that have vertical developments built in the municipality of Guadalajara during the period 2012-2018.
- Recognize the sustainable elements in terms of the existence of green walls, green roofs, which have vertical developments built in the municipality of Guadalajara during the period 2012-2018.
- State the existence of the vertical developments that have obtained the LEED certification built in the municipality of Guadalajara during the period 2012-2018.

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Method

To know the sustainable elements of the 46 vertical developments built during the period 2012-2018 in the municipality of Guadalajara, a qualitative research was carried out. This type of approach, according to García (2014), is an inductive study that analyzes and describes the characteristics or qualities that distinguish people, things, knowledge, theory or ideas.

Likewise, it was descriptive, since it constitutes a description of an explanation of reality, (Hernández, Fernández and Batista 2014)

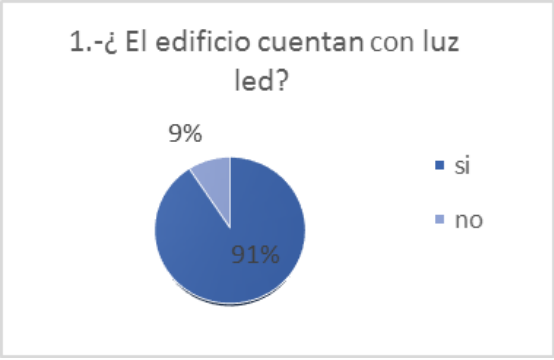
Likewise, it is a cross-sectional investigation, since it was carried out over a certain period of time, according to Cohen and Manion (2002).

In order to know the objective data of this research, a survey was carried out, which consisted in formulating a set of nine closed questions related to the research indicators (Ñaupas, Mejía, Novoa and Villagómez 2014). To this end, the 46 buildings mentioned were searched, where the work managers, engineers and architects were consulted, as well as the sales managers, to whom the questionnaire was applied (see annex 1). In addition, the website of each of the vertical real estate developments was researched, with the intention of corroborating and completing the requested data.

Results and Discussion

Once the data was obtained, the percentages of the data were analyzed and extracted. The following results were obtained.

Figura 1. Respuesta sobre la existencia de luz led



Fuente: Elaboración propia

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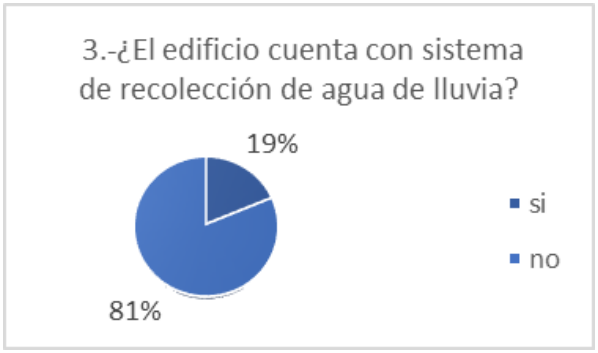
Figura 2. Respuesta sobre la existencia de sistemas de separación de aguas grises

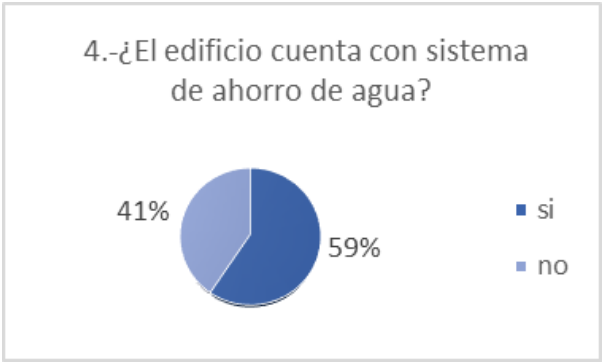
Fuente: Elaboración propia

Figura 3. Respuesta sobre la existencia de sistemas de recolección de agua de lluvia



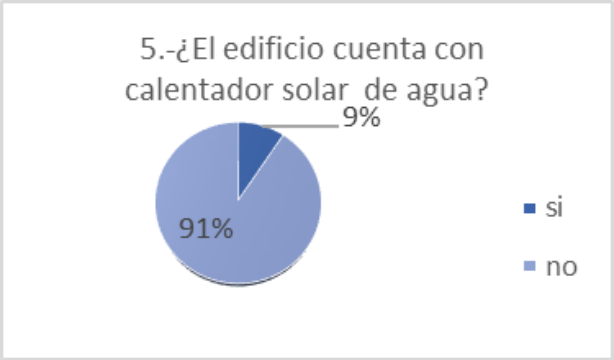
Fuente: Elaboración propia

Figura 4. Respuesta sobre la existencia de sistemas de ahorro de agua



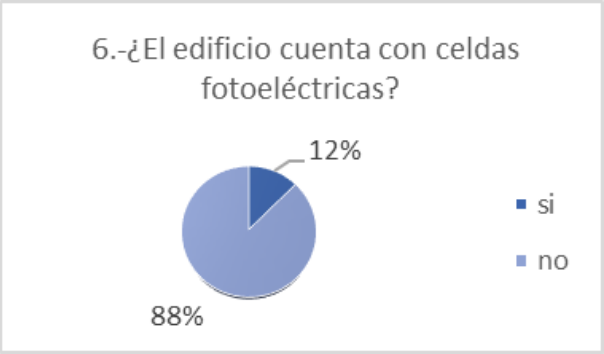
Fuente: Elaboración propia

Figura 5. Respuesta sobre la existencia de calentadores solares de agua



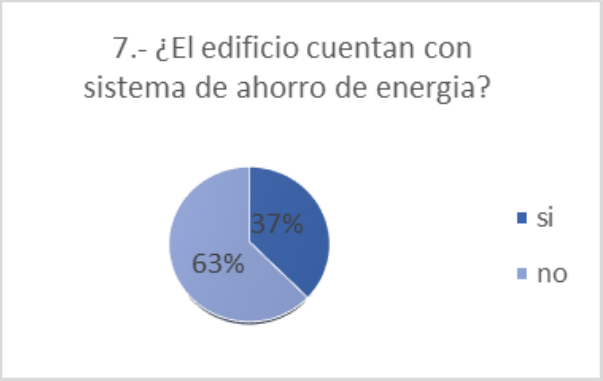
Fuente: Elaboración propia

Figura 6. Respuesta sobre la existencia de celdas fotoeléctricas



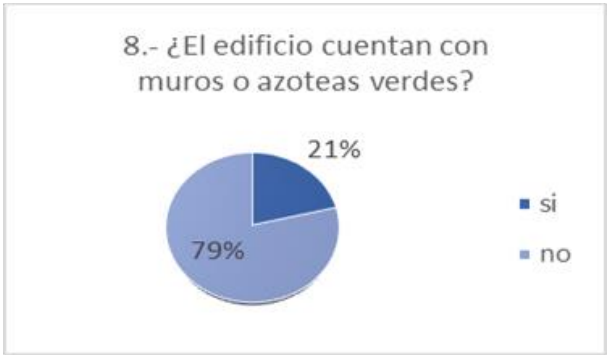
Fuente: Elaboración propia

Figura 7. Respuesta sobre la existencia de sistemas de ahorro de energía



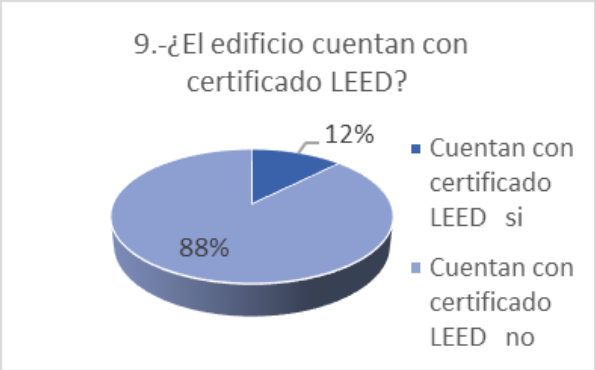
Fuente: Elaboración propia

Figura 8. Respuesta sobre la existencia de muros o azoteas verdes



Fuente: Elaboración propia

Figura 9. Respuesta sobre si cuenta o no con la certificación LEED



Fuente: Elaboración propia

One of the main arguments for vertical real estate development has been the search for sustainable architecture. However, as can be seen, in the vast majority of these buildings, no elements were contemplated in their construction that pay for this objective, since they have been developed with traditional features except for water and energy saving systems. Also, regarding this pair of systems, it would be worth questioning if they were included to protect the environment or if they are actually used as a marketing strategy, as an attraction for possible buyers of these properties.

In addition, regarding the argument that four times more space is saved when building in vertical form, it would be worth evaluating if that saving compensates for the accumulation of people and their vehicles in a small area, and the generation of consequent pollution.

On the other hand, the UN states that sustainable design must take into account, in addition to the environmental elements already mentioned: respect the context and the landscape, the climate, the wind, the soil, the resources found in the zone and that do not increase pollution. In spite of the above, it has been seen that the buildings under observation have been built in what were previously houses of a horizontal type, vacant lots, old houses, even a cluster of buildings is present in a very small area, which makes it clear that the requirements of sustainable constructions are not taken into account; only take into account where there is a space to build.

This study is channeled to investigate, as mentioned above, to know only the elements of sustainability related to water saving, energy saving, walls and green roofs that have vertical developments, as well as to identify if they are backed by LEED certification, therefore it is important to clarify that there are other sustainable elements of vertical buildings, such as the management of waste, materials used in construction, the location of the building and its connections, which are not addressed here .

Similarly, something important to mention in this research is that the information that was collected in its vast majority was provided by people who are directly involved with the construction of vertical developments, which allows us to have greater truthfulness of it.

Subsequently, it would be worthwhile giving rise to other investigations related to this topic of study, such as, for example, identifying the benefits they have had from these energy and water saving systems, as well as if the climate of the interiors of these buildings due to the existence of green walls and roofs, if the number of buildings in terms of LEED certification has increased or are still few, and finally it would also be important to know the operation and supply of water services , energy and drainage of these vertical developments.

Conclusions

Once this research work is done, it can be seen that the interest of the builders of the vertical developments is not focused on using the natural alternative resources that are at hand, as is the case of water: the ecotechnologies to capture the water of the rain are not considered transcendental, since they continue to use the drinking water of the public network, which will bring as a possible consequence an excess of the same and a decrease in the flow for the residents of this building. However, it can be stated that they do show a better interest in using water saving systems because

they may consider it an attraction for buyers of the departments or offices of the buildings. It is also observed that a third party considers the separation of gray water necessary, possibly because it represents a saving to cover secondary needs of this resource.

Regarding the elements present in the vertical developments regarding the use of energy, it is found that the use of LED light is not considered important, as well as the use of solar water heaters and photoelectric cells for conversion of solar energy in electrical energy, which expresses that it has decided to continue using the energy of the public network without increasing the heating of the atmosphere. It should be mentioned, however, that they do give importance to energy saving devices, but, as mentioned above, these systems may be used more as an attractiveness of the building than as an ecological technology to reduce the cost of energy. electric power. Likewise, it is found that the green roof systems or green walls are only implemented in a quarter with respect to the total of the vertical developments taken into account, which shows that they prefer to resort to other systems to improve the indoor climate of these buildings, and perhaps use air conditioning regardless of the implications in terms of the environmental impact that this causes.

Finally, it was found that few buildings have LEED certification, which indicates that developers of vertical buildings in the city of Guadalajara do not build with environmental responsibility, and are far from building under the vision of sustainability, so It is necessary that all the actors that participate in and decide on vertical urban development become aware of the importance of acting with environmental values and do not superimpose economic interests on life itself and the life of the planet.

References

Adler, I. Carmona, G. y Bojalil, J. A. (2008). *Manual de captación de agua de lluvia para centros urbanos.* México: Programa de las Naciones Unidas para el Ambiente / International Renewable Resources Institute-Mexico. Recuperado de https://www.academia.edu/6712743/MANUAL_DE_CAPTACI%C3%93N_DE_AGUAS_DE_LLUVIA_PARA_CENTROS_URBANOS_MANUAL_DE_CAPTACI%C3%93N_DE_AGUAS_DE_LLUVIA_PARA_CENTROS_URBANOS.

Arroyo, R. y Jiménez, R. V. (2014). Tecnología led para un programa mejorado de luz sustentable. *Mundo siglo XXI,* 9(33), 71-80. Recuperado de https://www.mundosigloxxi.ipn.mx/pdf/v09/33/06.pdf.

Cohen, L. y Lawrence, M. (2002) Métodos *de investigación educativa*. España: Editorial La Muralla.

Construmática (s. f.*).* Sistemas de ahora de agua. *Construmática. Metaportal de Arquitectura, Ingeniería y Construcción.* Recuperado de https://www.construmatica.com/construpedia/Sistemas_de_Ahorro_de_Agua.

Expok. (2014). Las ciudades verticales son la respuesta sustentable al crecimiento urbano. *Expok. Comunicación de sustentabilidad y RSE.* Recuperado de https://www.expoknews.com/las-ciudades-verticales-son-la-respuesta-sustentable-al-crecimiento-urbano/.

Fernández, R. Pérez, N. Quevedo, S. Pérez, L. y Franco, A. (2008). *Ajardinamiento de fachadas y jardines verticales: otras formas de jardinería aplicadas a un desarrollo urbano más sostenible.* Universidad de Sevilla. Consultado en octubre del 2018. Disponible en: http://www.sech.info/ACTAS/Acta%20n%C2%BA%2052.%20IV%20Jornadas%20Ib%C3%A9ricas%20de%20Horticultura%20Ornamental/Comunicaciones/Ajardinamiento%20de%20fachadas%20y%20jardines%20verticales,%20otras%20formas%20de%20jardiner%C3%ADa%20aplicadas%20a%20un%20desarrollo%20urbano%20m%C3%A1s%20sostenible.pdf.

García, R. (2014). *Metodología de la investigación.* México: Editorial Trillas.

Greenpeace (s. f.). Calentadores solares: Energía renovable en tu hogar. Campaña de energía y Cambio climático. *Greenpeace.* Recuperado de

https://www.greenpeace.org/mexico/Global/mexico/report/2006/1/calentadores-solares-energ-a.pdf.

Hernández, R., Fernández, C. y Baptista, L. P. (2016) *Metodología de la Investigación* (4.ª ed.). México: McGraw-Hill.

Hernández, S. y Garduño, A. (2009). Tecnologías actuales aplicadas al desarrollo urbano sustentable. *Revista Acta Universitaria, 20*(1). Recuperado de http://www.actauniversitaria.ugto.mx/index.php/acta/article/viewFile/72/59

Hernández, S. (2008). El diseño sustentable como herramienta para el desarrollo de la arquitectura y edificación en México. *Revista Acta Universitaria, 18*(2). Recuperado de http://www.redalyc.org/articulo.oa?id=41618203.

Huerta, G., Jiménez, D. y Prado, E. (2011). *Sistema Automático recuperador de agua pluvial y aguas grises.* (trabajo de fin de grado). Instituto Politécnico Nacional, Ciudad de México. Recuperado de https://tesis.ipn.mx/bitstream/handle/123456789/10562/72.pdf?sequence=1&isAllowed=y .

Huelsz, G. y Sierra, J. A. (2013). Hacia edificaciones más sustentables. *Revista Digital Universitaria, 14*(19). Recuperado de http://www.revista.unam.mx/vol.14/num9/art29/.

Ñaupas, H., Mejía, E., Novoa, E. y Villagómez, A. (2014), *Metodología de la investigación cuantitativa-cualitativa y redacción de tesis.* Bogotá, Colombia: Ediciones de la U.

Rodriguez, E. (s. f.). ¿Qué son los paneles solares? *Área Tecnología.* Recuperado de http://www.areatecnologia.com/electricidad/paneles-solares.html.

Salas, J. M. (2018). Desarrollo Inmobiliario vertical en la ZMG, 2012-2018. Implicaciones en la calidad de vida. Etapa I. (proyecto de investigación). Documento no publicado.

Salas J.M. Porras I. Galindo L. (2018) Proyecto de investigación "Crecimiento inmobiliario vertical en los municipios de Guadalajara y Zapopan, durante el periodo 2012-2018". Sistema de Universidad Virtual. Universidad de Guadalajara. Documento no publicado.

Schiller, S. y Evans, J. M. (2007). Criterios de sustentabilidad en proyectos urbanos. Ponencia presentada en el IX Encuentro Nacional e V Latino Americano de Conforo no Ambiente Construido. Ouro Preto, del 8 al 10 agosto de 2007. Recuperado de www.infohab.org.br/encac/files/2007/ENCAC07_1687_1696.pdf.

Smartlighting (2015). Control de Iluminación inteligente y eficiencia energética. Recuperado de https://smart-lighting.es/control-de-iluminacion-inteligente-y-eficiencia-energetica/.

Usón, E. (2012). Estrategias para la reducción del impacto ambiental en los nuevos desarrollos urbanos: Ejemplo de aplicación. *Revista Arquitectura Ciudad y Entorno, 7*(19).

Vallejo, V. M. (2014). Las diversas certificaciones aplicables a los edificios sustentables en México. *Revista Multidisciplin@*, (18). Recuperado de http://www.revistas.unam.mx/index.php/multidisciplina/article/view/50693.

Winitzky, C. (2013). Herramientas de diseño para una arquitectura sustentable. (tesina). Universidad de Belgrano, Buenos Aires, Argentina. Recuperado de http://repositorio.ub.edu.ar/handle/123456789/1582.

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Anexo

Cuestionario

UNIVERSIDAD DE GUADALAJARA

SISTEMA DE UNIVERSIDAD VIRTUAL

CORDINACIÓN DEL POSGRADO EN VALUACIÓN

1. Fecha:	

2. Domicilio del edificio:	

3. Nombre del edificio:	

4. Nombre del entrevistador:	

5. Nombre del entrevistado (opcional):	

6. Puesto del entrevistado:	

7. ¿El edificio cuenta con luz leed?	SÍ		NO	

8. ¿El edificio cuenta con sistemas de separación de aguas grises?	SÍ		NO	

9. ¿El edificio cuenta con Sistema de recolección de agua de lluvia?	SÍ		NO	

10. ¿El edificio cuenta con sistema de ahorro de agua?	SÍ		NO	

11. ¿El edificio cuenta con calentador solar de agua?	SÍ		NO	

12. ¿El edificio cuenta con celdas fotoeléctricas?	SÍ		NO	

13. ¿El edificio cuenta con sistema de ahorro de energía	SÍ		NO	

14. ¿El edificio cuenta con muros o azoteas verdes?	SÍ		NO	

15. ¿El edificio cuenta con certificado LEED?	SÍ		NO	