

DESIGN OF THE ROADMAP FOR THE CONSTRUCTION OF WOODEN SOCIAL HOUSING IN URUGUAY.

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ABSTRACT: The government of Uruguay, aware of the new forest heritage present in its territory, has decided to promote the production of social housing in wood [1]. From a strategic planning process based on the "Delta Model" methodology [2] and the participation of all the different actors, represented by: the academic sector, government agencies, the productive and industrial sector, professional organizations, and users, it was possible to agree on a set of 10 actions that allow a qualitative and quantitative leap in this matter [3].

Thus, progress was made in the definition of priorities and actions for the development of pertinent public policies, such as: improvement of regulations, standards, and characterization of national wood; design of training programs for technical and professional skills; compliance with challenges of technological progress of small companies; and the implementation of a dissemination program at the national level. In addition, a crucial aspect has been the activation of the demand, from the execution by the public sector of calls for the construction of social housing in wood (in extension and height) and the creation of economic or fiscal incentives to develop this type of houses.

KEYWORDS: Strategic planning, public policies, promotion programs, wooden houses.

1 INTRODUCTION

1.1 DIAGNOSIS AND CONSULTING

Various studies diagnosed the gaps and challenges that the wood products sector faces today in Uruguay [4], as well as the regulations to increase the participation of this type of building in its public policies and the construction industry [5].



Figure 1: Forest plantation in Uruguay. Source: SPF.

Within the framework of this Administration, the Uruguayan Ministry of Housing and Territorial Planning (MVOT) has established various programs that make it possible to achieve a housing solution for large sectors of the population. Within them, it has been proposed to promote the use of wood of national origin in constructive solutions tending to increase the supply of public housing, reducing execution times and construction costs.

To carry out this challenge, the MVOT, with the support of the Inter-American Development Bank (IDB), decided to manage an international consultancy to support the preparation of this "Roadmap" which would allow prioritizing and coordinating the actions necessary to achieve this goal.

1.2 WOODEN CONSTRUCTION AROUND THE WORLD

According to the World Bank, there will be a need for 300 million housing units by 2030 [6], and how different countries address this deficit will be fundamental to guaranteeing global sustainable development.

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In this sense, two factors have positioned wood as the optimal construction material for the 21st century: productivity and environmental impact.

Regarding productivity, during the last decades, the wood industry has evolved thanks to the development of the industrialization of the production of engineered wood elements, the creation of more efficient construction systems, and the prefabrication of parts and components, which have resulted in the massification of its use in construction.

Regarding the environmental impact, wood "sequesters carbon," a process that takes place from the afforestation stage when the trees absorb carbon dioxide in their photosynthesis process and stores it inside for years. When trees are treated to produce wood, carbon remains stored inside for the entire useful life of the element.

1.3 WOODEN CONSTRUCTION IN URUGUAY

Although Uruguay is not a country with a long history of wood construction, the forestry industry has great national relevance, contributing to 4% of the national GDP, translating into more than 2,100 million dollars; this arises from the implementation of the Forestry Law in Uruguay in 1987, at which time the production of the national forestry industry began to grow exponentially, registering an increase from about 200 thousand hectares in the 1990s to about 1 million hectares in 2020, encouraging the use of wood for both construction and carpentry. In addition, the sector generates around 18,000 jobs, which rises to more than 25,000 jobs when considering the indirect and induced effects [7].



Figure 2: Morgavi Woods sawmill. Source: Morgavi Woods.

Regarding the construction industry in Uruguay, there is a record of at least 14 low-income housing projects in wood, totaling more than 260 units built in the last decades. These are framed in individual initiatives of specific departmental governments, some in agreements with other state agencies or institutions.

In this line, the Government of Uruguay, through the MVOT, ensures in its Five-Year Housing Plan 2020-2024 that in this period, it must offer 105,545 housing solutions, which include construction of new homes, relocations, repairs, neighborhood improvement, among others. Furthermore, in the same document, the MVOT states as

one of its objectives is "To promote the use of wood of national origin in constructive solutions aimed at increasing the supply of public housing, reducing execution times and construction costs" [8].

In this line, the government has implemented a series of initiatives to promote the use of wood in construction, among them, the creation of the Honorary Wood Commission (CHM) according to the National Budget Law 2020-2024; a collaborative table, made up of actors from the private, public, academic and professional sectors that seeks to develop a plan to promote the use of Uruguayan forest resources.

2 CO-CONSTRUCTION OF THE ROADMAP

2.1 METHODOLOGY

For the definition of the "baseline" and the identification of barriers and challenges to achieving this objective, those surveyed by the Honorary Wood Commission were considered:

Table 1: Challenges defined by the Honorary Wood Commission.

Nº	Challenge
1	Updating of laws, rules, and regulations.
2	Building capacity of professionals, technicians, and workers.
3	Research and development of construction elements and systems.
4	Technology transfer to the MSME sector.
5	Supply of structural Wood.
6	Overcoming cultural and market barriers.
7	Structure multi-stakeholder governance models.

As a methodology to carry out this strategic planning work, this project was inspired by the "Delta Model" conceived by MIT professor Arnaldo Hax and already used during other projects, together with one of the authors of this article [9] [10], and establishes the following five strategic tasks:

Table 2: Five strategic tasks.

Nº	Task
1	Constituent segmentation and value proposition.
2	Existing and desired capabilities.
3	Define Mission-Vision for Roadmap.
4	Roadmap Agenda: Axes, actions, and goals.
5	Management of the agenda: Indicators and metrics.

Following this model, a critical step was the segmentation of the different "constituents or stakeholders," for which we worked based on five large reference groups, all of them linked in some way to the theme of building wooden houses:

The public sector, represented by the ministries of Housing (MVOT), Agriculture (MGAP), Industries (MIEM), Environment (MA), and Economy (MEF), together with the respective agencies and directorates; the private sector, represented by the world of forestry, wood processing, and industrialized construction; the academic sector, coming from the university faculties of architecture, engineering, chemistry, among others, the technical careers and the LATU and LATITUD laboratories; the technical-professional sector, represented by the associations of architects, engineers, developers, and technicians; and the civil society sector, represented by social workers who have participated in this type of project and neighbors who live in wooden houses.

During the process, the following activities were carried out:

Table 3: Process Activities

Nº	Activity
1	Review and comparison of documentation
2	Systematic documentation and benchmark
3	Collaboration with Technical Committees
4	Structured interviews with stakeholders
5	Departmental visits
6	Advisory to the MVOT
7	Cooperation in the definition of public policies.
8	Development of a Roadmap or Map of Actions
9	Review and dissemination

Some of the most relevant processes are described below.

2.2 LOCAL DIAGNOSIS

In Uruguay, to promote the wood industry in general, and thus enabling the use of the material for both construction and carpentry, among other actions, the MVOT creates the Office of Construction Advice, Planning, and Development in wood, whose objectives are:

Table 4: Objectives of the Wood Office

Nº	Objective
1	Promote the use of Uruguayan wood for construction.
2	Promote research and standardization of construction systems and technologies in wood to define quality standards.
3	Prepare technical documents for the use and acceptance of wood in construction.
4	Participate in the process of granting the “CIR” (registration certificate) for construction technologies in wood.

Uruguay's national housing policies are implemented by the Public Housing System (SPV), an organization headed by the National Housing Directorate (DINAVI) of the

MVOT, which is made up of various institutions, such as the Honorary Commission for the Eradication of Unhealthy Rural Housing (MEVIR), the National Housing Agency (ANV), the Social Welfare Bank (BPS) and the Mortgage Bank of Uruguay (BHU), from where various housing programs are developed to provide access to housing promoted by the Ministry.

There are currently some social housing projects in wood, such as Barrio Progreso (nine houses) and Barrio Manduvi (forty-five houses), located in Rivera; the T15 project (twenty-three homes), situated in Tacuarembó.



Figure 3: Barrio Manduvi Houses (forty-five houses), located in Rivera.

In addition, there are other detaching works, in engineered wood, such as the Wanderlust Hotel (1805m² in GLULAM and CLT) in José Ignacio, the Anastasio Inn (1200m² in CLT), and the Atchugarry Museum of Contemporary Art (5000m² in Eucalyptus Grandis GLULAM).



Figure 4: Wanderlust Hotel (1805m² in GLULAM and CLT) located in José Ignacio.



Figure 5: Atchugarry Museum of Contemporary Art (5000m² in Eucalyptus Grandis GLULAM).

A series of organizations and associations that bring together companies and institutions with similar objectives related to the forestry sector in Uruguay were also identified, the most critical being: The Honorary Wood Commission (CHM: made up of representatives of the MGAP, MIEM, MVOT, MA, Congress of Mayors, LATU, UdelaR, and Private Universities); The Timber Development Network (REDEMA: in charge of the project to Strengthen the Timber Industry in the Northern Region, with Emphasis on the Competitiveness of MSMEs); The Association of Entrepreneurs of Wood and Related Products (ADEMA: which represents all its associates in defense of the interests of MSMEs, both in sawmilling and carpentry) and the Association of Wood and Related Industrialists of Uruguay (ADIMAU, which brings together furniture manufacturers).

Some limitations and needs revealed were the following:

Table 5: Limitations and needs revealed

Nº	Limitations and needs
1	Regulatory limitations related to the Horizontal Property regime.
2	Limitations to incorporating non-traditional construction solutions.
3	Restrictions related to the action of fire loads and fire regulations.
4	Need for infrastructure and equipment for laboratory tests and to verify the performance of construction systems with wood.
5	Necessity to develop a conformity assessment and certification system for wooden houses.

2.3 INTERNATIONAL BENCHMARK

In addition to the local diagnosis, an International Benchmark study was carried out, which allowed drawing a baseline on the "state of the art" in areas related to wood construction through the experiences of other countries which have a history of using wood for the construction of collective housing, but they are different in their level of progress, internal characteristics, and development.

Chile: Where the Wood Agenda of the Ministry of Housing and Urbanism (MINVU) was created in 2012 around five strategic axes: regulations, quality, constructive solutions, training and dissemination, and triggering projects. Axes have been critical to developing a roadmap that has advanced in terms of wood construction thanks to continuous collaborative work.



Figure 6: Ecosustainable neighbourhood in Chañaral, Chile.



Figure 7: Experimental Tower with 6 floors. Peñuelas, Chile.

Canada: With a public agenda for wooden construction (2010 - 2030) led by Natural Resources Canada (NRCan), where since 2010, the programs have sought to develop two different axes of wooden construction: construction at height and construction at massive wood. They proposed a multivariate challenge, including developing new materials, new manufacturing and assembly processes, new building codes, and new design approaches, among others.

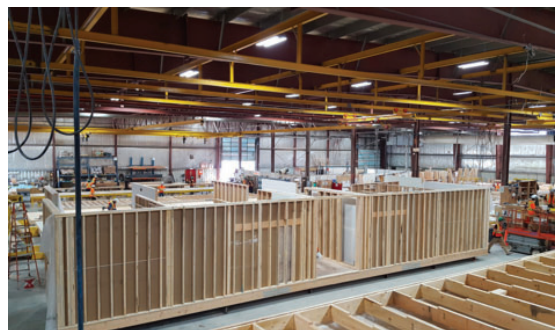


Figure 8: Prefabricated plant for wooden structures: Metric Modular. Source: www.naturallywood.com

Finland: where there is the Wood Construction Program (2016-2025), a joint venture of the Finnish government coordinated by the Ministry of the Environment, aimed at increasing the use of wood in urban development, public buildings, and large constructions such as bridges or sheds. The program also aims to diversify and expand the different applications of wood by developing the most significant possible added value to this material.



Figure 9: Houses in Sipoo. Source: <https://www.a-kruunu.fi>

Thus, the result was a comparative documentation of three countries that have faced similar challenges at different times, considering their particular institutions and existing capacities. It was also possible to know each country's historical line of development and the ambitious goals for the coming years aimed at increasing the construction of social housing in wood in those latitudes.

2.4 DEPARTMENTAL VISITS

The political-territorial ordering of Uruguay follows a regional logic, being organized into 19 departments. In this way, the administrative functions are distributed in two levels: The National Government and the Departmental Government. Furthermore, the Municipalities of each department are organized differently from each other to meet the needs and particularities of each of them.

The participation of departmental governments in general, and of forestry departments in particular, was considered essential for creating and developing the Roadmap.

In this line, more in-depth departmental work was carried out with the municipalities with the highest incidence of forestry, which are Tacuarembó and Rivera, considering them possible pilot departments for the development of the construction of social housing in wood. In addition, field visits and face-to-face interviews were conducted with authorities, professionals, business academics, workers, and users, and facilities, industries, and projects were visited. Thus, it sought to obtain a vision from the territories on the opportunities, barriers, and challenges that implementing an agenda for promoting low-income housing in Maderas would present, in addition to inviting them to participate actively in its performance.



Figure 10: Guided tour by the owner of the Nortimber sawmill, located in Rivera.



Figure 11: Visit to the Arboreal plant, located in Tacuarembó.



Figure 12: Conversation with the owner of one of the houses in the T15 project, located in Tacuarembó.

2.5 INTERVIEWS WITH STAKEHOLDERS

A series of structured interviews were carried out online via the Zoom platform, which allowed for conversations with 75 stakeholders in the sector, organized into five reference groups:

Table 6: Five reference groups

Nº	Reference groups
1	Public sector.
2	Business sector.
3	Academic sector.
4	Professional colleges.
5	Users.

The objective of these meetings was to understand the position of the actor interviewed in the production chain of the forestry sector and/or in the construction processes, considering the existing barriers to development in the current context, the possible lines of action for the future of the interviewed, and the appropriate external actions that would influence these lines of action.

It was considered that the "one-on-one" meeting methodology would be more suitable for the participants compared to more massive modalities such as the focus group, so that they have the space to express their points of view without restrictions, and thus gather the greatest amount of information possible and reliable.



Figure 13: Diagram (cloud) of sectors and constituent actors of the Roadmap.

For each interview, a detailed minute of the conversation was made, leaving a formal record. Firstly, one hundred and eight actions proposed by the seventy-five participating leading actors from the forestry and construction sectors were obtained. Many of these actions were repeated and/or aimed at similar themes, for which reason an analysis and processing of the proposals was carried out, after which the number was reduced to a total of sixty-two actions that were classified systematically in seven thematic axes.

2.6 PRIORITIES OF THE WORKING COMMITTEE

The sixty-two proposals for action obtained from the structured interview process were ordered around the following seven axes:

1. Laws, norms, and regulations for building in wood: Actions linked to innovating in the legal, normative, and regulatory bodies for building with wood, both nationally and departmentally, such as fire protection, horizontal property, structural performance, hygrothermal comfort, protection, and durability, among others.
2. Capacity building of professionals, technicians, and workers for the evaluation, design, and execution of wood

projects: Actions aimed at strengthening professional and technical capacities, both in the public and private spheres, for building with wood in areas such as engineering, architecture, construction, economy, industries, administration, and assemblies.

3. Research and development in elements and construction systems in wood: Actions aimed at strengthening the scientific and innovation bases linked to building with wood (materials and techniques) concerning advanced human capital, laboratory infrastructure, and other resources.

4. Transfer of technological capabilities to the SME sector of industrialized building with wood: Actions aimed at strengthening the scientific and innovation bases linked to building with wood (materials and systems) concerning advanced human capital, laboratory infrastructure, and other resources.

5. Supply of structural wood to the industrial processing chain, emphasizing SMEs: Actions aimed at strengthening the supply chain of certified structural wood, of national origin, to wood SMEs, guaranteeing a wide range of products sustainably over time.

6. Overcoming cultural and market barriers for wooden buildings: Actions aimed at overcoming the cultural and market gaps around wooden structures, which allow prejudices to be reduced and to recognize their environmental, economic, and quality advantages.

7. Governance structure for the promotion of low-income housing with wood: Actions aimed at strengthening the participation of multi-stakeholders in the development of the roadmap, integrating the network of initiatives currently under development (national and departmental), involving international experience in its management to accelerate in a guaranteed way the obtaining of good results.

3 ANALYSIS OF THE RESULTS

3.1 INTERNATIONAL BENCHMARK WORKSHOP

For the design of the Roadmap, it was considered of great value to share the information collected in the study with the actors involved and other interested parties. To this end, the International Benchmark Workshop was held on April 6, 2022, in a hybrid format, with a face-to-face attendance of 70 people, in addition to 499 connections in an online form.

The workshop had the participation of 9 Uruguayan speakers, who delved into the different topics in the base case of Uruguay, and five international speakers who presented the cases of Chile, Canada, and Finland.

The day was organized around five thematic blocks within which three experts presented, to then move on to a

question space led by a moderator. They talked about Uruguayan programs and regulations, the benchmark with Chile, Finland, and Canada, the wood industry in Uruguay, and academic capacities and national laboratories. With this, it was possible to draw a baseline and identify the leading local challenges to overcome the gaps to effectively promote social housing in wood.



Figure 14: Exhibitors of the Block n°1 of the International Benchmark Workshop.



Figure 15: Participation of the Minister of Housing and Territorial Planning of Uruguay, during the International Benchmark Workshop.

3.2 10 (+1) PRIORITIZED ACTIONS

As a result of the previously described structured interviews with the different actors involved in the forestry and construction industry, a series of actions grouped into seven thematic axes were defined, then discussed and prioritized by a select Working Committee to prioritize them. in order of importance and urgency.

A selection of the actors previously interviewed worked in a committee around three tables, placing different representatives of the five reference groups in each, thus achieving a broad and non-sectoral vision of the proposals for action.



Figure 16: Working Committee Tables.



Figure 17: Presentation by one Working Committee Table.



Figure 18: Space for questions during Workshop.

Each table discussed and voted on at least 2 of the seven axes, defining each of their assistants which actions were first (3 points), second (2 points), or third priority (1 point) for the development of this Roadmap.

This collaborative process resulted in a list of 10 priority actions to promote the construction of affordable housing in wood, which were defined as primary lines of action for the development of the Roadmap. These actions had a high transversal adherence averaging 87.9%, varying between 100% and 74%.

Thus, the ten prioritized actions (plus one that which was considered a necessary cross-section), accompanied by a communication process and a governance plan, were the following:

Table 7: Prioritized actions after voting and % of consensus.

Nº	Prioritized action	%
1	Create or update the national and local regulations for wood construction, such as: the national fire decree, the horizontal property law, wood durability and others.	100%
2	Develop and carry-out several wood projects: high- rise and block housing units and public buildings to stimulate demand.	96%
3	Complete the description of local wood to support the updating of the legislation and the certification of production standards (including resistance and protection, among others).	94%
4	Generate and implement collaborative training program at all levels (professionals, technical staff and workers) in the private and public sectors.	93%
5	Encourage the development of building solution suitable for the local wood and its required performance standards (structures, fire, acoustic, thermal, etc.) through access to public CIR (registration certificate), or similar.	91%
6	Develop an investment and support program for woodworking SMEs to improve the competitiveness and productivity, including training activities and partnership.	89%
7	Create and implement an effective communication strategy for the different audiences: users, developers, professionals, general public (at national and departmental level).	85%
8	Generate incentives for private developers so that they choose wood for their buildings (exemptions, contributions, financial or insurance costs).	81%
9	Promote trade in forestry products, ensuring a constant quality supply for SMEs, sawmills and component production.	76%
10	Generate guidelines for the design, specifications, construction, and use (maintenance) of timber buildings (wood framing and engineering) for the different target audiences.	74%

C. CROSS-SECTION. Generate a governance structure involving all Roadmap stakeholders, working together with other proposals currently under development. N/A

Each of these actions is associated with the priority axes of the working committee described above and has specific tasks, internal groups, external advisers, complementary initiatives, and a metric with particular goals for six months, two years, and four years. For example, among the most relevant:

Table 8: Examples of specific actions and metrics.

Action	Specific task	Term
Action 1	Approval of new fire resistance laws and regulations.	Two years
Action 2	Architecture competitions and the start of works.	Two years
Action 2	Constructed works of isolated housing complexes, a collective housing building, and a social equipment building.	Four years
Action 4	Training and specialization program.	Four years
Action 7	Communication Strategy.	Two years
Action 8	Economic Incentive Instruments.	Four years
Action 10	Publication of Wood Design Guides.	Two years

3.3 INTERNAL GROUPS AND EXTERNAL ADVISORS

For the correct development of the Roadmap and each of the ten prioritized actions, internal groups were defined in charge of meeting the specific objectives that each of them poses. These groups were determined based on their relationship with the topic to be dealt with and the existing capacities they can offer to face the challenges.

The five reference groups were included, maintaining the intersectoral methodology of the project. In addition, it was considered, for specific lines of action, to work with external advisors specialized in the issues to be dealt with, but simultaneously, with a broader perspective than internal groups directly related to these.

Each group has members committed to a dedication of 4 hours per week (nucleus), 1.5 hours per week (committee), and 1.5 hours per month (assembly).

4 CONCLUSIONS

4.1 MULTI-SECTOR PARTICIPATION

The success of the Roadmap for promoting low-income wooden housing in Uruguay is subject to joint multisectoral participation in its creation, development, and implementation. For this reason, including the experiences and points of view of actors from all areas of the forestry and the construction sector was essential for analyzing the current national context prior to its co-construction.



Figure 19: Release of the “Roadmap for the construction of wooden social housing in Uruguay”.

4.2 ONGOING ACTIVITIES

Technical Cooperation with Japan is currently under development through the efforts of the Inter-American Development Bank (IDB), which offers an investment of USD 750,000 to support the MVOT and other relevant actors in developing wooden construction nationwide. The previous emphasizes the evaluation of the regulations and the existing regulatory framework, identifying existing obstacles and gaps; public policies to encourage sustainable construction; research and development on relevant topics for the development of the value chain and the positioning of wood products in the national and international market; technology transfer between the public sector and the private sector; and positioning of the national market at a regional and global level, among others.

There is a continuity of the "Petit Committee" made up of the consultants who carry out the Roadmap, representatives of the MVOT, and the IDB, where the progress of the tasks is monitored, as well as new initiatives and forms of financing are proposed.

Two technical secretaries were hired, who organized and monitored the meetings and the progress of the different technical groups. After adjustment, the Technical Groups are already constituted, meeting periodically.

Three international competitions are underway: one for the design and construction of a high-rise social housing building in the city of Durazno, which the ANV will

develop; another, for the design and construction of new types of housing in extension with wood technology of 20 units in the town of Tranqueras, department of Rivera, which MEVIR will develop; and, finally, a third competition for the design and construction of a health Polyclinic, which the PMB will produce.



Figure 20: Call for architectural competition for mid-rise residential buildings and extended housing, respectively.

Finally, two international consultants are working to generate economic incentive instruments for construction in wood and design and implement a training strategy for building in wood in Uruguay.

4.3 DOCUMENTS OF THE PROCESS

The co-creation process of the Roadmap for the Construction of Social Housing in Wood in Uruguay was documented through a triptych for mass distribution and a book, both available since May 2022 at the Ministry of Housing and Territorial Planning (MVOT) and the Inter-American Development Bank (IDB).



Figure 21: Book “Roadmap for the construction of wooden social housing in Uruguay”.

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