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Use of Audiovisual Methods and Documentary Film for the Preservation and Reappraisal of the Vernacular Architectural Heritage of the State of Michoacan, Mexico

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Abstract: The State of Michoacan has a wide and rich architectural heritage which is represented by different vernacular typologies which employ different materials and techniques according to the local resources. However, this wide knowledge and cultural heritage are disappearing, with several monuments and buildings being abandoned due to new dynamics and social changes. The traditional techniques have been substituted for modern and industrial construction systems since they are associated with obsolete ways of life. Through international cooperation for development and research projects, many activities were carried out to analyze the durability of local materials and vernacular constructions of the state. The main ones included the architectural survey and inspection of these buildings, photographic and drone surveys, characterization in the laboratory and oral interviews with local users. During the field work, these interviews with the local population, the creation of multimedia content and the use of audiovisual methods had crucial importance in the documentation of this local knowledge and culture, being great methods for scientific communication and dissemination. The main product is the documentary *Xirangua*, which means 'roots' in the *Purépecha* language, the main indigenous ethnicity in the state. This documentary explores the traditional architecture and construction of Michoacan, showing the reality within the loss of this vernacular heritage and portraying the importance of its conservation through the perspective of the local population, users and artisans. The use of these audiovisual techniques has demonstrated to be a suitable option to promote and preserve cultural heritage and educate, include the local actors in the process, and make the general public aware of the current issues, with this being one of the first works which explores this approach.

Keywords: cultural heritage preservation; documentary film; scientific communication; vernacular architecture; entertainment for education; traditional knowledge

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1. Introduction

Vernacular architecture is one of the essential cultural expressions of our societies, characterized by some principles that can be difficult to define and have been socially constructed [1]. The term, from its first notions, has been related to the authentic, the indigenous [2], the rural [3], etc., which does not differ from the current conception in the professional and academic context. Nevertheless, these constructions entail a much more complex universe, where the relations of the users with the space, the lifestyle activities and the transition through generations play a big role.

These typologies respond to the local environments, finding straightforward solutions for the adaptation of human life and responding to the physical and cultural context of the territory. One of the trademarks of vernacular architecture is the employment of

local materials, facilitating the manufacture and building processes while using the available resources of the immediate context respectfully. Another of its particularities is the production by non-experts or qualified labor, as the empirical knowledge is transmitted through generations [4], building a sense of identity between these groups [5].

Currently, most of this architecture remains in the rural areas, where there are still some villagers and artisans with the technical and ancestral knowledge to build and preserve these constructions, but the common situation at overall level is the neglect, abandonment and disappearance of this heritage. Consequently, this heritage stands unprotected and due to the loss of the traditional techniques, the interventions to preserve these buildings often accelerate the deterioration process (see Figure 1), finding situations where the local users do not know how to take care of their own dwellings.

Figure 1. Abandonment of traditional dwellings and monuments, and bad construction practices regarding the traditional materials and systems.

While these local constructions had not been contemplated, appraised and protected by the institutions in charge or even the society, at the beginning of the twenty-first century, the treatment of this heritage has changed. The ratification of the *Chapter on the Built Vernacular Heritage* by ICOMOS in 1999 [6] is significant, which brought visibility to the different traditional architectures across the globe and established the first guidelines and strategies for its conservation at an official level. However, sometimes, the most difficult constraining factors are the social ones [7] since these constructions are associated with the lower socioeconomic classes and the rural population [8], and this type of architecture is consequently considered obsolete.

In the last few decades, many research projects and initiatives have documented, analyzed and produced literature regarding many features of these buildings [4,9–11], with the principal objective being the preservation and conservation of this heritage. One of the main appeals of vernacular architecture is the unlimited potential of these construction systems regarding sustainability and circular economy [5,11–16]; in fact, they have helped to develop the principles of bioclimatic architecture and most of the techniques can be reused or recycled limitlessly.

Nevertheless, this extensive literary production is difficult to access to the general public, and the lack of guidelines and regulations for these systems has propitiated the loss of the traditional knowledge and identity of the communities. Consequently, it is necessary to manage resources and research projects to continue studying, documenting and learning from these ancient techniques and systems. The present research work has intended to study, analyze, characterize and later disseminate the vernacular architecture of the State of Michoacan, in Mexico. A novel and multidisciplinary approach was conducted, combining the standard methods to document and analyze this architecture with modern ones such as audiovisual formats, social media and the documentary film.

The principal objective of this research project was to reappraise and recover this vernacular architectural heritage of the region with all the knowledge and aspects entailed. For this purpose, a documentary project was designed, recorded and released on different audiovisual platforms. From this general mission, the different secondary objectives were conceived:

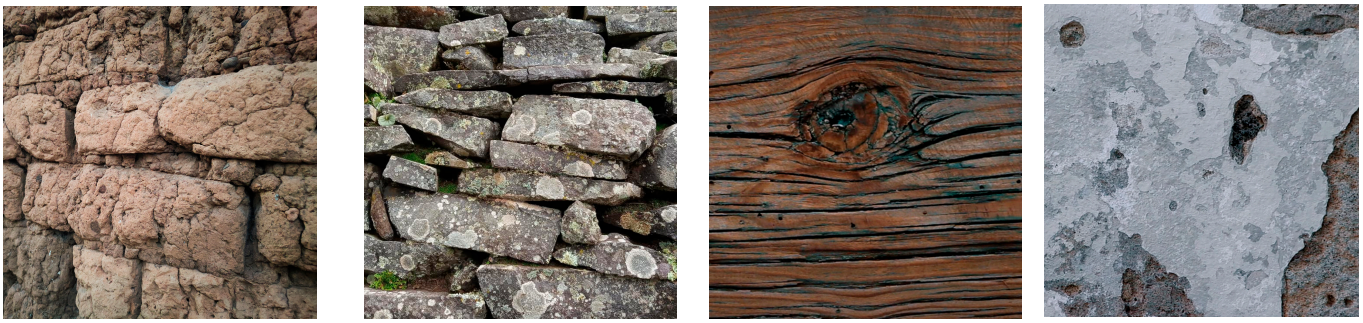
- Identify, document and analyze the vernacular constructions of Michoacan and their features through the field work and the architectural survey.
- Involve the communities and the users of the vernacular heritage in the promotion and preservation of their heritage by means of participatory design, with them also being the storytellers of the audiovisual project.
- Use this documentary project as a tool for both dissemination and scientific communication, reaching a specialized target but also the general public.
- Implement both the field work expertise and the documentary film in educational activities at university level, with the first approach being the summer research project celebrated in the Universidad Michoacana de San Nicolás de Hidalgo (UMSNH).

1.1. The Situation of the Vernacular Architecture of Michoacan

The State of Michoacan is one of the 32 entities which comprise Mexico (see Figure 2), located in the western central part of the country. The wide area of the state and its geographical position, bordered by the Pacific Ocean and surrounded by the Trans-Mexican Volcanic Belt, produce many climatic regions, which translates to different architectures with a wide variety of typologies, forms, materials and systems. Culturally, the state also presents great richness; the presence of various indigenous groups prior to the arrival of the Spanish empire (particularly the *Purépecha* group due to their notoriety in the region) generated an interesting combination of the local materials with both pre-Hispanic [17] and colonial techniques, giving birth to a new way of building, so-called 'Novohispano/a' architecture [18].

Figure 2. Location of Michoacan.

The prevalence of the traditions and many of the original cultural manifestations along with the diverse geography and range of climatic regions make Michoacan a really interesting study case. With an area of 58,599 km^2, this great diversity produces a great range of solutions and typologies, varying depending on the local resources and materials which make up the vernacular architecture of the state. We can identify four main traditional construction materials: natural soils, stones, wood and lime, all of them being easy to spot throughout the territory (see Figure 3).



(**a**) (**b**) (**c**) (**d**)

Figure 3. Main local materials of the vernacular architecture of Michoacan and their transformation in constructive systems: (**a**) Natural soils; (**b**) Stones; (**c**) Wood; (**d**) Lime.

In that exact order, first we find the natural soils, commonly referred to as earth or *tierra* in Spanish, being one the oldest construction materials in the continent, with an important tradition of the adobe technique [19]. Nevertheless, the constituent component of all the earthen techniques are the clays, which come from the devitrification of quartz sands and act as the cementitious material within the mixtures. In Michoacan, we can find rich clayey soils with high content of montmorillonites and ilites [20], which are employed for the manufacturing of adobes. However, these soils also have other applications in building construction, such as the earthen mixtures used as coating or refurbishments to protect the exterior walls, or the earthen mortars utilized to join different types of masonry.

Regarding the natural stones, there are plenty of quarries in the state where these materials are extracted and crafted [21], the basalts being the most common. Basalts are igneous intrusive stones, with about 50% SiO_2 and rich in Fe and Mg. On the other hand, the igneous extrusive stones are rhyolites or acid tuffs with 70% SiO_2, with the local ones being the ignimbrites, which are utilized in the majority of the monumental buildings of the state [22–24], and are acknowledged for their pink coloration. There are also dacites, as shown in Figure 1 in the arch, which present 52–65% Silica. Regarding the sands utilized mainly for the production of mortars, these are andesites, with less than 52% SiO_2. Stone masonry has historically been reserved to the most important monuments [25], normally associated with religious use due to their massive presence and durability (see Figure 4); nevertheless, we can find these materials in almost every type of structure, with their main use being foundations for the constructions, avoiding the water penetration through capillarity.

(**a**) (**b**)

Figure 4. Use of natural stones in monumental buildings: (**a**) Pre-Hispanic archeological site of Ihuatztio; (**b**) Colonial temple and tower in San Nicolás Obispo.

Wood has a wide presence in almost all the regions of Michoacan, as it has been used traditionally for the roofing systems of both the vernacular architecture and monumental buildings. Nevertheless, its importance stands out in the *Purépecha* Plateau regions where some constructions are entirely made with this material, using species such as pines or oyamel firs. In other areas, such as *Tierra Caliente* or the coastal zone, lighter species such as reeds and dry lawn are used, to shape the vernacular constructions with a technique known as *bajareque*.

Finally, lime has been used since pre-Hispanic times, being one of the oldest construction materials in the continent and totally relevant for the technological development of the architecture [26]. The properties of lime are highly valued, as it provides excellent adhesion, workability and plasticity, which is why it has been traditionally used in mortars [27]. Lime mortars have been employed to protect masonry structures from anthropogenic action and the moisture caused by rainwater, and often they incorporate biomaterials which can enhance their durability and provide useful properties to the mixtures, with an extended use of cactus mucilage [28,29]. Additionally, lime has been used in the region to stabilize the clayey soils and earthen components such as the adobes [20], reducing the vulnerability of these constructions to the effect of water.

From the combination of these materials and the adaptation to the local resources and climatic conditions, the vernacular architecture of the state stands out for the variety of typologies found therein. These constructions are adjusted to their local environments and the local materials, resulting in three main typologies of residential buildings: the adobe, the *bajareque* and the *trojes* (see Figure 5).

(**a**) (**b**) (**c**)

Figure 5. Vernacular housing typologies of Michoacan: (**a**) Adobe; (**b**) *Bajareque*; (**c**) *Troje*.

The adobe house is the most representative and easy to find, being the most shared not only in the state but in a great part of the whole country. The great qualities of earth as a construction material and the availability of the resource make it a global technique with multiple variations utilized since the beginnings of human civilization [10,30–32]. The adobe, being a masonry technique, has been linked to the technology brought by the Spanish [33], although we can find pre-Hispanic examples in other regions of the country [34,35].

The adobe house, without any doubt, has been the most studied typology, and it can be found in many of the regions of Michoacan, due to the thermal inertia that the walls provide to the building and the easy obtainment of the natural soils, the raw material. The traditional adobe house in Michoacan settles in stone foundations (often of volcanic stones due to the orography) with thick masonry walls and wooden roof structures covered with ceramic tiles (see Figure 6). Despite this ideal model, aspects such as the morphology, the slope of the roof, the proportion and position of the openings, or the dimension of the adobes vary within the region and the local conditions. The geographic, environmental and socioeconomic factors generate diverse

variations in the dwellings; for instance, the warmer and dryer regions present façades with more openings and hollow areas to assure natural ventilation.

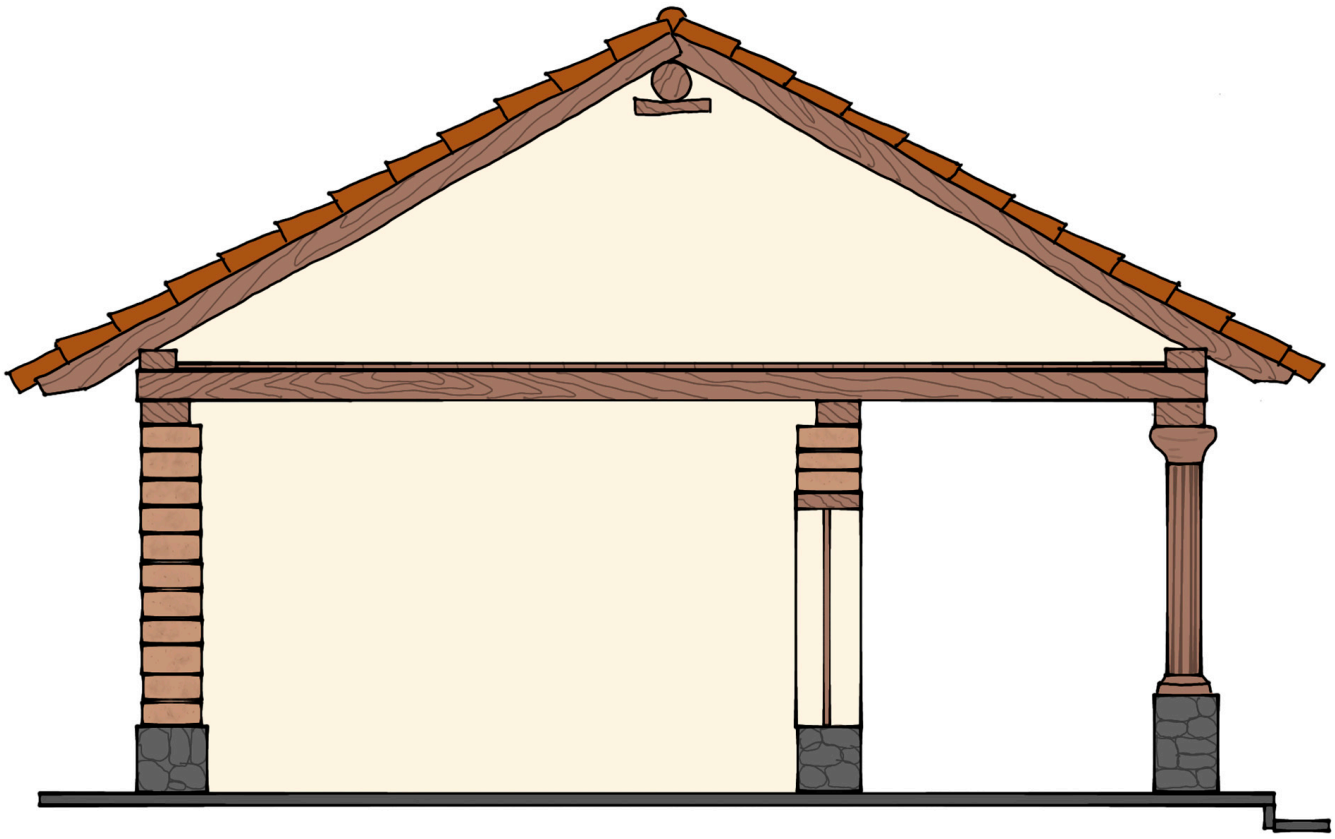
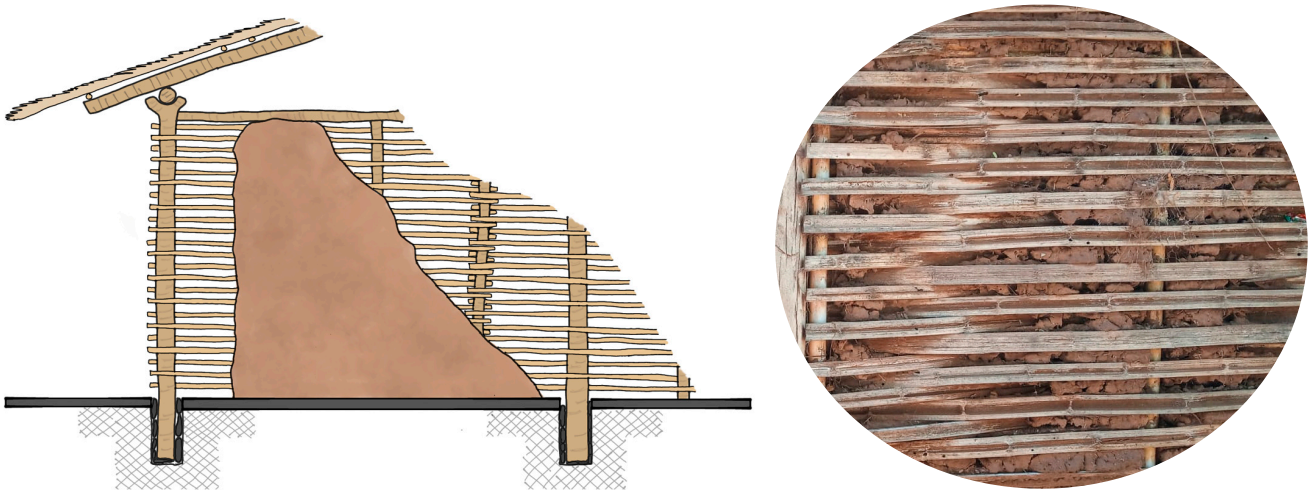


Figure 6. Section detail of the traditional adobe house.

Secondly, we find the *bajareque*, equivalent or similar to the wattle and daub which can be found all over the world [14,36,37]. It is a mixed technique which combines an interlaced wooden structural frame with an earthen refurbishment that functions as the enclosure and protects the system from weathering (see Figure 7). The technique had an important relevance and presence in Mesoamerican cultures, being found in many archeological sites [38–40]. These buildings can be found in the coastal land of the state and the climatic and cultural region named *Tierra Caliente* (which means "hot land"). The extreme temperatures are one of the main reasons for the presence of *bajareque* constructions in these regions, due to the natural ventilation they provide.

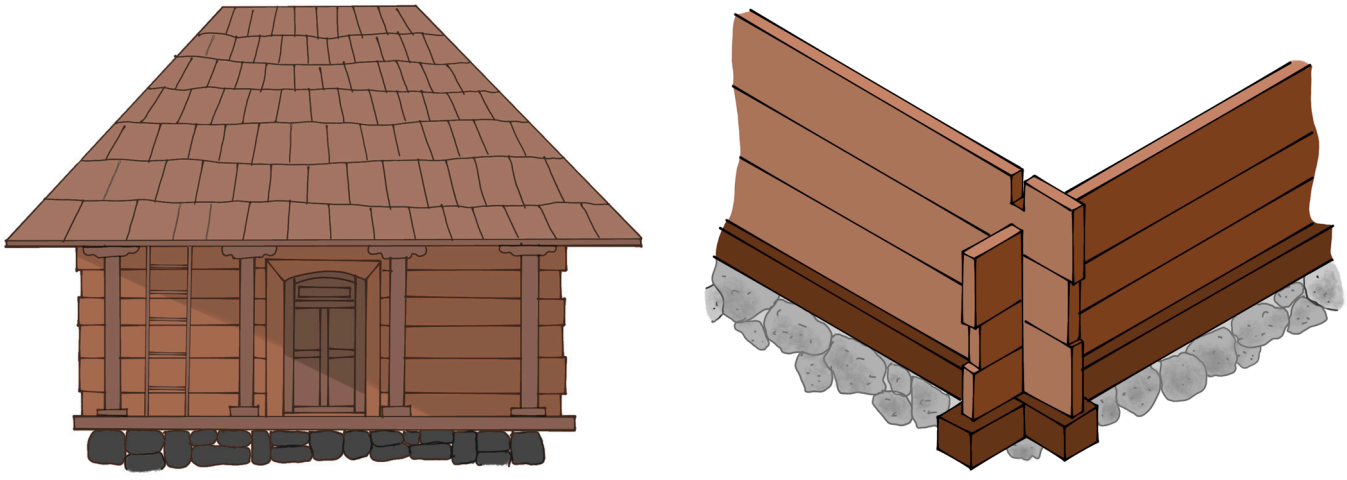
As well as the adobe houses, these dwellings have stone foundations, although these are less sophisticated and robust due to the lightness of the whole structure. Traditionally the constructions presented vegetal roofing systems; nevertheless, as a result of the industrialization and globalization processes, the majority of buildings have currently substituted them for metallic sheets. Another relevant aspect of the existing houses is the presence of the earthen layer, as many houses have lost it and only reapply it from time to time before the arrival of the rainy season (see Figure 7b).



(**a**) (**b**)

Figure 7. (**a**) Bajareque wall section drawing. (**b**) Current wall with a detached refurbishment.

Lastly, we can find the *trojes*, which are the representative vernacular buildings of the *Purépecha* region and culture. These structures are completely built with wooden beams, including the floor slabs, the walls and the roof systems, which are covered with very thin wooden tiles called *tejamanil* (see Figure 8a) [41]. They also present the singularity of not using any nails or adhesives to join the beams, as the different pieces are assembled using geometric unions (see Figure 8b). Additionally, due to this peculiar system, they can be easily dismantled, moved to other places and rebuilt; therefore, they can be inherited by the new generations. Traditionally, they were used as dormitories and storage rooms for the harvests, mainly corn, but also worked as outdoors kitchens with some variations. The *trojes* which worked as kitchen spaces did not have a mezzanine floor because they incorporated superior lateral openings instead to enable natural ventilation.



(**a**) (**b**)

Figure 8. (**a**) Typical façade; (**b**) Technical detail of the junction between the wooden beams.

However, it is important to clarify that all these typologies remain in the rural areas and communities of the state. The urban areas have ruled out all the ancient typologies in pursuit of a new urban image [42], and it is almost impossible to find new constructions using traditional techniques or materials nowadays. The *World Report 2016–2019 on Monuments and Sites in Danger* emphasizes the critical situation of Mexico regarding the vernacular rural housing, noting that the federal institutions in charge of heritage

promotion and preservation, the INAH and the INBA, do not register or catalog these modest constructions [43].

These circumstances, in combination with catastrophic events such as the 2017 earthquakes, which caused major levels of destruction in many regions of the country, have resulted in a great loss of vernacular heritage. For instance, the adobe buildings were perceived as unsafe structures by the population [44], and the institutions and companies encouraged the users to replace their dwellings with cement blocks and modern materials.

The housing issue in Mexico is extremely complex, and due to the previously mentioned reasons, the vulnerable position of vernacular architecture has grown, accelerating the abandonment process of traditional materials, which are perceived as unsafe and associated with poverty and lack of progress [45]. Conversely, other social phenomena such as migration have contributed to precipitate the loss of this heritage [46], as the new generations replicate modern models and rely on industrialized materials and systems.

In recent decades, the loss and decrease of vernacular constructions in Mexico has been remarkable; for example, the permanence of these structures in the country has fallen by more than a half in the last 20 years, from 18.93% in the 2000 census to 7.57% in 2020 [47,48]. The situation in the State of Michoacan is very similar to that of the rest of the country. From the INEGI data, it can be observed that the percentage of traditional housing has diminished from 15.60% in 2015 to 11.25% in the last census of 2020 [48,49]. Nevertheless, it is important to remark that we can find certain regions where these vernacular constructions are more likely to be found and where the traditions have been somewhat maintained (see Figure 9).

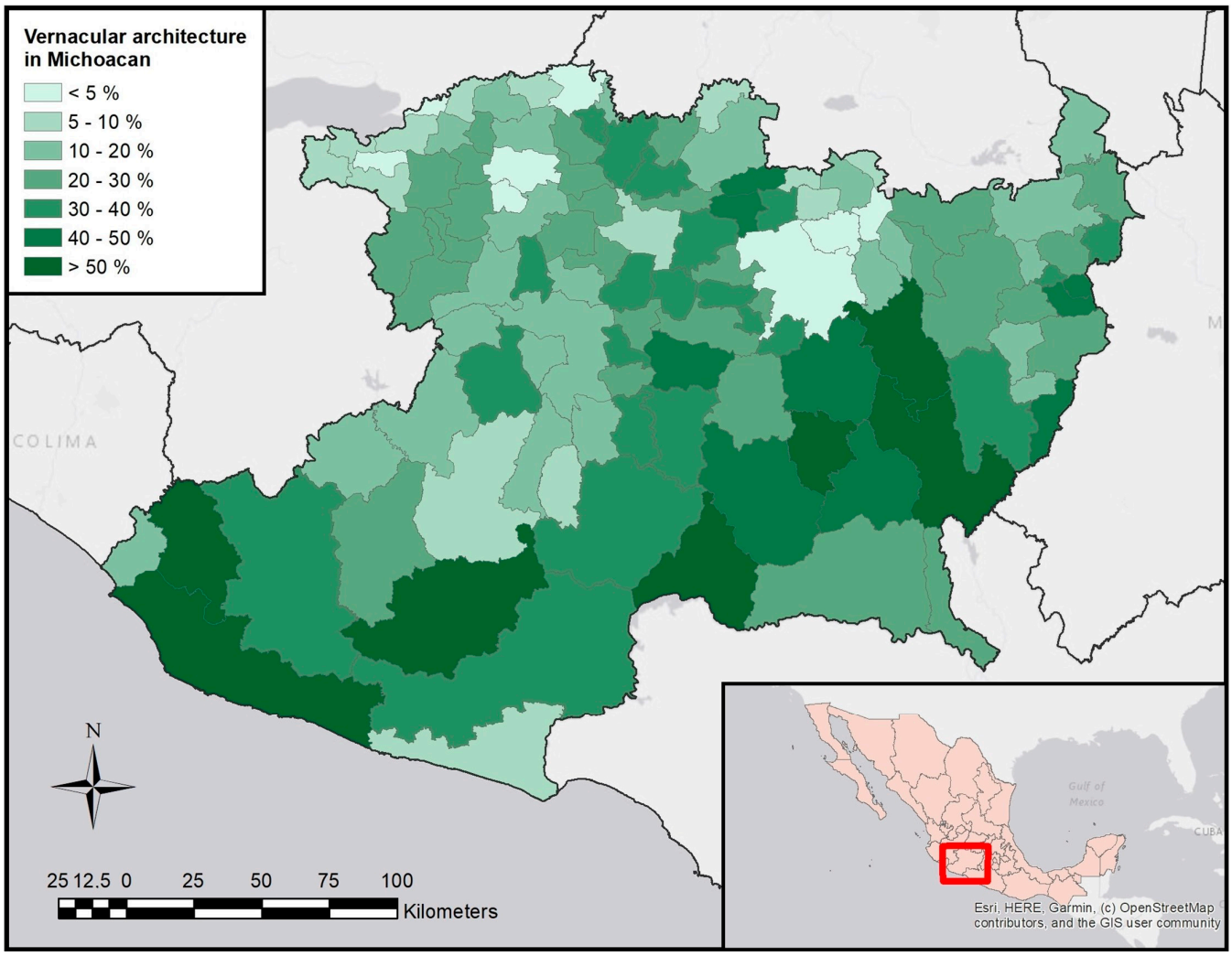


Figure 9. Distribution of vernacular housing in the State of Michoacan.

Finally, the monumental heritage of Michoacan has experienced the same phenomena and conservation issues as vernacular residential architecture. Sadly, it is common to find abandoned constructions such as temples or *haciendas* (see Figure 10). The sacred architecture symbolizes the most visible image of evangelism in the territory, while the Mexican *haciendas* are rural estates used for rural and latifund production of colonial origin in the New Spain territory between the 16th and 18th centuries, based on the control of the local resources and the human workforce. These constructions present the same traditional materials as the more modest dwellings, being also great examples of the adaptation to the local environment.

(**a**) (**b**)

Figure 10. Abandoned monuments in Michoacan: (**a**) Hacienda San Joaquin Jaripeo; (**b**) Templo inconcluso de Taretan.

1.2. The Audiovisual Methods and Documentary Film as Tools for Scientific Communication and Dissemination

One of the main problems for scientific dissemination is the lack of accessibility of the research results to a broader public [50]. Scientific papers or communications can experience difficulties in generating interest, excluding the specialized research segments and groups that normally receive these dissemination activities. On the other side, when we consider scientific communication, we are dealing with the translation of this information to the general public, where we also find a large number of issues. For instance, the scarce current regulations for scientific communication are attached to anachronic and inefficient practices, which must be transformed. The principal barriers are not economical or technical but social [51]. The newest audiovisual formats and social media are precisely the most useful tools to change the status quo, but generally, scientists are not familiar with these methods.

In this sense, the concept of citizen science is very interesting [52], asserting that the knowledge is constructed by society and not the academic elites. With that in mind, it is necessary to engage the youth with scientific contents, and audiovisual formats can be the first contact. However, audiovisual technologies have a wider trajectory within the field of media studies, where they are a key part of the educational background and training of the students [53], while other disciplines are not oriented in these techniques and rely on the more traditional ones. Taking into account the above, within the audiovisual formats, the documentary film is probably the most accessible, quickest and easy to share.

Documentary films have a clear advantage in spreading scientific and cultural knowledge due to the adaptability of the narrative and the technical resources available [54]. We can find examples of the use of film and documentary as educational strategies for children with learning disabilities with positive results [55]. Additionally, some studies have reported an improvement of the academic score of students in secondary schools with the integration of audiovisual materials [56,57]. Other research

works have explored and confirmed the effectiveness of the documentary not only for the academic public but the general audience [50], reporting an increasing interest in scientific themes. At last, some studies have combined and correlated the scientific paper and the documentary [58], identifying the strengths and weaknesses of each format but highlighting the complementarity they can achieve together.

While video is not an emerging format for science communication, online video sharing platforms have indeed democratized the access of the general public to this information. Nowadays, individuals who are interested in sharing scientific information or results can use these platforms freely to engage with wider and more diverse audiences and get quicker and more fluent feedback [59]. Notwithstanding the convenience of the documentary to communicate science, it is notable how audiovisual consumption has changed drastically in recent years, as well as how the new technologies facilitate and increase the visualization of content. Nevertheless, the current situation makes it difficult to engage the general public with scientific audiovisual products, since it is difficult to captivate the viewer among the vast online universe [60].

There are clear differences between the scientific discourse and the treatment of the information by the media, and these projects need to achieve a balance between dissemination and entertainment. For instance, videos accessible online allow immediate feedback and help to establish a communication between the sender and the receiver, which can be used to perfect the outlook and depth of the work, and that is the reason why in recent years, many scientific channels on YouTube or Instagram have grown exponentially.

Regarding cultural heritage, digital technologies have been employed with remarkable success, as they help with the digitalization and documentation of the materials [61]. Several cultural heritage projects have included these new technologies [62–66], and some of them have considered virtual and digital platforms scientific communication and dissemination. In the field of vernacular architecture, many strategies have been implemented in recent years to promote and enhance these constructions, considering that they often exhibit a lack of protection from the authorities. The 3DPAST initiative is a great example, with interesting outputs including a website and a mobile app [67], proving that the conventional presentation of results must adapt to the modern times. Other researchers have identified these mobile applications and devices as great opportunities for the cultural sectors and even to improve the tourism experience [68].

Regarding the experiences related to architectural heritage or architectural history, we can find few documentaries [69,70]. While the format has been not exploited yet, researchers emphasize the importance of portraying the personal point of view of the interviewees, while the director has his own outlook and it is displayed through the storytelling and the script [70]. In this respect, the visual power of the architectural objects and the interesting narrative of the traditional constructions facilitate this type of audiovisual projects, and it would be very positive to increase their production as educational tools, as well as scientific and cultural dissemination products.

The conduction of architecture film festivals is one of the most efficient ways to connect both fields and dialogue between the different artistic representations and put the cities and stories on display [71], generating interesting debates and solutions for urban and architectural issues. In Europe, we can find events with a wide background and acknowledgement, such as the Copenhagen Architecture Festival, the Architecture Film Festival Rotterdam or the FICARQ—International Architecture Film Festival in Madrid, Spain, all of them being internationally recognized. Meanwhile, in Latin America, more recent initiatives such as the Arquitectura Film Festival in Chile or CINETEKTON in Mexico have been the most remarkable ones during the last years. These festivals can function as great showcases to relate narratives about our cultural heritage without dismissing the more technical and specialized aspects distinctive of scientific communication.

2. Materials and Methods

The research process of this research project implemented an innovative multidisciplinary and interdisciplinary methodology with the main objective of identifying, cataloging, characterizing and ultimately preserving and reappraising the vernacular heritage of Michoacan. The project, titled "Durability of local materials and traditional techniques of the Mexican vernacular architecture in the State of Michoacan" but also referred to as "DBMC 2020" was funded by the CIMNE, in Barcelona, Spain, through the 1st International Contest for Cooperation and Development of the XV International Conference on Durability of Building Materials and Components, which was an open competition for students.

The project envisioned more common research techniques, but also the use of audiovisual methods to complete the scientific communication to new targets, specially through social networks. However, the cooperation for development focus was not lost, as from the first moment, the rural communities were contacted and the participative design was considered [72]. A multidisciplinary group was formed, including researchers, architects, civil engineers, geologists, designers, communication experts and filmmakers. The methods can be classified in two groups: first, the activities derived from the field work and regular research, and second, the elaboration of a scientific documentary, which was a novelty for all of us.

2.1. Field Work, Documentation and Surveying of the Vernacular Architecture

The DBMC 2020 project included several field work activities to identify, document and characterize the features and properties of the vernacular architecture in Michoacan. These included architectural and photographic surveys of the constructions, the diagnosis of the buildings, and the realization of oral interviews and recordings with the locals. Furthermore, once the field work was completed, all these experiences were integrated into the educational and training activities developed in the university and research programs of the UMSNH.

The architectural survey was one of the principal activities developed, helping to obtain a great amount of quantitative data which could be processed for different purposes. It is important to document the typologies and architectural features of these study cases, as we can find and acquire relevant information which goes way beyond the architectural plans of the buildings. For example, the surveys conducted in the *Ödemiş-Dereuzunyer* settlement, in Turkey, helped to understand the traditional lifestyle, architectural evolution, vernacular construction technology, traditional building materials, traditional craftsmanship and intangible cultural heritage [73]. By studying the ruins of the monumental vernacular architecture, it is also possible to obtain a better knowledge and interpretation of these historical structures [74], while facilitating the eventual restoration and preservation projects.

To achieve all these analyses with an optimum level of detail and collect the data of each vernacular building, the team prepared technical surveying sheets. The design of these sheets was based on field visits in the locality of Vila Real de Santo Antonio in Portugal, as they were designed for the seismic vulnerability assessment of the vernacular constructions [75], which share many attributes with the ones in Michoacan. The seismic vulnerability assessment methods, especially the vulnerability index approaches, are very interesting for the cataloging and documentation of vernacular buildings, due to the great amount of information and constructive aspects of the buildings that they require [76]. The inspection sheets were also developed with the previous experience of the group with monumental and vernacular architecture, as these documents are very useful for the restoration and conservation projects. The group had used them previously [77], and the prior experience with cultural heritage and cooperation projects helped during the field work process.

As a result, these inspection sheets contain all the technical data and information of each dwelling, including all the main constructive parameters: foundations, walls, openings, slabs and horizontal structures, roofing system and other elements. The materials, systems and state of conservation of each parameter were registered, as well

as the general information (number of users, location and direction, approximate year of construction, position within the aggregate, etc.).

Among the information gathered, the conservation state of the residential buildings was very important [78], as it provides insight into the decay and deterioration processes of these constructions. On the other hand, the analysis of the construction techniques and the arrangement of the materials and systems help to determine and characterize the architectural typologies [79–82], but also to implement retrofitting strategies and to plan conservation and preservation measures for these constructions [83].

The technical surveying sheets and all the data gathered were completed by means of photographical surveys (see Figure 11). The equipment utilized consisted of an SLR camera, a drone DJI Mini 2 and the personal cell phone cameras of the team members, which are considered basic tools nowadays. The photographic techniques also help to capture qualitative aspects of the residential environment and its impact on the user's daily life, allowing to get other qualitative information which complements the technical data obtained with the surveys.

Figure 11. Architectural and photographic surveys during the field work in Ario de Rosales, State of Michoacan, Mexico.

The project also contemplated implementing all this experience and knowledge acquired in the educational practices in the university. One of the techniques employed regarding the education and awareness of cultural heritage and vernacular architecture was the conducting of questionnaires among undergraduate students within the frame of the scientific research summer program "*Verano de la Investigación Científica y Tecnológica del Pacífico*". In this program, students mainly from different universities in Mexico, but also Colombia, take a seven-week stay in a receiving institution with prestigious researchers, working with them in scientific projects and training activities. The main purpose of the program is to promote the mobility of students in Latin America, awakening their interest in scientific research.

The target of these questionnaires was very interesting as all the interviewees came from different environments and contexts, both urban and rural, which may vary the conception about vernacular architecture. The questionnaires revolved around the role of traditional construction and local materials in the university programs, considering that the students came from architecture and civil engineering careers.

Additionally, as part of the summer research program, a specific workshop about vernacular architecture was designed, titled: "Vernacular architecture, traditional materials and its implementation in cooperation to development projects". The workshop combined conventional lessons about traditional materials and how to use them in modern building construction, and some of the outcomes of the DBMC project with practical courses in the laboratory to demonstrate the students in person how these systems work and how they could be a logical alternative to the industrialized materials (see Figure 12).

Bringing back the educational approach of the DBMC project, the documentary *Xirangua* was one of the activities included in the program of the workshop, as it is discussed in the following section.

(**a**) (**b**)

Figure 12. Educational activities in the workshop: (**a**) Lecture in front of the scientific research summer students; (**b**) Earthen construction practical course.

2.2. The Introduction of the Documentary Film for the Architectural Heritage Documentation and the Recording of Xirangua

While the project was carried out, the team started to rely more on the audiovisual recordings and the interviews with the local population. Other projects recorded in the same regions served as an inspiration to create a documentary with the purpose of displaying the concerns and thoughts of the real local actors [84]. Then, the idea of *Xirangua* was born, which is the *purépecha* word for roots, meaning all the traditions that we are leaving behind. The main objective was to show the reality of the loss of this vernacular heritage and portray the importance of its conservation by means of interviews with all the involved agents: local population, artisans and constructors, academics and experts.

The concept of the project was to focus on the experience and understanding of the users, the main characters of the documentary [70]. They were the most appropriate people to transmit the qualitative aspects of this architecture; moreover, the older ones still remember the traditional knowledge passed on from generation to generation (see Figure 13). The interviewees became interested in the project from the first moment, generating a friendly atmosphere and feeling very pleased to share their culture.

The creative process was essential, deciding to divide the film into three chapters: the first explaining the local materials, the second presenting the three main typologies of vernacular architecture in the state, and the third dealing with the abandoned monumental heritage. The narrative development was complemented with the positive initiatives carried out with the DBMC project among others and the conclusions from all the interviewees.

One important aspect was searching for sponsors and strategic support of recognized institutions, mainly the universities, as it had an educational background and purpose, but also the cultural heritage organizations, with the participation of the ICOMOS Mexican National Committee, as well as local private companies which financed some of the costs. All the institutions helped to promote and advertise the project; the goal was to maintain them all in the same script and achieve a positive outcome.

Figure 13. Recording of the interviews with locals in Ihuatzio.

Once the project was embraced and backed, the subsequent stages and processes were defined. The documentary was recorded between May and August of 2021, touring more than fifteen municipalities and communities of the state. The postproduction and editing were completed in November, as well as the translation of the English subtitles, with the objective of reaching an international audience, competing in film festivals and performing in cultural events outside Mexico. Finally, the documentary was released in February 2022, as will be detailed in the Section 3.

3. Results and Discussion

The interdisciplinary approach of the project allowed it to address multiple areas of the vernacular architecture, from the architectural and typological analysis, the morphologies, spatiality and materials to the environmental and vulnerability studies. On the other hand, the realization of an audiovisual project which documents and transmits the wealthy knowledge and culture of the communities functions as a more direct format to reappraise cultural heritage and communicate science.

3.1. Typological, Environmental and Material Analysis of the Vernacular Architecture

The three typologies mentioned before were found and documented along the territory of Michoacan. The field work and the surveys of the traditional buildings allowed the team to gather substantial amounts of information regarding the architectural features, construction materials and systems, structural condition and current use of the building, among many other aspects.

In addition to these factors, the inspections of the dwellings allowed us to identify the decay mechanisms of the structures and the predominant alterations with modern materials and constructive systems. For instance, the adobe constructions often present modifications with non-compatible materials, the attachment of concrete structural elements such as columns or beams, the use of cement to erroneously protect the walls, the addition of new spaces with incompatible materials, the substitution of the wooden beams for metallic ones or the ceramic tiles for ceramic sheets, among many others (see Figure 14). The monumental earthen heritage presents similar alterations; nevertheless, the worst factor is the abandonment of these structures (see Figure 15).

(**a**) (**b**) (**c**)

Figure 14. Constructive malpractices and modifications on adobe dwellings: (**a**) Invasion of the traditional wall in San Nicolás Obispo; (**b**) Cement coating in Tacícuaro; (**c**) Cement coating and pavement in Tacíacuaro.

Figure 15. Abandoned earthen architecture haciendas in Huaniqueo.

The *bajareque* houses have not been as modified as the adobe buildings, since they are found only in certain regions of the state, in more isolated and rural communities. The main alteration found in these dwellings is the substitution of the traditional roofs built with vegetal materials and fibers, for metallic sheets, which are cheap and easy to find and do not require extensive maintenance (see Figure 16a). Consequently, these constructions have worsened the great thermal comfort they provide, as the users expressed during the interviews.

In the same vein, in the case of the *trojes*, the most frequent alteration in all the surveys was the substitution of the *tejamanil* (the thin wooden roof tiles) by metallic sheets, losing a great trademark of these constructions (see Figure 16b). We can find other modifications in the usage and role of the *troje*: the mezzanine floor, in the past used for the storage of grains, now has very different utilizations, for instance, the users dry the clothes there since it is the warmer part of the house. These anecdotes show us the reutilization of the spaces and the change in the lifestyle of the communities; nevertheless, many constructions have been demolished, abandoned, or not given the appropriate maintenance, which is the main issue regarding the preservation of this architectural heritage.

Notwithstanding the unpleasant situation of the vernacular architecture in Michoacan, from the surveys and the interviews with the users, we could find some positive testimonies, as they truly value and appraise their heritage. These experiences are quite meaningful, regarding the preservation and conservation of the cultural aspects of this architecture. In this sense, some users of *trojes* had given a new direction to their familiar legacies: for instance, a traditional cook in Charapan uses it as the dining area of her restaurant, and a mask craftsman has established his workshop therein. In Figure 17 we can appreciate the clear differences between two cases, and how the second has preserved the distinctive elements of the *purépecha* culture such as the masks, the paintings, the handicrafts or the old family photographs.

(**a**) (**b**)

Figure 16. Substitution of the traditional roofing systems: (**a**) *Bajareque* house in Santa Cruz de Morelos; (**b**) *Troje* in Charapan.

(**a**) (**b**)

Figure 17. Preservation contrast between two *trojes*: (**a**) San Nicolás Obispo; (**b**) Charapan.

Following the cultural relevance of this architecture, the *bajareque* involves a traditional construction technique which is handed down from generation to generation. It is important to note that the technique is utilized not only for the dwellings and outdoors kitchens and ovens, but also barns, which curiously receive the local name *troje* (see Figure 18). This cultural value is precisely one of the recent aspects to consider when evaluating the heritage [85]. From the conversations with the local people [86], we can see how the availability of the prime materials, the simplicity of the system, the great comfort it generates and the rapid construction make this technique very popular in these communities.

(**a**) (**b**) (**c**)

Figure 18. *Bajareque* constructions in Santa Cruz de Morelos: (**a**) House; (**b**) Kitchen; (**c**) *Troje*.

On the other hand, the architectural analysis of these constructions must take into account the external aspects which govern the typologies and the technical solutions. One of the most interesting features about vernacular architecture is the adaptation to the local environmental conditions, finding clever solutions with the local materials, and the adjustment to the available technology. In the course of the field work, the group could experience the impressive change of scenery before and after the rainy season (see Figure 19), and how the vernacular constructions provided an excellent thermal comfort. For instance, Santa Cruz de Morelos presented a dry desert landscape during the first campaign of surveys; however, after the intense rains, the vegetation grew quickly and the apparent temperature and humidity changed drastically, this being situation a constant in many regions of the state.

(**a**) (**b**)

Figure 19. Change of scenery in the locality of Santa Cruz de Morelos: (**a**) March 2021; (**b**) July 2021.

As was explained in the Introduction, one of the principal objectives of the research was to transmit all the knowledge obtained through educational activities and scientific dissemination. From the surveys conducted with the students of the summer research program, it could be observed that they did not have a complete knowledge of vernacular architecture, and in a few cases, they only knew the most basic concepts. Some of them had indeed acquaintance, as they came from rural communities and were raised conscious of these constructions; however, the rest were very unaware.

For these reasons, the workshop planned included many lessons to detail the different materials, components and techniques and how they can implement all of them in modern buildings. The other objective was to engage the students in these subjects as they will be the future professionals and decision-makers in the construction industry; therefore, they will have a broad perspective and understanding and will act responsibly regarding the environment. These actions resulted in a very positive impact, as the students got involved and demonstrated curiosity and enthusiasm to keep learning about vernacular architecture. The documentary also played a big part of this, as it was included in the activities and complemented the training with a more attractive format.

3.2. The Scientific Communication and Educational Purposes of the Documentary Xirangua

With less than a year since its release, the documentary *Xirangua* has achieved some accomplishments, both in the academic and the artistic/cultural sectors. The film premiered on 11 February 2022 in the Cultural Centre "Centro Cultural Clavijero" in Morelia, which is also one of the headquarters of the cultural secretariat of the Michoacan government. The event was scheduled to match the official release of the documentary in the online platform YouTube in original version (https://youtu.be/5T1tHXvgfjQ (accessed on 20 January 2023)) and with English subtitles (https://youtu.be/g1xX2O5vV44 (accessed on 20 January 2023)) [86]. The advertising campaign and the use of social media to promote both the event and the online video were very important, which included several interviews, press releases, and the creation of the logos and promotional posters (see Figure 20).

Figure 20. Official promotional posters of *Xirangua*.

The most immediate repercussion of the project was achieved with the means of communication, with several interviews in the press, radio and TV during the weeks before and after the official release. The interest and reception by the media in Michoacan were fantastic, as it was supported by the Culture Secretariat of the Michoacan Government. Subsequent to the main event, *Xirangua* has been projected in other universities and cultural centers (see Figure 21), the majority being architecture or civil engineering faculties, generating interesting debates with the students and the professors. The film has been projected in overseas institutions too, drawing the attention of a public that is not familiar with the Mexican culture or architecture; this was also one of the objectives from the conception of the project, to make an enjoyable product regardless of the origin of the audience.

Figure 21. Presentations and projections of *Xirangua*.

Regarding the educational use of the documentary, it works as an alternative path to the traditional concept of learning. Our society has adopted a sociocultural perspective of learning [87], and this format is very easy to share with all audiences. *Xirangua* has been projected and included in educational activities with universities and schools, helping to generate a straightforward debate with students of different ages and backgrounds. Consequently, they have learned to appreciate these techniques in a more positive way, understanding the cultural and architectural values of these constructions. It was also included as part of the workshop "Vernacular architecture, traditional materials and its implementation in cooperation to development projects" to complement the theoretical and practical lessons; the results were impressive as many students expressed an interest in following a research career as a result of the interest in vernacular heritage.

The audiovisual project can also be used and embraced for scientific research, considering all the qualitative information obtained. The results of the scientific communication include the educational activities mentioned before, the presentation of the project in congresses and conferences, and the publications in specialized means. On the other hand, the interviews with the local users of the vernacular constructions can be also used as a historical record that could help other disciplines to understand all the social changes that are happening in our times. Additionally, the reflections of the interviewees bring an anthropological approach to the conservation issues, helping to understand the cultural significance of the local architectures [88]. For instance, the heirs of the *trojes* keep track of the generations which have inhabited the house, and are conserving them as a familiar legacy (see Figure 22).

Figure 22. Heirs of *trojes* in Charapan, Michoacan, Mexico.

Lastly, the documentary accomplished some significant achievements, one of the most relevant being the recognition by the state-owned television (SMRTV: Sistema Michoacano de Radio y Televisión) and being shown on TV, reaching the goal of being accessible for the general public, especially in the context of Michoacan. On the other hand, the film was selected in an international festival, the ninth edition of CINETEKTON International Film and Architecture Festival, which is celebrated in the city of Puebla, Mexico. The team went to the premiere in November 2022 and the projections worked as spaces for dialogue and the exchange of ideas regarding the architectural and urbanism topics of the documentary.

4. Conclusions

In general, the situation of the vernacular architecture of Michoacan is very similar to that of other study cases all over the world, presenting constructive modifications and decay processes on account of the industrialization and globalization of the building industry. These alterations have resulted in structural damage, malfunctions, a decrease of the comfort or eventually, the loss of this cultural heritage. One of the main causes of the abandonment of these traditions and ancient knowledge is the disinformation and distrust about them.

In this sense, it is necessary to continue working to change the bad conception of vernacular architecture in Mexico, which is synonymous with poverty and technological gap; in addition to that, other regions of the world have a much more positive vision of these techniques. The project DBMC 2020 has made efforts in this direction, cooperating with local communities to reclaim and reappraise their cultural heritage. Several positive aspects have been found during the field work, including regions and communities where the vernacular constructions remain almost unaltered and the local people are proud of them and ensure the conservation of their homes and monuments.

The documentary *Xirangua* portrays this situation, which is entirely applicable to other regions and study cases around the world. Beyond the explanation and presentation of these issues and main characters, this project has added value since it explores new ways to carry out scientific communication and dissemination in a limited context. Although the documentary film is not a novel technique, the incorporation of new dynamics such as the participatory design involving the communities or the use of social media for a better engagement with the youth make this research very innovative.

A number of outcomes have been achieved with the field work thanks to the architectural survey and detailed analysis of these constructions. Precisely, these logical solutions of the vernacular architecture must be taken into account in future strategies to preserve this heritage, as a good understanding and technical knowledge will be useful for restoration and conservation projects. On the other hand, the information gathered could be used for the cataloguing of these techniques and typologies, and has an inestimable value at the time to document and analyze this heritage at risk.

The scientific communication and dissemination of the results obtained with the project DBMC 2020 have been notable through the conventional methods, applying all the experience obtained to the educational and training activities in the university. Nevertheless, the principal product has been the documentary. The immediate impact and the capacity to effectively communicate the situation and issues of the traditional architecture in Michoacan make it a perfect tool for the scientific communication with a more general public; additionally, the recording process has also given us a lot of tools which we were not familiar with but which have great academic and research utility.

The use of the scientific documentary film with educational purposes has been demonstrated to be especially effective to promote the role of cooperation and collaboration in scientific projects [89]. In this sense, it started from a cooperation to development project and one of the main objectives was to engage the traditional knowledge of the local peoples with the academic understanding of vernacular architecture.

The audiovisual consumption pattern of the new generations is constantly changing and scientific communication needs to be adjusted to the new formats and achieve a better engagement with the youth. In this sense, the documentary film has demonstrated to be one of the most convenient platforms for scientific communication and dissemination, making the technical and cultural information much more accessible to all target audiences. One of the keys is the open access to all this information and cultural projects, with YouTube being a free platform with international outreach and the most commonly used by far.

In this sense, it was possible to engage and spark the young students' interest in these research topics. The impact on the early vocation of the students, including the engagement, was one of the objectives of this project that exceeded the initial expectations, reporting great results after the summer research program and the workshop conducted. One of the future research lines includes working with elementary and middle school students, arranging the projection of the documentary in private and public schools to test the viability of the project in this environment.

However, possibly, the best aspect of *Xirangua* has been the feedback of the communities and peoples interviewed, as they have enjoyed and promoted the film and have interacted and shared the publications on social networks. In this respect, the audiovisual methods should gain importance for raising awareness and educating about our cultural heritage. For many years, vernacular architecture has been neglected and forgotten in many ways and the youth is not concerned with the enormous worth of these buildings, and this type of initiatives certainly help to change the mindset of some individuals.

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