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Design & Engineering Master of Science

Enclosing Collaboration (EnCo) in the furniture sector

A tool for strengthening new product development dynamics between designers and manufacturers in Uruguay

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Acknowledgements

"The history of Latin America in terms of science and technology is like the teeth of a saw. During periods of prosperity, we grow; when there is regression, it is let go. Why is it let go? Because it does not play a relevant economic role and because, for the majority of the population, it is distant. Is it distant because they are ignorant? Or is it foreign to them because we have not succeeded in making science and technology have an impact on the quality of life for the majority of people? If this were to happen, we could achieve that investment in science and technology, during times of crisis, is the last thing to be cut, so that it is understood as a factor of a certain type of development. Not the prevailing one today."

"La historia de América Latina en cuestión de ciencia y tecnología es como los dientes de un serrucho. Periodos de bonanza, crecemos; cuando hay retroceso, se deja caer. ¿Por qué se deja caer? Porque no juega un papel económico relevante y porque para la mayoría de la población, le es lejana. ¿le es lejana porque son ignorantes? ¿o les es ajeno porque no hemos logrado que la ciencia y la tecnología incida en la calidad de vida de la mayoría de la gente? Si pasa esto, podríamos lograr que la inversión en ciencia y tecnología, cuando hay épocas de crisis, sea lo último que se corta, porque se llegue a comprender que es un factor de un tipo de desarrollo. No el predominante hoy."

Interview with Rodrigo Arocena at the Latin American Social Science Council (CLACSO TV, 2015).

Abstract

The collaboration for new product development between designers and manufacturing companies in Uruguay is characterised by inherent challenges arising from both day-to-day operational difficulties and structural issues within the industrialization process. This thesis aimed to explore how the collaboration between these two parties can be strengthened in the Uruguayan context of new product development.

The research process focused on gaining a comprehensive understanding of the Uruguayan design landscape and the collaborative dynamics within the furniture sector. To achieve this, interviews were conducted with representatives of both parties, providing valuable insights from diverse perspectives. The culmination of the research was the development of a tool designed to foster stronger partnerships between design studios and furniture producers.

Throughout the research, several challenges were observed in the collaboration, such as a lack of experience working together, a failure to respect each other's work, and a lack of trust on the other's knowledge, leading to difficulties in achieving common objectives. Consequently, a tool was developed to strengthen collaborative practices during productive visits — crucial meetings where details of the production process are defined. The aims of this tool were to structure the meeting, promote the participation of both parties, provide a comprehensive vision of the project, and be flexible in discussing diverse topics, while addressing the challenges in adopting innovative solutions for this sector.

This thesis involved an immersion in an area that has a real impact on the production but has been little studied in Uruguay. The focus was on bridging the gap between design and the productive sector to strengthen working dynamics by gaining a better understanding of the situation and proposing a tool that is truly adapted to this context.

Abstract in Italiano

La collaborazione per lo sviluppo di nuovi prodotti tra designer e aziende manifatturiere in Uruguay è caratterizzata da sfide intrinseche che derivano sia dalle difficoltà operative quotidiane che dalle problematiche strutturali all'interno del processo di industrializzazione. Questa tesi ha l'obiettivo di esplorare come rafforzare la collaborazione tra queste due parti nel contesto uruguaiano dello sviluppo di nuovi prodotti.

Il processo di ricerca si è concentrato su come ottenere una comprensione approfondita del panorama del design uruguaiano e delle dinamiche collaborative all'interno del settore dell'arredamento. Per raggiungere questo obiettivo, sono state condotte interviste con rappresentanti di entrambe le parti, offrendo importanti contributi da prospettive diverse. Il culmine della ricerca è stato lo sviluppo di uno strumento progettato per favorire partnership più solide tra gli studi di design e i produttori di mobili.

Durante la ricerca, sono emerse diverse sfide nella collaborazione, come la mancanza di esperienza nel lavorare insieme, la mancanza di rispetto reciproco per il lavoro svolto e una mancanza di fiducia reciproca nelle conoscenze, che hanno portato a difficoltà nel raggiungere obiettivi comuni. Di conseguenza, è stato sviluppato uno strumento per rafforzare le pratiche collaborative durante le visite produttive, incontri cruciali nei quali vengono definiti i dettagli del processo produttivo. Gli obiettivi di questo strumento sono: strutturare l'incontro, promuovere la partecipazione di entrambe le parti, fornire una visione completa del progetto ed essere flessibile nel discutere argomenti diversi, affrontando le sfide nell'adozione di soluzioni innovative per questo settore.

Questa tesi ha comportato un'immersione in un'area che ha un impatto reale sulla produzione, la quale, tuttavia, è stata poco studiata in Uruguay. L'attenzione è stata rivolta a colmare il divario tra design e settore produttivo per rafforzare le dinamiche lavorative attraverso una migliore comprensione della situazione e proponendo uno strumento particolarmente adattato a questo contesto.

Parole chiave:
design collaborativo - aziende manifatturiere - produzione di mobili

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Introduction

Strengthening the collaboration between designers and manufacturing companies

Latin America industrialization had predominantly involved replicating products designed in the central countries (Cabrera, 2016). The specificities of this process have resulted in a disconnection between the scientific sector, influenced by theoretical concepts from central regions, and the local industry reality (Cabrera, 2016). Uruguay is no exception to this phenomenon, and a remarkable disconnection exists between the academic system and the productive sector. Consequently, there is a common belief that Uruguay's lack of a robust industry posed a significant obstacle to the development of industrial design. A recent survey on innovation in Uruguayan companies indicated that a mere 19% engage in innovative activities, and only 6% are linked with knowledge-producing institutions like universities of research centres (Hernandez et al., 2021).

The participation of workers in the design practices to increase the value of industrial production dates back to Participatory Design in the Nordic countries during the 1970s (Sanders and Stappers, 2008). Collaborative work brings diverse perspectives and responsibilities to the project, necessitating

interdependence to achieve common objectives (Kleinsmann, 2006). Thus, encouraging collaboration between designers and manufacturing companies in Uruguay is crucial to bridging the gap between them. Designers need to prioritise strengthening their relationship with the productive sector.

Since I began my design studies in Uruguay, the prevailing conversation has revolved around the limitations within the field and the minimal impact that design had in the manufacturing sector. During my experience working with manufacturers in the furniture sector, I gained an in-depth understanding of their processes, sparking a profound interest in the collaborative efforts between designers and manufacturing companies. While this research initially stemmed from personal motivation, it revealed that the issue is not only associated with everyday practices but is a structural problem in the relationship between manufacturing companies and designers, not just in Uruguay but across Latin America.

The gap between designers and manufacturing companies poses a challenge to their collaboration. Therefore, this research was an exploration of the state of the design in Uruguay concerning the productive sector. It analysed how the collaboration between design studios and manufacturing companies, particularly in the furniture sector, was conducted, and seeks to understand the challenges within this collaboration. The primary goal was to determine how to strengthen the collaborative work between design studios and furniture manufacturers in Uruguay during New Product Development (NPD).

How can be strengthen the collaboration between design studios and furniture manufacturers in Uruguay during NPD?

The research was structured into three main phases. The first two phases focused on better understanding the design situation and its association with the manufacturing sector. Meanwhile, the third phase was dedicated to the development of a tool to strengthen the collaboration.

The initial phase involved understanding the overall landscape of the product design field in Uruguay, which provided insights about the characteristics of the design process and its relationship with the manufacturing companies. Notably, it became evident that furniture design was the most influential domain, with design studios creating projects for each client and collaborating closely with manufacturing companies.

The subsequent phase deepened into comprehending the working dynamics between design studios and manufacturing companies. Interviews with both entities revealed key aspects of furniture production, such as project customization, small-scale production or unique pieces, and flexibility in the production techniques. Moreover, challenges in the collaboration were observed, primarily associated with the lack of expe-

rience working together and unfamiliarity with each other's work. Therefore, highlighting the importance of creating collaborative environments to achieve common goals in product development.

Finally, to overcome these challenges while working together, a tool was developed and tested to strengthen collaboration during the productive visit, when design studios and furniture producers define the details of the project. The focus of the tool was to structure the meeting, facilitate the decision-making process, and encourage knowledge integration between the actors. The tool aims to promote genuine collaboration and respect for everyone's work.

Literature review

Introduction

The literature review in this thesis comprises three distinct sections. The initial two parts are dedicated to contextualizing the design situation in Latin America and Uruguay, respectively. The final part presents a theoretical framework to understanding collaboration.

The first part aims to provide a deeper understanding of the design development in the Latin America region. It seeks to offer a broader perspective on this process and its interrelation with the industry.

The second part is focused on Uruguayan context, with the goal of identifying parallelism in the development of design within Latin America context. Additionally, it aims to comprehend the current state of the design initiatives in Uruguay and their relationship with the productive sector.

The final section offers a theoretical framework for understanding collaborative design involving actors form diverse backgrounds. It serves as a guide to better understand the structures and process of collaboration.

Design in Latin America

The relationship between design and the productive sector

The development of industrial design in Latin America is an interesting process marked by various stages, intricately related with the social, political, and the economic context of the region, that had an impact on the industrial design and its relationship with the industry.

Latin America, comprising South America, Central America, Mexico, and the Caribbean Islands, is a diverse region with a multifaceted history, with both shared pasts and unique differences among its counties. Over the time, industrial design has been shaped by social, political, and economics factors, leading to distinct phases of development and transformation. From the pre-Columbian heritage in craftsmanship, the global influence of developed countries during the industrialization and the effort by some designers to create a local identity.

From commodities to industrialization

Prior to the development of industrial design in Latin America, between the 1930s and 1940s, the production of new manufactured products in the region was limited. Latin America primarily produced commodities from agriculture and mining, while industrial goods (such as machinery) were imported. Moreover, industrial production relied on the acquiring of patents and licences from developed countries, which restricted innovation to the needs and limitations of the industry (Cabrera, 2016). This approach for industrialization created an asymmetrical relationship, not only related with the low cost of the raw materials and the overpricing of the industrial exports from the developed countries, but also in the development of the new technology and knowledge (Cabrera, 2016).

In 1948, the United Nation Economic Commission for Latin America and Caribbean (CEPAL) was created with the aim to contribute to the development of the region. They believed that development was the only way to transform Latin America's role as a producer of raw materials, and industrialization was the key to achieving it (Cabrera, 2016). That meant diversifying sectors and productive areas, as well as state intervention with policies to stimulate the internal market, education and technological progress (Cabrera, 2016). Industrialization was seen as an opportunity for technological development, and a way to decrease the inequality and dependence in the relationship with the central economies (Bonsiepe et al., 1985).

During the end of the 1950s and 1960s, industrial design was incorporated into the re-

flexion as a decisive factor to contribute to technological and social development (Bonsiepe et al., 1985; Buitrago & Braga, 2014). The development of the productive sector was seen as a relevant factor to create the material culture of the society, and as a consequence, to reduce the technological dependence (Bonsiepe et al., 1985). Therefore, the benefits of the industrial design were on micro- and macro-economic aspects (Bonsiepe et al., 1985).

The contributions of designers in Latin America such as Gui Bonsiepe in Chile, Tomas Maldonado in Argentina and Carla Porset in Mexico, had a significant impact on the development of the discipline. Design was closely related to the process of industrialization that was taking place throughout the region. Additionally, the Ulm School of Design (ULM) had a profound influence on design theory in Latin America, as both Tomas Maldonado and Gui Bonsiepe were part of the school.

Gui Bonsiepe, a German Designer and professor at ULM, is one of the most important theoreticians in the design field for peripheral counties, particularly for Latin America. After his arrival in Chile, following the closure of the ULM, he oriented the design practice towards operational rationalism and social projects, closely linked to his previous experience in Germany (Cabrera, 2016). Therefore, the design principles were focused on the low-cost mass production and an international language (Sol, 2013).

Fig. 1: BKF Chair

Distance between scientific system and productive sector

One of the main structural differences in peripheral design is the distance between the scientific and technological system and the productive sector. According to Cabrera (2016), the original context, which lacked technological resources, is a consequence of the technical and cultural dependence on the centre. Latin America was merely reproducing products designed in the developed countries. Moreover, the scientific and academic system approach was following imported theoretical assumptions and pursuing the development model of the centre. As a result, there was a dislocation between practices and reality. Furthermore, the technological gap was visible even in cases of innovation, as it was not applied or disseminated, remaining isolated from the social substratum. The result was a disconnection between both parts (Cabrera, 2016) .

Design vs Crafts

During the 1930s and 1940s, the region sought to establish its cultural identity through the development of new products and furniture, using local materials and traditional processes (Chimento, 2023). A notable example is the butterfly chair (fig. 1), also known as BKF after its designers: Antonio Bonet, Juan Kurchan and Jorge Ferrari Hardoy. This chair, made of iron and cow leather, evokes the traditional way of cooking in the Argentinean countryside and relates rural traditions in the countryside to the modern architectural space (Chimento, 2023).

However, the development of Design during the industrialization was mostly associated with industrial production, as it was believed that it was the only solution for dependence (Cabrera, 2016). Consequently, Design was defined as a distinct practice from crafts and decorative arts, apparently silencing the lo-

Fig. 2: Chair Butaque

cal craft tradition in the face of massive production (Devalle, 2021).

Argentina serves as an example of the process of industrialization during the period post-war until the end of 1950s, marked by the development of state-owning manufacturing companies, mainly military-related, which deepened industrialization. From the 1940s, there were some experiences in furniture and lamps design and production. But it was during the 1950s that the concept of industrial design began to take root in Argentinean culture. In the 1960s, the diffusion of the design reached its peak in Argentina. SIAM, a company that produced cars and home appliances, established a Design Department and hired professionals to give an identity to the company in the graphics and unified products design (Gay & Samar, 2007).

A notable figure in design during this period was Porset, a Cuban-born furniture and inte-

rior designer who primarily worked in Mexico. She was concerned about finding a balance between the traditional and popular Mexican furniture style and the simplicity of the international style, adhering to the principle that 'less is more' (Sol, 2013). She pondered whether it was possible to be a contemporary designer while embracing a Mexican identity (Sol, 2013). The chair Butaque exemplifies her thoughts about combining international design influences with Mexican traditions (fig. 2).

Crisis – the failure of the industrialisation

The industrialization process in Latin America did not develop as expected; economic and political changes led to the failure of positioning the region as an industrialised continent. The aim of achieving technological

independence from the developed countries, with design playing an important role, did not materialise.

The failure of the industrialization process in Latin America can be attributed to several causes, mainly related with the degradation of the local industries, the arrival of international companies, the shift towards dictatorships in the 1970s, and the disconnection between the productive sector and scientific system.

The model of industrialization by substitution of importations helped to accelerate the process, expanding the internal market (Gay & Salmar, 2007). However, by the late 1950s, a crisis emerged due to machinery deterioration, the impossibility to import replacement, and the lack of economic means to incorporate advanced processes, as a consequence of a global closure of the economy (Gay & Salmar, 2007). This led to an economic-political opening, with the establishment of subsidiaries of international companies focused on internal production (Gay & Salmar, 2007). Consequently, the innovation effort was reduced, as the technology came from the central countries.

Moreover, the development of the design was linked with the concept of social and technological design for developing countries, carrying political implications (Cabrera, 2016). For instance, Bonsiepe was part of INTEC in Chile (1970-1973) aiming to collaborate in the process of technological modernization of the productive sector during the Allende government (the first democratically elected socialist president). However, with the beginning of the dictatorship in Chile, the project was cancelled, and he had to move to Argentina. During the Cold War

period, under right-wing governments and the paranoid persecution of communism, the space for the development of the design was severely reduced (Cabrera, 2016).

Another factor that affected the development of the design discipline was the disconnection between the scientific and technological system with the productive sector. Although many companies made the effort to generate their own technology, it was limited to minor improvements that did not have a substantial impact on the technological knowledge (Cabrera, 2016). The ideas and intentions that designers were trying to achieve followed the logic of the central model, which resulted in a disconnection from the productive reality (Cabrera, 2016). Therefore, their effort was reduced to isolated examples that do not show the reality of the situation (Cabrera, 2016). For example, Bonsiepe's work in INTEC did not yield significant results as it lasted only three years.

Neo-liberalism and the local tradition

The neo-liberal policies implemented in the 1990s motivated designers to seek ways to distinguish themselves from the large number of imported products flooding the market and to reflect on the region's identity (Chimento, 2023). The main principles of the new design in Latin America were oriented towards the exploration of new materials, the reminiscence to nature and the local context, and the low scale production associated with craftsmanship (Chimento, 2023).

One notable example of this new design approach was the work of the Campana broth-

Fig. 3: Vermelha Chair

Fig. 4: Stool Matero

ers with the chair Vermelha in 1998 (fig. 3). Inspired by Brazilian weaving traditions, the chair represents chaos and the sensorial exploration, reflecting in the essence of craftsmanship (Chimento, 2023).

Moreover, the studio Disegno Patagonia (fig. 4), located in the southern region of Argentina near Bariloche, creates products inspired by the local fauna, drawing from the geometry patterns of Patagonian plants and animals. These products are integrated with the landscape, representing a fusion of popular products connected with the traditional culture of the region with contemporary design.

Moreover, they take advantage of the local expertise of craftsmen, making conscious selections of materials and processes (Chimento, 2023).

Final comments

The development of industrial design in Latin America has been a process characterised by both progress and setbacks. A significant recurring theme throughout the different periods has been the quest for a distinctive local identity. While the design in the region has been approached diversely, the examples observed often aimed to embrace local traditions, ranging from mass production to low scale craftsmanship manufacturing.

However, in contrast to central countries, design in Latin America faced different challenges during the development. The productive sector's dependence on knowledge from developed countries impeded the design's ability to effectively bridge this gap. Additionally, frequent economic and political changes disrupted the continuity of policies oriented toward the design development. As a consequence, a disconnect arose between the scientific sector and the industry, with academia primarily focused on adapting theoretical concepts from central countries to a productive sector operating under distinct circumstances (Cabrera, 2016).

Design in Uruguay

The development and integration with productive sector

Uruguay, a small country nestled between the two dominant forces of the continent -Brazil and Argentina- occupies a mere 176,214 km² of land with a population of approximately 3 million. The country's primary economic resources are agriculture, forestry, and animal husbandry.

According to Cecilia Ortiz de Taranco, author of the chapter on Uruguay in the book *History of the Design in Latin America and the Caribbean* by Fernandez and Bonsiepe (2008),

design has not found a consolidated presence in the country's production practice. She further explains that the challenges experienced in industrial design are closely tied to the country's small internal market size and the sporadic or the partial development of industrial activities. Despite this fragmented trajectory of the design within the nation, there have been some national experiences in the automotive and furniture sector.

Bento Gonçalves
Brazil

Montevideo
Uruguay

Buenos Aires
Argentina

República Oriental del Uruguay

Area: 176,214 km^2

Population: 3 286 314 inhabitants

Language: Spanish

GDP: 59.32 billion USD (2021)

GDP per capita: 17,313.19 USD (2021)

Main economic resources: agriculture, forestry and animal husbandry (colaboradores de Wikipedia, 2023).

Fig. 5: Uruguayan Culture

This moodboard aims to represent the Uruguayan culture. Uruguay is a small country with a desire to stand out between its two larger neighbours, which often overlook it. It was shaped by immigrants and has always looked to Europe for inspiration. The country is divided between the capital city and the countryside, with roughly half population residing in each region. The climate is generally pleasant, with hot summers and cold winters. And yes, Christmas falls in the summer here.

While we might not always like to admit it, we share traditions with Argentina, particularly in food, culture, and mate consumption. Nevertheless, Uruguay it is the land of Suárez, Cavani, and Frolán. Football is what makes us known around the world, bringing us together and instilling a sense of pride.

Fig. 6: Interior of architect Vilamajó's house

Fig. 7: Drawing table designed during the experimental course in furniture design.

The initial phase of design in Uruguay emerged during the first half of the 20th century, marked by an innovative vision for its time. Pedro Figari played a significant role by implementing an educational reform that promoted an exchange between industry, craftsmanship, and local culture to create practical objects. Moreover, between the 1930s and 1950s, there was a surge in renovating architecture that extended to the interior furnishing of homes. Prominent national architects, including Julio Vilamajó, Mauricio Cravotto, or Román Fresnedo Siri, among others, designed interior spaces and everyday objects. Furniture design adhered to the principles of modern design, emphasising form, austerity, and the absence of added decoration, but not following the production techniques. (Fernandez & Bonsiepe, 2008)

From the mid-1950s to the early 1970s, a new phase unfolded, with the emergence of novel project areas in both industrial and graphic design, alongside initial efforts to establish a specialised design education. In the context of economic policies oriented towards industrialization by import substitution, there were incursions in car design. A prominent instance was Indio car (1970), a low-cost vehicle characterised by its austere aesthetic; only 2000 units were produced. (Fernandez & Bonsiepe, 2008)

Regarding the furniture, it was closely integrated within the architecture culture, aligning with the principles of modern design —simplicity, functionality, and industrially based constructive rationality. However, Uruguay followed a distinctive trajectory. On one hand, modern furniture was crafted using traditional techniques, imitating European or North American models, or with local proposals that explored these themes. This duality approach included both craft and industrial design, where industrial products were artisanally reproduced. It reflected a conservative perspective by copying international models while concurrently displaying innovation against traditional furniture style. On the other hand, Uruguay hosted licensed operations of renowned design companies such as Knoll and Herman Miller, which left a discernible impact on local production. (Fernandez & Bonsiepe, 2008)

Transitioning into the second-half of 1980s and throughout the 1990s, a new phase in the country's design development commenced. This period coincided with the end of the dictatorship and it was marked by the design integration into formal education through the establishment of a specialised design centre. Emerging designers began to incorporate on the national stage, but with a limited influence. The establishment of design associations also signified the increasing activity within the design landscape (Fernandez & Bonsiepe, 2008).

Product design's role in society has grown in recent years with the emergence of specialised furniture design studios like Menini Nicola, Muar, Claro, and Carolina Palombo, among others. Additionally, there has been international recognition through participation in design exhibitions and competitions.

Matteo Fogale, who studied in Italy and resides in London, also shared his perspective on Uruguayan furniture design. He notes that defining Uruguayan furniture design is challenging due to its distinctiveness compared to other Latin American countries with stronger craftsmanship traditions. While Uruguay historically looked to Europe for design, it is recognised for using materials like wool and leather. Fogale describes Uruguayan design as fresh, less influenced by extensive industrial experience. The use of natural materials and traditional techniques sets Uruguayan design apart (Fogale, 2021).

1915
Escuela de Artes y Oficios
Figari assumed as a director

1942
Universidad del Trabajo del Uruguay (UTU)
Creation of a school of crafts.

1952
Facultad de Arquitectura
Creation of the design department inside the Arquitecture Faculty.

1963 - 1965
Experimental course in furniture
Course between Facultad de Arquitectura and UTU

1988
Centro de Diseño Industrial (CDI)
First school of industrial design in the country.

2000 - 2002
Post-graduate programmes
Seminars and courses were introduced at CDI in various areas

2005
Escuela Universitaria Centro de Diseño Industrial (EUCD)
Transfer of the CDI to the Universidad de la República as an Independent School inside the Facultad de Arquitectura.

2012
Diploma de Especialización en Proyecto de Mobiliario
First edition of the postgraduation program in furniture design

2019
EMT Diseño - UTU
First high school course in design at UTU.

Graph 1: Timeline of the development of design education in Uruguay.

Fig. 8: Furniture design course exhibition at the faculty of architecture.

The education in Design

Pedro Figari (1861-1938) stands as a pivotal figure in the development of the design in Uruguay. As Rosi explained in the document *Industrial Design for the development of the country* (2018), Figari's effort was dedicated to establish an institution capable of providing education in both science and art, with the ultimate goal of applying these disciplines to the industrial field. In 1915, he assumed the role of director at the *Escuela Nacional de Artes y Oficios* (National school of arts and crafts). There, he proposed a pedagogical plan that emphasised research and utilisation of local raw materials and technologies that enclosed the national culture, all directed towards creating comprehensive

and practically valuable objects (Fernandez & Bonsiepe, 2008). The core objective was to train new generations with the competencies needed to deal with the industrialization process. However, the institution as Figari created ceased to exist after his departure.

Following this first effort, experiences emerged in the 1960s at the Faculty of Architecture of *Universidad de la República* (UdelaR) – Uruguay's main public university– and *Universidad del Trabajo del Uruguay* (UTU) – technical school focused on crafts. During this period, an experimental course in furniture design for architecture spaces was conducted between 1963 and 1965
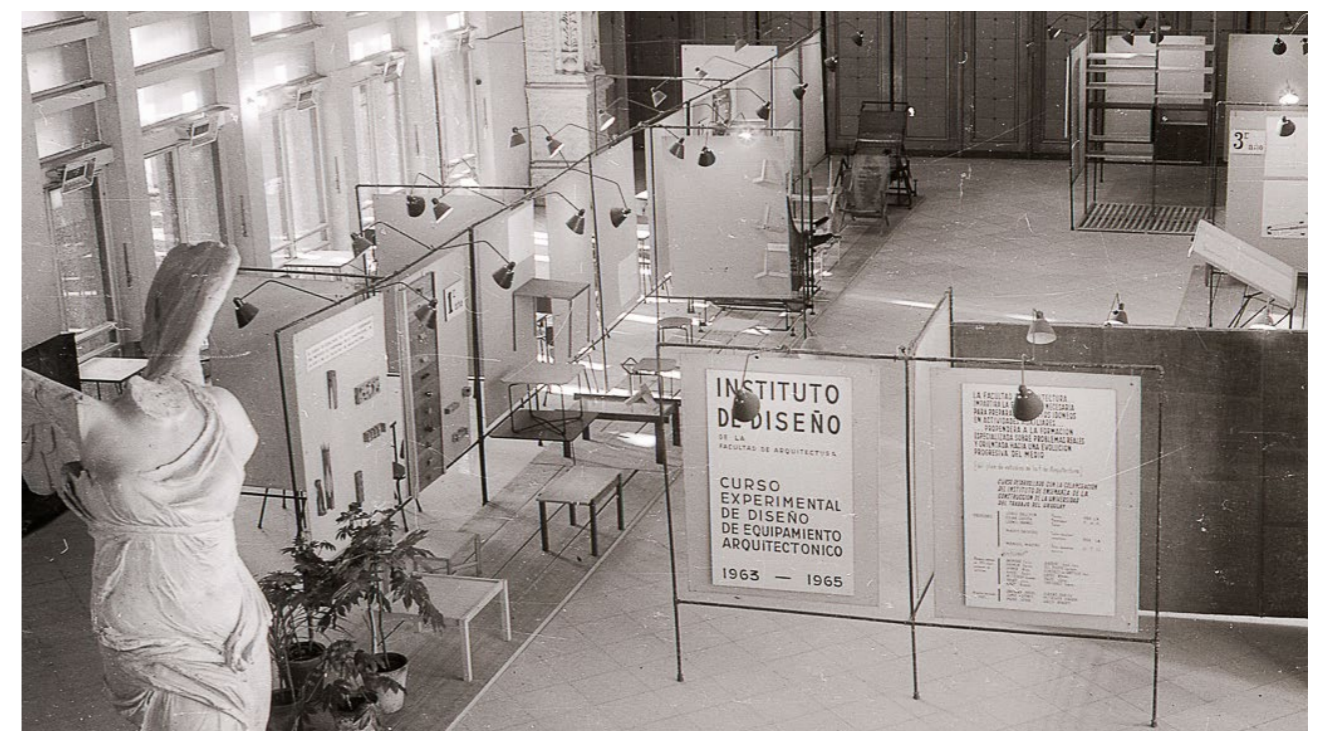
(fig. 7). This initiative comprised theoretical courses, practical projects, and was complemented by seminars and exhibitions (fig. 8) (Fernandez & Bonsiepe, 2008). Additionally, Tomas Maldonado introduced design seminars in Argentina that were also presented in Uruguay during this era (Rosi, 2018). These initiatives facilitated the exploration of new educational approaches in design, although they were truncated by the onset of dictatorship in 1973 (Rosi, 2018).

With the restoration of democracy in 1985, the government, through the Minister of Education and Culture, engaged with the Italian Foreign Affairs Minister to explore the establishment of Uruguay's first Industrial Design Centre (Rosi, 2018). This endeavour included an analysis of the state of the productive sector, revealing that many manufacturing companies operated with outdated techniques, technology, and practices (Rosi, 2018). Consequently, the envisioned role for the *Centro Diseño Industrial* (CDI) was to be deeply rooted in the country's reality, acting as a reference point in the formation of new designers who could contribute to design dissemination through practical engagement (Rosi, 2018).

The *Centro de Diseño Industrial*, offering two streams –industrial and textile– served as the country's inaugural education experience in design at this level. As an independent institution under the purview of the Ministry of Education and Culture, its original philosophy focused on swiftly training technicians who were committed to full-time education (6 or 7 hours on-site), enabling them to enter the workforce in four years to address societal demands (Suárez Ceretti, 2011). In 2005,

an exploration of alternative institutional approaches occurred, with the resolution to re-integrate the CDI in the formal educational system. It led to the integration of the CDI into the Faculty of Architecture in UdelaR as an independent school (Suárez Ceretti, 2011). Beyond institutional shifts, other pedagogical adaptations were introduced, such as reducing in-school hours to foster students' reflective capacity alongside practical skills (Suárez Ceretti, 2011), making a paradigm shift from technical training to professional development.

At postgraduate level, the CDI introduced seminars, courses and post-graduate programmes in various areas, including furniture, textile and fashion, packaging, control of quality, and business management between 2000 and 2002, although this lacked continuity (Suárez Ceretti, 2011). In 2012, the first edition of the Specialization Diploma in Furniture was launched at the Faculty of Architecture. This programme is one of the postgraduate studies in design available in Uruguay and has persisted since then.

At pre-university level, interesting courses have been developed in recent years as a part of the UTU. In 2019 was initiated the most important, the EMT in Design, a three-year high school course that allows students to enter university. Another experiences were an optional design course and the FPB in design and carpentry, both for the initial three years of high school. The optative course exposed students to the academic offerings for their final three years in high school, with design being an integral part. Moreover, the FPB in design in wood, a curriculum spanning the first three years of high school that

Fig. 9: SUM exhibition poster and qr code to watch a video of the exhibition.

combined design and carpentry. However, following the latest education reform, courses of the first three years of high school, including the elective course in design and the FPB in design with wood, were removed from the curriculum, leaving only the EMT in design.

Design initiatives in Uruguay

The first professional industrial designers completed their studies in 1992, but their contribution was limited due to the intake of only twenty to thirty students per year (Fernandez & Bonsiepe, 2008). As a result, several design studios emerged, including Diseño Básico or Kairos y Cromos. With the institutionalisation of design education, various organisations were established to unite designers. In 1995, the *Asociación de Diseñadores Industriales y Textiles* (ADIT) was formed, serving as an association that brought together industrial and textile designers.
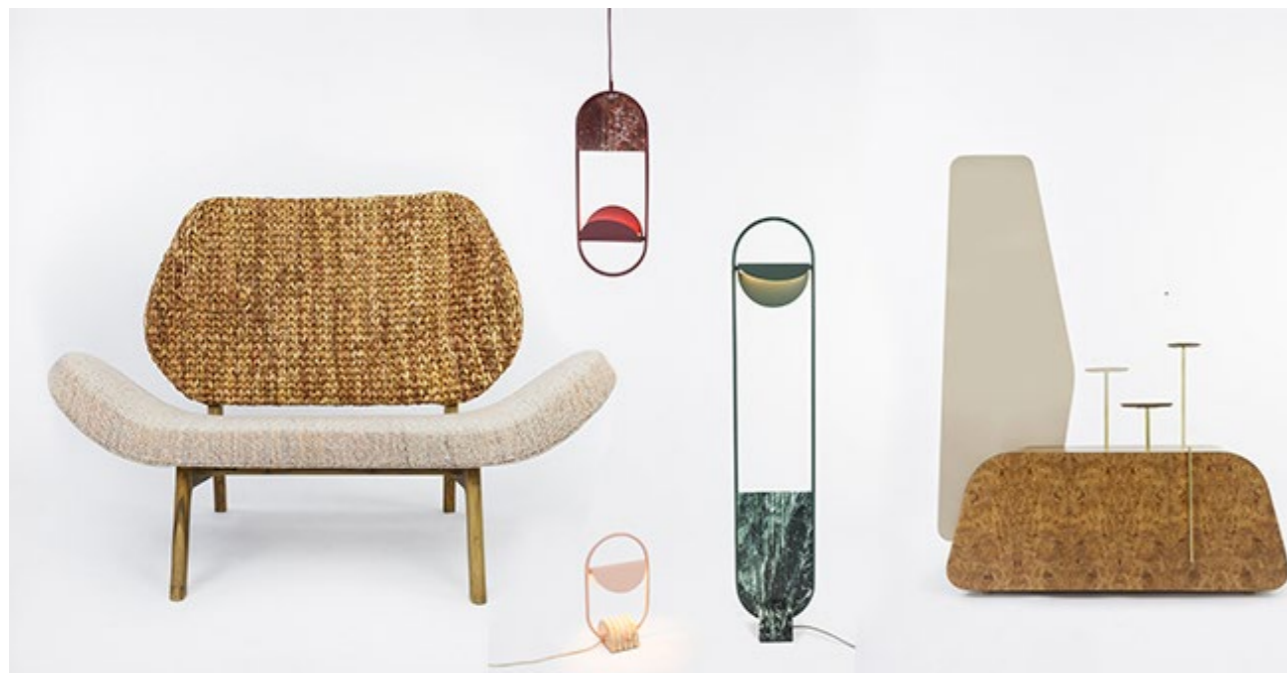
Fig. 10: Furniture designed for the *Invisible threads* project.

Fig. 11: Furniture designed for the *Poetic forms* project.

In 2009, the *Cámara de Diseño del Uruguay* (CDU) was established, an association comprising design companies, independent designers, entrepreneurs and institutions in the design sector. The CDU's purpose is to provide a platform for coordinating and executing public and private strategic actions to position design as a generator of economic, social, cultural, and environmental value, as well as an innovation driver for the productive sector (CDU, 2021). The CDU is part of the *Conglomerado de Diseño*, a public-private coordination entity composed of three sectors: the private sector represented by the CDU, the public sector with the Ministry of Industry, Energy and Mining and the Ministry of Education and Culture, and the academic sector comprising both public and private educational institutions (CDU & TNU,

2011). The aim is to establish an institutional framework for the design and define strategic objectives for the sector. Consequently, they develop proposals to co-finance projects, often collaborative, that integrate design into the productive sector (Conglomerado de Diseño, n.d.).

One of the significant activities organised by the CDU is a series of events held during June, to promote the design and engage designers. Since 2015, the Camera has organised annual activities that bring together designers from various domains, showcasing their work.

The development of product design in Uruguay is predominantly associated with furniture. It can be attributed to several factors, such as the prior involvement of architects

before the formal education in design was establish, the commencement of postgraduate furniture design studies in 2012, and the international recognition of Uruguayan design in competition like the *Salão Design*[1] in Brazil.

Subsequently, furniture designers opted to establish an exhibition to promote products that were internationally selected or awarded during the year. This exhibition was named *Selección Uruguaya de Mobiliario* (SUM). The inaugural exhibition took place in 2013, featuring over 15 furniture pieces. This exhibition became an annual event until 2019 (fig. 9).

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[1] Salão Design is an award organised since 1988 by the Furniture Industries Union of Bento Gonzalves in Rio Grande do Sul – Brazil.

In addition to the collaborative efforts among furniture designers for the exhibition, two lines of products were developed in 2018 and 2019 for display at the London Design Festival. The first, *Invisible threads*, drew inspiration from the drawings of Uruguayan modernist architect Julio Vilamajó (fig.10). The second, *Poetic forms*, took inspiration from one of the cultural icons, the poet Juana de Ibarborou (fig. 11). Both collections were curated by Matteo Fogale. Fogale's intentions were to create unique pieces, free from constraints of marketing, production costs, or selling cost. His focus lay in discovering elements that could set the creations apart in the market, and he believed the answer lay within the materials used (2021).

Design intervention in the local productive sector

To gain a deeper understanding of Uruguay's productive sector, the most recent survey on innovation in manufacturing and service companies, conducted by ANII (National Agency of Research and Innovation) from 2016 to 2018, revels that 121.125 people are employed in the industry in Uruguay, accounting 26% of the companies in the industry and service sector. Moreover, only 5% are professionals and 4% are technicians (Hernandez et al., 2021).

The survey indicates that only 19% of Uruguayan companies engage in innovation activities. The primary innovation activities are the acquisition of software and databases (15%), acquiring capital goods (8%), and intern R&D (6%). Surprisingly, 56% of the companies are not interested in pursuing innovative activities. The main barriers to innovation include the small size of the market, concerns about the macroeconomic context, and the challenges in accessing funding (Hernandez et al., 2021).

Regarding association for innovation, only 6% of companies are connected with knowledge-producing institutions like universities or research institutes. The primary linkage between companies occurs through the market (24%). Moreover, the level of collaboration between companies is low, with only 9% participating in networking and 5% in cooperative agreements (Hernandez et al., 2021).

Specifically for the furniture sector, 24% of the companies engage in innovation, which is 5 points above the overall average. How-

ever, the average investment in innovation is the lowest among the industry sector. The predominant innovative activity in the sector is the acquisition of capital goods, accounting for more than 80% of innovations. (Hernandez et al., 2021)

Numerus companies in the creative economy report challenges in finding avenues for innovation and developing new products and business models in collaboration with other economic sectors (Pastorino et al., 2021). Additionally, for the productive sector, the significance of incorporating creative industries as a factor of innovation or as a business strategy remains relatively low (Pastorino et al., 2021). Consequently, the availability of public funds for design development has not only impacted the growth of the discipline but also its connection with the productive sector. Notable examples of such programmes are: *PRODISEÑO, Fondo Naranja, Fondo Semilla* and *Voucher de innovación para las industrias creativas*.

- *PRODISEÑO* is a programme developed by the Ministry of Industry (MIEM) and CDU aimed at enhancing companies' competitiveness by integrating design into their business operation through the provision of funds to hide professional designers (CDU, 2002).

- *Fondo Naranja*, also promoted by the Ministry of Industry (MIEM), finance projects focused on the design or redesign of products or production processes carried out by design MSMEs. Projects must demonstrate the high integrated value of design (MIEM, n.d.).

- *IMPULSA + DISEÑO* was a programme designed by MIEM and CDU to identify problems and opportunities in incorporating design as a tool to enhance products and processes in manufacturing companies. It encompassed three progressive steps: opportunity detection, creative exploration, and the use of three tools such as design coaching, *PRODISEÑO* and the *Voucher de innovación para contratar industrias creativas* (CDU, 2019).

- *Vouchers de Innovación para las industrias creativas* was a programme supported by ANII to promote collaborative innovation between creative companies and other economic sectors. Vouchers were used to co-finance projects between companies, incentivizing private investment in innovative activities (Pastorino et al., 2021).

Of those programmes promoting design integration with the productive sector, only *PRODISEÑO* remains available. However, its focus is more on the graphic area, as product development involves higher investments not covered by the programme. Moreover, the assessment of vouchers for the creative industries revealed valuable insights. Designers evaluating the programme stressed the importance of creating more opportunities for connection, exchange and exploring collaboration possibilities. Coordinators of the programme highlighted the need to assist companies from different sectors in discovering potential synergies despite differing languages, thus enhancing collaboration (Pastorino et al., 2021).

Final comments

The evolution of design development in Uruguay has been characterised by a discontinuous and slow process. Progress has often been tied to specific individuals or institutional interests. Consequently, when the responsible parties change, projects tend to face setbacks, such as evident education and governmental programmes.

Furthermore, across different phases of the design in Uruguay, parallels can be drawn with the Latin America process. Despite the slower development, smaller scale, and limited industrial growth in Uruguay, similarities emerge. For instance, strategies like industrialization by import substitution, prevalent in Latin America, were also applied in Uruguay, though yielding modest outcomes in the furniture and automobile sector. Moreover, reacting to the influence of neoliberal policies in the 1990s, the design sought to distinguish itself from imported products and to establish a local identity. This inclination is evident in the projects like *Invisible threads* and *Poetics forms*, where designers draw inspiration from the national culture to create furniture using local materials and artisanal process.

In terms of the relationship between design and the industrial sector, recent years have witnessed efforts to foster collaboration between the two. However, the structural challenges originating from the inception of design development, coupled with the limited development of national industry and the low cooperation between industrial entities and research institutions, have hindered meaningful progress in closing the gap.

Collaborative design

to support new product development in Uruguay

This section is dedicated to gain a better understanding of collaborative dynamics in design from a theoretical perspective. In the previous sections, several characteristics related to design in Uruguay were observed, including its small scale production, the disconnection between design and industrial sector, and the manner of working as a partners in production. Therefore, collaboration between designers and manufacturing companies is essential in the product development structure in Uruguay. As a result, the quality of the interaction and integration of the actors will influence the outcome (Standers and Stappers, 2008). Consequently, a theoretical understanding of collaboration in design proves to be an invaluable mean for comprehending their relationship and strengthening collaborative practices.

A definition of collaborative Design

The complexity of the design work demands a continuous collaboration to support more responsible processes and outcomes (Vita, 2023). Various terms have been used for collaboration in the field of design, such as Co-creation, Co-design, or Participatory Design, which may have different origins but share the common principle of involving

people in the design process and outcomes (Vita, 2023). According to Sanders and Stappers (2008), the collective practice of creativity in design has been referred to as Participatory Design since the 1970s. The concept originated in Nordic countries, where it was believed that involving workers in the process would enhance the value of industrial production (Sanders & Stappers, 2008).

Furthermore, according to Kleinsmann, the definition of collaborative design is as follows:

"the process in which actors from different disciplines share their knowledge about both the design process and the design content. They do that in order to create shared understanding on both aspects, to be able to integrate and explore their knowledge and to achieve the larger common objective: the new product to be designed." (2006, p. 30)

This definition appears to align with the concept explored in this thesis, as it is broad yet specific to the collaboration between designers and other actors with different backgrounds, as is the case of manufacturing companies.

Collaborative actors

During the collaborative new product development (NPD) process, actors from different fields present their viewpoints, proposals, and considerations to contribute to the final product's form (Bucciarelli, 2002). Each party holds their unique perspective and responsi-

bilities within the team, relying on each other's knowledge for successful task completion (Kleinsmann, 2006). Consequently, both knowledge-sharing and knowledge-integration are critical to the success of the design process (kleinsmann et al, 2010).

Apart from the core team members, specialists can also contribute to the project. Those specialists are experts in particular subjects and can provide valuable insights for solving problems more efficiently. However, they are not directly involved or responsible for the project. Insead, they offer proposals that the team will evaluate their relevance and potential impact. (Andreasen et al., 2015)

Moreover, when interacting with external actors, suppliers or practitioners, both formal and informal interactions are important for developing a common understanding of both the process and the final product. Workshop, presentations, or site tour, therefore, play a significant role in building synergies and fostering mutual familiarity (Le Dain et al., 2020).

The key actors in this thesis are the designers and the manufacturing companies. However, it is essential to make certain considerations. In the furniture sector, both parties should collaborate as a partners during production and decision-making processes. However, manufacturing companies sometimes act as specialists offering insights, but they do not partake in decision-making. Additionally, the interaction between these actors is similar to that with external collaborators, emphasizing the importance of developing a common understanding.

Collaborative structure

In order to collaborate effectively in teams, the structure plays a vital role in achieving set agendas and goals. However, if the work environment is overly structured, it can potentially hinder creativity (Andreasen et al., 2015). According to Le Dain (2020), formal socialisation provides the necessary structure for effective team member integration, while informal socialisation mechanisms are also crucial for knowledge sharing and mutual learning.

During the collaborative negotiation process, frames are built to enclose the problem and the solution space to take actions that lead the team to effective decisions and knowledge integration (Kleinsmann, 2012). Frames can be created through three activities: naming −identification of important elements that needs explicit attention−, moving −development of ideas, exploration of problems, or investigation of design decisions that contribute to reframe the problem−, and reflection −questioning decisions taken to have insights of the progress and quality of the process (Kleinsmann, 2012). Therefore, frames guide the team towards further steps (Kleinsmann, 2012).

Creating a common understanding and facilitating team exchange during the early phases of the project are crucial for achieving project goals (Le Dain et al., 2020). These initial interactions provide a foundation for clear understanding of the project's rational and the establishment of a collaborative framework (Le Dain et al, 2020). In particular, Sanders and Stappers (2008) emphasise that the integration of all the actors from the

idea generation and throughout the design process, particularly during decision-making moments, can significantly influence the design outcome.

Characteristics of collaborative design

According to Kleinsmann (2006), collaborative design contains three principal characteristics: knowledge creation and integration, communication among actors, and creation of shared understanding.

Knowledge is more than a mere accumulation of recorder information, it includes the ability to register and remember late. As per Kleinsmann and references therein (2006), a distinction can be made between tacit and explicit knowledge. Explicit knowledge can be systematically communicated in a formal manner, whereas tacit refers to the mental models specific to a given situation and context. Therefore, actors should be capable of transferring tacit knowledge into explicit knowledge and vice versa (Kleinsmann, 2006).

Throughout the collaborative process, there is a cycle of knowledge creation, where actors with diverse knowledge bases elaborate their own frames, which represents the divergent part. Conversely, during the process of knowledge integration, actors share their knowledge, constituting the convergent part (Kleinsmann, 2006). The integration of knowledge should lead to insights to the success of each member's task (Kleinsmann, 2006).

Communication among actors is mainly concerned with what to communicate, how to do so, and what medium to use (Andreasen et al., 2015). According to Kleinsmann (2007) key elements in the communication of multidisciplinary teams include the use of jargon that hinder outsiders' understanding, as well as different methods of representations of design which can lead to varying levels of abstraction. Therefore, the effectiveness of design communications relies on minimising the gap between actors and developing shared understanding (Kleinsmann, 2007).

According to Kleinsmann (2006), these frames enable actors to create shared meaning, directly linked with structures. However, the heterogeneity within teams is associated with innovation, flexibility, and creativity, yet differing perspectives can lead to a reduction of shared understanding (Cash et al. and references therein, 2017). To counteract this negative impact, a crucial step is developing a common understanding through the use of a framework that enhances interaction (Cash et al., 2017). Therefore, if creating a shared meaning is a challenge, it becomes necessary to assess the formal frameworks (Kleinsmann, 2006).

Mental models represent insights and comprehension of something, and when shared, a common model is created (Andeasen et al., 2015). These shared mental models aid in understanding and agreeing upon the process and the design content, thereby forming the frames for team collaboration. The mental models that are shared in a team reflect the shared understanding of the actors (Kleinsmann, 2006).

As a result, to achieve effective collaboration in the design process, actors must possess the ability to create and integrate knowledge through design communication. Moreover, the quality of this communication is influenced by the presence of shared understanding. (Kleinsmann, 2006)

Boundary objects

When heterogeneous groups collaborate in the design process, managing varying agendas and goals becomes a central concern (Islind et al., 2019). Incorporating resources to facilitate collaboration, such as objects or representations, can play a crucial role in creating shared understanding (Islind et al., 2019). Boundary object is *something* that can be understood from multiple parties without requiring a full understanding of every detail (Andreasen et al., 2015). In essence, it serves as a bridge in communication among the actors (Islind et al., 2019).

According to Carlile (2002), boundary objects possess three main characteristics: the shared syntax or language that enables members to express their knowledge, semantics that allow actors to learn and specify the differences and interdependencies, and pragmatics that facilitate the joint transformation of individual knowledge. These characteristics provide the necessary framework for representing, learning and transforming shared understanding (Carlile, 2002).

Various items can serve as boundary objects, including documents, contracts, rules, plans, drawings, sketches, or models, which actors from different disciplines can interpret (Andreasen et al., 2015; Stenfors et al., 2004). These elements contribute to creating coherence throughout the project and enhance team organisation and decision-making (Andreasen et al., 2015).

Particularly in the design field, drawing-based communication is key for teamwork, as drawings serve as standardised tools for comprehension, with the precision necessary for those who know the codes (Andreasen et al. and references therein, 2015). However, drawings also have limitations, as they may not explicitly transmit which is the critical information. Consequently, they can be both convincing and devoid of meaning (Andreasen et al., 2015). As a result, visual communication, a key element supporting teamwork, is frequently complemented by verbal explanations (Andreasen et al., 2015).

Collaboration between designers and craftsman

Craft and industrial knowledge are interconnected areas that have a mutually beneficial relationship, as craft influences industry, and vice versa (Woolly, 2011). Craftsmen within the industry context bring valuable insights to the practice due their expertise in materials and techniques (Woolly, 2011). Additionally, artisans possess the skills and flexibility necessary for the production, allowing them to identify problems and solutions with efficiency (Temeltas and Kaya, 2021).

The knowledge incorporated within the craft process is primarily tacit, derived from experimental and informal learning (Temeltas and Kaya, and references therein, 2021). This type of knowledge is not transmitted through words but is shared through collaborative actions (Temeltas and Kaya, 2021). Consequently, from the design perspective, engagement with artisans results in mutual learning, where designers can acquire this tacit knowledge (Temeltas and Kaya, 2021).

However, this perspective of the crafts as a merely knowledge resource for the industry overlooks the intrinsic value of the artisanal work. In a study conducted in Chile exploring the relationship between designers and artisans, Cattan Lavin (2019) reveals that the participants perceive this relationship unbalanced. Artisans are frequently regarded not as partners, but merely as suppliers of the workforce. When designers approach the collaboration from an outsider standpoint, it becomes challenging to encourage genuine inclusion and engagement with craftsmen (Cattan Lavin, 2019).

As Cattan Lavin (2019) suggests, craft and design share a common interest: making. Hence, understanding the artisanal approach is a collective learning process. For instance, rapid prototyping −a technique frequently used by designers− is similar to the test-and-error methodology used by artisans to acquire knowledge (Cattan Lavin, 2019). Furthermore, prototyping can enhance communication among stakeholders, facilitating the exchange of ideas in a more understandable manner (Temeltas, 2017).

Context of application

Insights and drivers from the literature review

The literature review for this thesis comprises distinct segments that define the context of this research. The first two parts aim to contextualise the situation in Latin America and Uruguay, respectively. The final part presents a theoretical framework focused on collaborative design to strengthen the relationship between designers and manufacturing companies. This section serves as a recapitulation of the principal aspects, providing context to better understand the foundations of this research (graph 2).

The Latin America context is characterised by several crucial aspects: the industrial development modality, the gap between scientific system and productive sector, and the significance of cultural tradition. These aspects play a vital role in understanding the present landscape in Uruguay.

During the 1950s, industrialization was viewed as an opportunity for technological and cultural development to reduce the dependency on central countries (Bonsiepe et al., 1985). The model of industrialization by substitution of imports was implemented

in the region and expanded the local market (Gay & Salmar, 2007). However, this faced a crisis, leading to economic and political openings that reduced innovation effort (Gay & Salmar, 2007).

In the context of industrialization, a disconnection between theoretical practices and practical reality becomes apparent. The gap between the scientific and technological system and the productive posed challenges in bridging this divide. Academic focus on adapting theoretical concepts from developed countries that did not always align with the operational methods of local industry (Cabrera, 2016).

Cultural identity was a significant focal point during different phases of the design development. While industrialization emphasised the distinction between design and decorative arts, silencing the local craft tradition (Devalle, 2021). Despite this, designers like Porset sought a balance between tradition and the international style (Sol, 2013). During the neoliberal phase, local tradition became a distinguishing factor, associating production with local materials, craftsmanship, and regional inspiration (Chimento, 2016).

In addition to the Latin American characteristics, understanding the design in Uruguay necessitates considerations such as the influence of furniture design, the limited extensive industrial experience, and the distance between design and the productive sector.

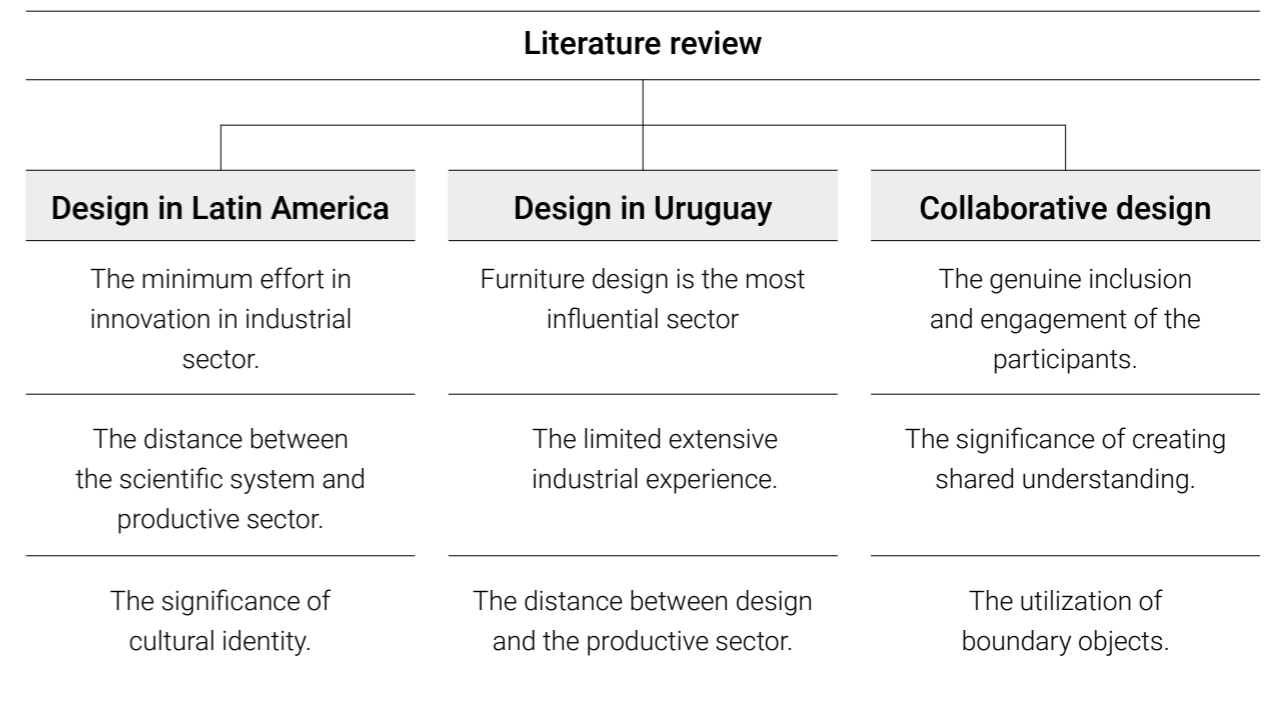The development of industrial design in Uruguay has been primarily linked to the furniture sector, evident in educational initiatives and design studios gaining regional recognition.

The relationship of the design, particularly in the furniture sector, and the local industry can be characterised in two ways. Firstly, the historical development of furniture, which followed European and North American models but utilised artisanal methods (Fernandez & Bonsiepe, 2008). Secondly, Fogale's description of contemporary local furniture design highlights its reduced influence from extensive industrial experience (2021). This characterization of furniture design portrays its relationship with the industry, showcasing the potential for leveraging traditional techniques to develop interesting projects with available technological possibilities.

The innovation percentage in productive sectors remains quite low, despite the furniture sector showing higher values, mainly dedicated to acquiring capital goods (Hernandez et al., 2021). Moreover, programmes aiming to integrate design with the productive sector seem insufficient to generate a significant impact.

The third part of the literature review constitutes a framework for collaboration, providing theoretical means to strengthen the integration between designers and manufacturing companies. This is crucial as the quality of the interaction and integration between the actors influence the outcomes (Standers and Stappers, 2008).

Three key aspects are vital for contextu-

Literature review		
Design in Latin America	**Design in Uruguay**	**Collaborative design**
The minimum effort in innovation in industrial sector.	Furniture design is the most influential sector	The genuine inclusion and engagement of the participants.
The distance between the scientific system and productive sector.	The limited extensive industrial experience.	The significance of creating shared understanding.
The significance of cultural identity.	The distance between design and the productive sector.	The utilization of boundary objects.

Graph 2: Outline of the context of application of the research.

alising this project: genuine inclusion and engagement of the participants, the significance of creating shared understanding, and the utilisation of boundary objects.

The local furniture production blends both industrial and artisanal elements, with artisans contributing skills and flexibility to identify problems and devise efficient production solutions (Temeltas and Kaya, 2021). However, findings from a study in Chile suggest an unbalanced relationship between designers and artisans, where the latter are often perceived as a workforce rather than collaborative partners (Cattan Lavan, 2019). Hence, genuine inclusion and engagement are fundamental for productive integration and shared objectives.

Creating shared understanding is vital for collaboration efficiency, helping align individual perceptions and frame solutions to generate common meaning (Kleinsmann, 2006, 2007). Early establishment of shared understanding plays a pivotal role in project success and establishing a collaborative framework (Le Dain et al., 2020).

Boundary objects play a crucial role in facilitating the collaboration, bridging communication between the actors to create coherence, enhance team organisation, and improve decision-making (Islind et al., 2019; Andreasen et al., 2015). Drawing-based communication is essential in collaborative context, adding in standardised comprehension and teamwork (Andreasen et al., 2015).

Methodology

Research aim and objectives

The aim of this research is to investigate the collaboration dynamics between design studios and manufacturing companies of the furniture industry of Uruguay to support new product development. Specifically, this thesis is guided by the following research question: *How can be strengthened the collaboration between design studios and furniture manufacturers in NPD in Uruguay?*

For this purpose, the thesis set three main investigation objectives:

1. Gain a comprehensive understanding of the situation of the design intervention within the local productive sector to find the key domains of influence of industrial designers and to understand the process of NPD.

2. Define the collaboration dynamics between designers and manufacturing companies, with a particular focus on the most relevant industrial sector of design intervention.

3. Develop a solution to strengthen collaboration dynamics between designers and local industry.

Initially, it was necessary to assess the overall situation of the design field in Uruguay. To achieve this, the decision was made to investigate design studios, as they actively contribute to the development of the discipline. Moreover, the presence of an association that brings these studios together facilitated access to information.

Data collection for this initial phase involved an analysis of the design studios members of the *Cámara del Diseño de Uruguay* (CDU). This was complemented with the information belonging to the service or products offered by each studio. Consequently, this approach allowed us to understand the NPD process in the country and initiated an exploration of the studios' interaction with manufacturing companies. Additionally, an interview was conducted with Carlo Nicola, a Uruguayan designer, referent in the design field in the country. This interview served to validate the collected data and to provide further insights into the development of design in Uruguay.
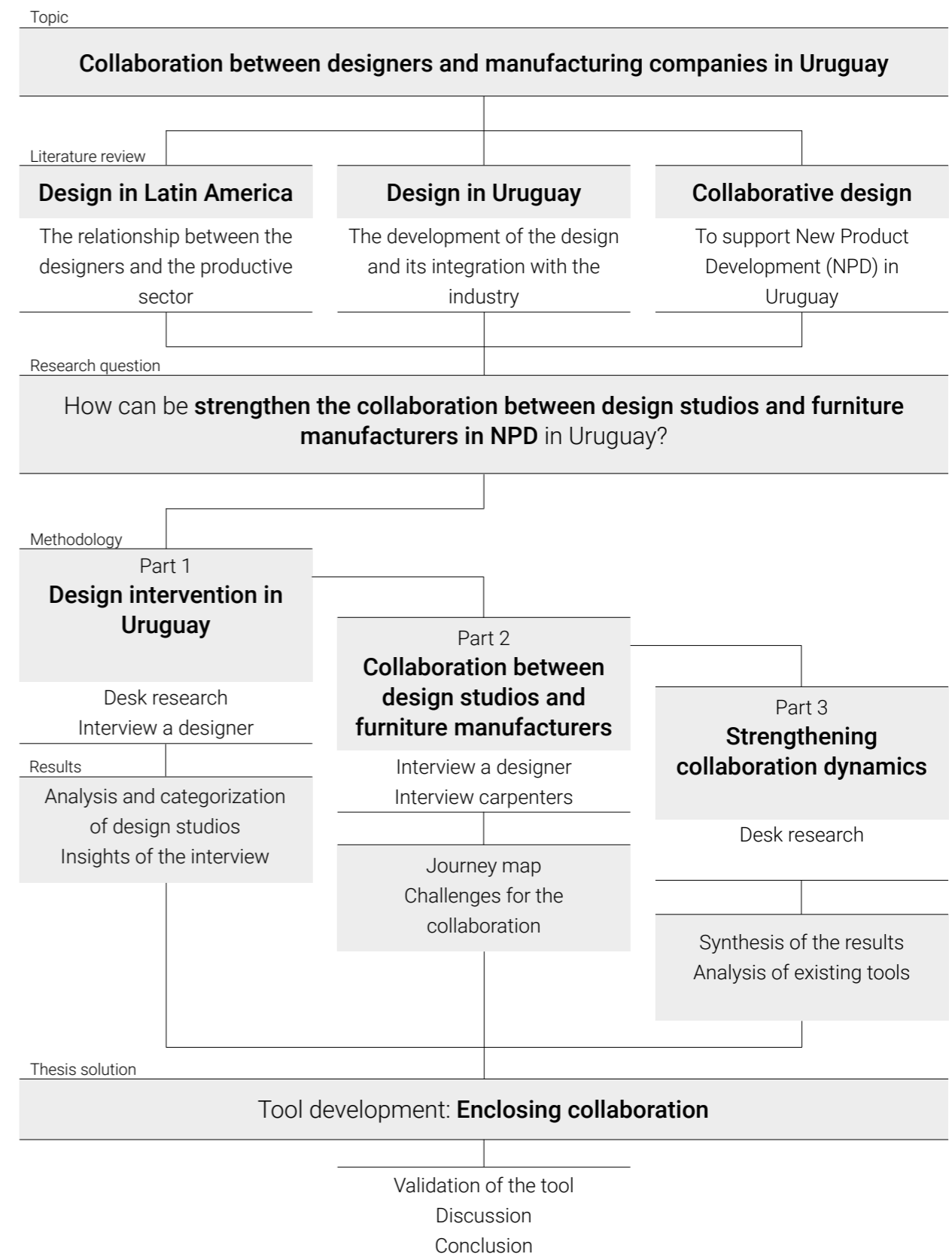
The second part of the research was dedicated to understanding the relationship between the design studios and the manufacturing companies, with specific focus on interactions with carpenters. This emphasis on carpenters arose from observations in the first part, which revealed them as the most common producers with whom designers interact.

Data collection of this phase involved interviews with both designers and carpenters, aiming to capture both perspectives on collaborative dynamics. Through these interviews, we gained insights into the stages of the collaboration process and identified challenges and issues that emerge during these interactions.

The third part of the research aimed to synthesise the previously collected data and underscore key points essential for strengthening collaboration between both parties. Additionally, it involved analysing existing tools to gain a wider perspective on fostering shared understanding and facilitating decision-making.

By conducting these three phases of the research, we achieved understanding of the state of design in Uruguay and gained valuable insights about the collaborative dynamics between manufacturing companies and designers within the country. Furthermore, the research served as the foundation for the developing a tool to improve the collaboration between design studios and furniture manufacturers.

Graph 3: Outline of the research

Topic
Collaboration between designers and manufacturing companies in Uruguay

Literature review

Design in Latin America	**Design in Uruguay**	**Collaborative design**
The relationship between the designers and the productive sector	The development of the design and its integration with the industry	To support New Product Development (NPD) in Uruguay

Research question
How can be **strengthen the collaboration between design studios and furniture manufacturers in NPD** in Uruguay?

Methodology

Part 1
Design intervention in Uruguay

Part 2
Collaboration between design studios and furniture manufacturers

Part 3
Strengthening collaboration dynamics

Desk research
Interview a designer

Interview a designer
Interview carpenters

Desk research

Results
Analysis and categorization of design studios
Insights of the interview

Journey map
Challenges for the collaboration

Synthesis of the results
Analysis of existing tools

Thesis solution
Tool development: **Enclosing collaboration**

Validation of the tool
Discussion
Conclusion

menini nicola.
diseño de muebles

Fig. 12 (Up): *Menini-Nicola* logo.

Fig. 13 (Right): The directors of *Menini-Nicola*: Agustin Menini and Carlo Nicola.

Part 1: Design intervention in Uruguay

The first part of the research focuses on gaining insights into the situation of the design field in Uruguay and gaining a comprehensive understanding of the work of design studios within the country. This phase aimed to find the key domains of influence of industrial designers and to understand the process of NPD.

Participants selection

A Participant in this research was Carlo Nicola, a Uruguayan product designer and co-director of *Menini-Nicola* (fig. 13), alongside his partner Agustin Menini. Since its establishment in 2008, their design studio has been dedicated to the design of furniture and interior spaces. *Menini-Nicola* has earned a distinguished reputation in the local market and has garnered international recognition in both Brazil and Argentina. Carlo's influence extends beyond his work in the industry.

Carlo Nicola has actively contributed to the growth of the design discipline in Uruguay. He was professor of the *Centro de Diseño Industrial* in the Industrial Design degree. Additionally, he has been involved in the *Di-*

ploma de Especialización en Proyectos de Mobiliario, a post-graduation programme focussing on furniture design at UdelaR. Carlo played a pivotal role as a founding member of the CDU. Over the course of more than 15 years, Carlo has become a reference point in the field of industrial design in Uruguay, actively participating in numerous events and collaborative projects with other designers. Some of them include SUM, an exhibition of furniture, and projects for Designjunction in London with the projects *Invisible threads* and *Poetic forms*.

Carlo has also contributed his expertise as a consultant, assisting manufacturing companies in integrating design into their operations and participating in the creation of strategies to connect design with different sectors of the economy.

The selection of Carlo Nicola for this interview was a deliberate choice, grounded in his extensive experience and multifaceted involvement in the design field of Uruguay. His influence extends across education, design associations, and collaboration with furniture manufacturers, granting him a broad perspective on how the design industry operates within the country.

Data collection

The data collection process was divided into three steps: the research on design studios in Uruguay, an exploration of the process of NPD within these studios and an in-depth interview with Carlo Nicola.

1. Research on design studios

Design studios in Uruguay are part of the CDU, an association that unites designers. While not all the designers are members of the CDU, it provides a representative sample of how the design studios operate, with the most prominent companies actively participating. Members are categorised based on their areas of expertise, including visual communication, textile, product, furniture, interior, landscape, service and interaction UX/UI. For this research, the focus was on product design and furniture, as these areas are in close contact with the fabrication of products.

2. Understand the process of NPD

In the preceding step, selected design studios underwent research to obtain a better understanding of their NPD process. This was achieved through an analysing of the service and products offered by these design studios. Consequently, this provided valuable insights into the operational dynamic of designers in Uruguay.

3. Interview in depth with Carlo Nicola

The aim of the interview was to have a comprehensive perspective on Industrial Design in Uruguay and explore the relationship between design and manufacturing companies. Moreover, the results of the first two steps were discussed with Carlo to have his expert opinion on the findings.

The interview was conducted via Google Meets, guided by a semi structured questionnaire in Spanish. It lasted approximately one hour, during which it was recorded and subsequently transcribed. The questionnaire broadly cover topics related with the general

state of the design in the country, the various areas of influence within the field, Carlo's personal experience in the industry, his collaboration experience with manufacturing companies at local and international level through Menini-Nicola in, the collective effort of the designers, and the policies aimed at promoting design. Carlo also shared his vision about the future of design in Uruguay.

Data analysis

Based on the collected information, three actions were taken to better organise and analyse the data: the creation of a map detailing the Design Studios and their role in the NPD process, the categorization of various NPD, and the extraction of insights from the interview.

Maps of Design Studios in Uruguay and their role in NPD

Using the data collected from steps 1 and 2, a map was constructed to achieve two objectives: identify the companies involved and comprehending the NPD process.

The table aimed to elucidate the role of the designer within the NPD process, inspired by the model of Perks et al. (2005), which recognized the involvement of the design function in each phase. Key phases of the NPD process included: identification of need, concept generation, design and development, manufacture, and lunch. This division allowed for the identification of those responsible for each phase of the process. Furthermore, it revealed whether the production was local or international.

Categorization of NPD process

Building upon the previous mapping exercise, categories of NPD process emerged and were systematically organised. To provide a clearer understanding of the product characteristics within each category, specific examples were included.

Insights from the interview

To gain a broader context of the design in Uruguay, an interview was conducted with a referent in the design field. This interview provided a deeper understanding of the local situation and served as a validation of the findings from the previous steps. Through the collaboration of Carlo Nicola, valuable insights were gathered to complement the existing information.

Validation

The results of the data analysis were discussed with Carlo Nicola. This step allowed for feedback on the findings and served as a validation process. Carlo's extensive experience in various facets of design and his status as a reference point in Uruguayan design made his input valuable for verifying the accuracy and relevance of the data and its interpretations.

Part 2: Collaboration between design studios and manufacturing companies

From the findings of the first part of the research, it became evident that one of the most expansive domains of product development in Uruguay was furniture design, where design studios and carpentry workshops collaboratively engage in the manufacturing process. Consequently, a detailed examination of this relationship between these key actors was undertaken.

To collect data on this collaboration, three interviews were conducted, including one with a design studio and two with different carpentry workshops. The objective was to uncover the intricacies of the collaborative process to identify any challenges or barriers encountered during this collaboration.

Participants selection

Carlo Nicola from *Menini-Nicola*

As previously mentioned, Carlo is a referent in the design field in Uruguay. He was specifically chosen for this part due to his extensive experience in furniture design, spanning over 15 years.

Pablo Ferrer from *Zona M*

Carpentry workshops were included in the interviews to provide a comprehensive perspective from both sides of the collabora-

tion. *Zona M* was selected because of its experience working with *Menini-Nicola* and its openness to discussions surrounding innovative product production. *Zona M* employs a traditional technique for furniture production, involving highly skilled workers in their workshops. While Pablo is no longer directly involved in production, his background in carpentry gives him the knowledge necessary to engage in discussions with clients and assess the feasibility of the projects.

Heber Coitinho from *Mundomadera*

Following the observation that Pablo had extensive experience collaborating with design studios, the decision was made to include an example of a more traditional relationship between designers and carpenters. Heber Coitinho, with over 30 years of experience in the sector, holds a position in the directive of the carpenters' association. *Mundomadera* shares similarities with *Zona M*, both operating a well-equipped workshop with specialised workers. However, the primary distinction lies in the client base, as *Mundomadera* focuses on construction carpentry and has experience collaborating with architects, despite both workshops producing furniture.

Fig. 14 : *Zona M* logo

Zona M

Sector: Carpentry - customized projects.
Director: Pablo Ferrer
Technical office: with designers and architects

Location: Montevideo - Uruguay
Web: zonam.com.uy

Fig. 15 : *Mundomadera* logo

Mundomadera

Sector: Carpentry - customized projects.
Director: Heber Coitinho
Technical office: with architects

Location: Montevideo - Uruguay
Web: mundomadera.com.uy

Data analysis

Information gathered from the interviews underwent several form of analysis, resulting in the following outputs:

Insights about carpenter work

Beyond inquiries about collaboration with designers, carpenters provided insights into the boarding working sector. This information deepens the understanding of this productive sector.

Journey map of the interaction

A journey map was created to enhance comprehension of the interaction process between both actors. The map delineated the various production stages and highlighted different pathways during the interaction.

Barriers and enables for the collaboration

Data from the interviews was consolidated into tables, one from the designer's and the other from the manufacturer's perspective. These tables were organised by production phases, identifying barriers and enables for the collaboration. These encompassed actions that facilitated or hindered collaboration. Moreover, the tables identified where each actor placed their focus during each step, given their distinct requirements and interests.

Difficulties in the collaboration between actors

After processing of the data, a table was constructed to see the difficulties encountered by both parties during collaboration. This framework serves to highlight areas where efforts should be concentrated to enhance the collaboration.

Data collection

Data collection primarily involved conducting interviews. During the initial interview with Carlo Nicola, he was asked to narrate the whole process of interaction with the carpenters. Specifically, he detailed the differences in these interactions when there was prior experience working together. Furthermore, for each phase of the interaction, Carlo was asked to identify specific incidents and challenges encountered throughout the process.

Subsequent interviews with carpenters involved presenting a diagram derived from the information obtained in the previous interview with Carlo. The carpenters were

tasked to narrate their processes, discussing individual steps, and identifying difficulties or issues within the collaboration. Additionally, general information about the carpentry workshop was discussed.

The interview format for this phase closely resembled that of the previous section, with semi-structured questionnaires conducted individually through Google Meets. Each interview had an approximate duration of one hour.

Part 3: Strengthening collaboration dynamics

This phase involved analysing and synthetizing the findings from the preceding research stages to lay the groundwork for designing the thesis solution. The primary goal was to obtain a comprehensive perspective on the accumulated information to define strategies for strengthening the collaboration between design studios and manufacturing companies. Additionally, an analysis of existing tools was conducted to better comprehend methods for enhancing collaborative practices in multidisciplinary teams.

Data collection

The data collection process comprised two main steps:

Bases of designing the tool

Information obtained from the initial and subsequent research phases, along with the insights gathered from the literature review, formed the foundation for comprehending and contextualizing the intervention.

Research about existing tools

To gain a deeper understanding of how collaboration could be strengthened, diverse tools supporting shared understanding and negotiation process were selected.

Data analysis

Data gathered for each phase underwent analysis to highlight significant outputs crucial for developing a new tool.

Bases of designing the tool

Crucial decisions and insights from the research were collectively analysed to broaden the understanding of collaboration strengthening and identify potential areas of intervention.

Analysis of existing tools

The analysis of the selected tools aimed to identify specific aspect within each tool that contribute to improving shared understanding and facilitating the decision-making and negotiation process within teams.

Thesis solution

Drawing from the collected and analysed data, a tool was proposed to strengthen collaboration between design studios and manufacturing companies. Initially, the specific requirements were formulated to guide the tool's development. Subsequently, the tool was introduced and described in detail.

Tool Validation

This section is dedicated to ensuring the validly of the tool. To obtain feedback on the tool developed during this research, several interviews were conducted to understand the perspectives of both actors, designers and manufacturing companies, regarding the tool's use.

In order to gather insights and opinions from the involved actors, interviews were conducted with design studios and carpenters. The interviews aimed to explore both the critical aspects and strengths of the tool, as well as opportunities for improvement.

Each interview was conducted individually via Google Meet and lasted approximately half an hour each. The initial segment was devoted to presenting the tool and its usage, while the second part focused on a questionnaire, allowing participants to provide their feedback.

The selected participants included Carlo Nicola from the design studio side, and Pablo Ferrer and Heber Coitinho from the carpenter's side. These actors were chosen based on their prior involvement in the thesis.

Results

Part 1: Design intervention in Uruguay

The aim of the first part of the research is to gain an understanding about the state of the design field in Uruguay and to begin comprehending the relationship between designers and manufacturing companies. Consequently, the findings were divided into three distinct parts: a map of the design studios, a categorization of the NPD process and insights from the interview.

Map of design studios in Uruguay

The objective of this initial map (graph 4) was to understand how the design operates in Uruguay, identify areas of influence, and determine the roles of the designers. To achieve this, a list of all design studios members of the CDU in the categories product and furniture design was compiled. This list initially included 16 companies, but 3 were eliminated from the study. These exclusions were La Agencia, as they primarily worked in the international market and lacked sufficient information regarding their NPD process model; Rafael Antía and Natalia Campos, as they were no longer active in the field.

From the final list, it became apparent that 8 of these companies primarily focused on furniture design, while 5 were involved in the creation of other types of products. This included companies like DVL and Proyector mainly working with plastic products, Je Suis, specialised in eyeglasses, and Beware, involved in digital fabrication.

The division of the NPD process into various phases allowed us to identify how these design studios related to manufacturing companies. For those not involved in furniture design, they acted as product producers, such as Je Suis and Beware, or provided consultancy on production but were not responsible for its execution, as seen with DVL and Projector.

However, in the case of locally produced furniture design, the design studio assumed responsibility for production, even though, in most of the cases, the manufacturing process was outsourced. This means that

designers were hired to produce a product rather than providing design service. Consequently, design studios and manufacturing companies became partners throughout the process, working together to achieve common objectives.

For furniture designed in Uruguay but externally produced, primarily in Brazil, the relationship was different, as design studios sold the product royalties and were not responsible for the final two phases, production and launch.

MOD stands out as the only company with products available for sale without designing for specific projects. They maintain an online product catalogue that allows for customization. In contrast, all other design studios in the furniture sector create customised projects for each client, although some studios also have other approaches to the NPD process. Furthermore, none of the furniture studios maintain stock products in the local market, ensuring that all the products remain customizable.

In conclusion, the map highlights the predominant studios engaged in furniture design alongside other types of products. Within furniture design, there is a division in terms of designers' role in production, depending on whether the production is local or international. Furthermore, a predominant NPD process type involves studios designing specific projects for each client.

Graph 4: Map of design studios in Uruguay
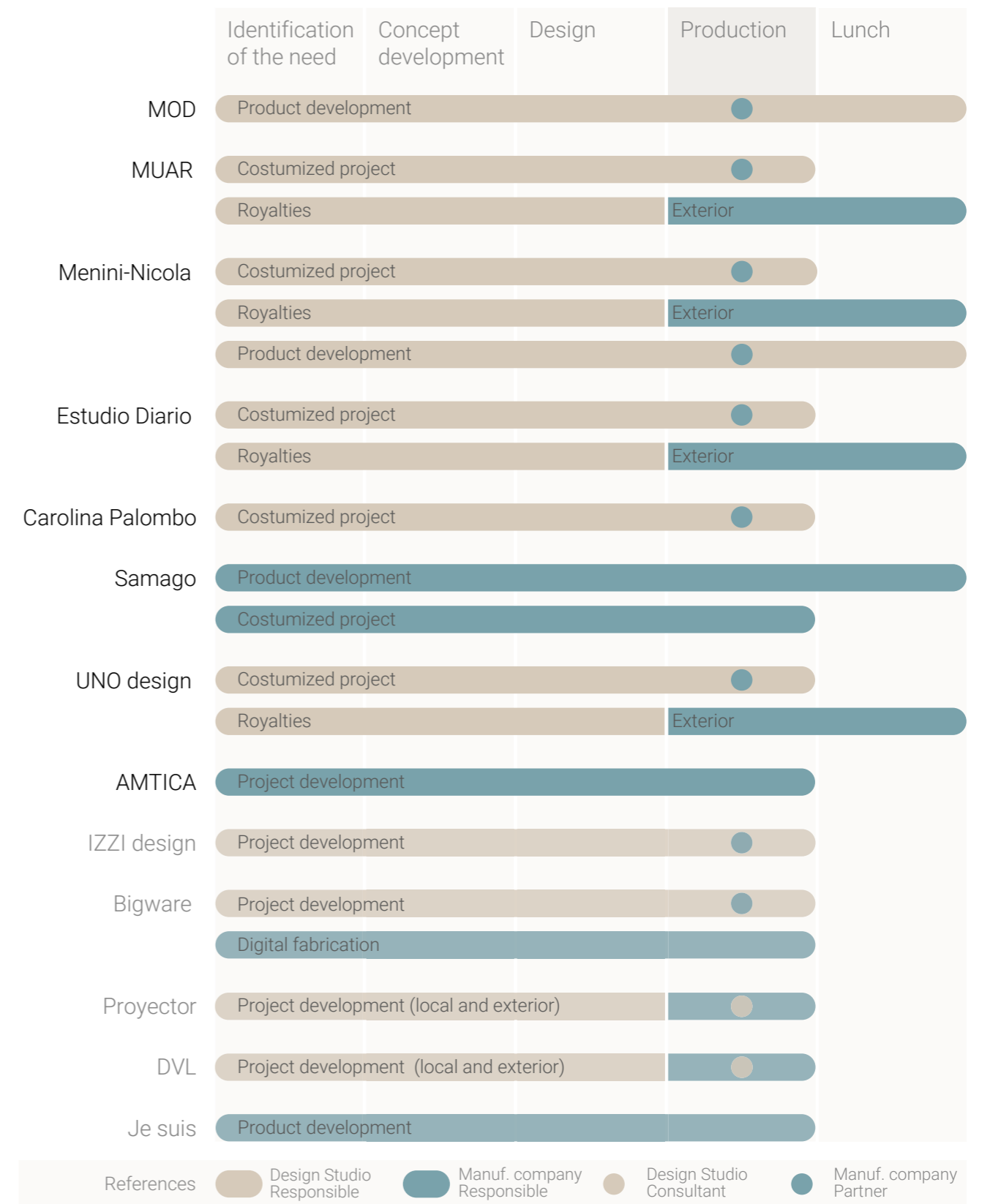
Categorization of NPD process

Based on the insights gained from the previous map, with a clear influence of the furniture sector, it was decided to concentrate on this area. Specifically, the NPD process for furniture can be divided into three categories: Product Development, Customised Project, and Royalties. Each category was analysed to understand the role and the responsibility of the design studio throughout the process, the relationship with the manufacturing company, and specific examples. This analysis aimed to provide a better understanding of how design studios develop their projects (graph 5).

Product development

This category places the design studio in charge of the entire NPD process, from the identification of the need to product launch. The process often begins with the studio's own interest or the intention of establishing a presence in the market. Furthermore, the studio takes responsibility for the production, which is frequently outsourcing, and the launch of the product. In this case, the initial effort is made by the design studio.

Examples of this category include MOD or Samago, both of which maintain online catalogues where clients can purchase their products. In both cases, clients have the option to choose from different variations, and some request minor customisations of the furniture.

Customised project

Starting from a client's requirement, whether an individual or a company, the design studio is responsible for the entire NPD process from the inception to the production. Similar to the previous category, the production process falls under the design studio's purview and is often outsourced. The NPD process concludes after fabrication since there is no product launch phase, the final product is tailored to a unique client.

This model does not pose a significant risk for the studios, as clients engage them before the project begins. Consequently, most of the design studios analysed work within this modality. For example, Menini-Nicola's MAM chair and MUAR's Bay chaise long were both designed for specific clients – Bay for a clinic and MAM for an agricultural market in Montevideo.

Royalties

The primary distinction in this category compared to the previous ones lies in the production and launch phases. In this case, the process may originate from the design studio's own interest or a company's requirement. However, the manufacture and sale of the product are not the designer's responsibility, although collaboration between both parties is possible. This production model is typically for production outside Uruguay, often in Brazil. Additionally, Uruguayan designers participate in international contests to gain more visibility and sell their projects.

Graph 5: Categorization of the NPD process

Product development

The **design studio in charge of the entire NPD process**, from the identification of the need to product launch.

The production is responsibility of the design studio, **manufacturers are partners**.

Fig. 16: Rack *virola* designed by MOD

Customised project

The design studio in charge of the **NPD process from the identification of the need to fabrication**.

The **fabrication process** falls under the design studio's purview.

Fig. 17: *Bay* designed by MUAR

Royalties

The design studio is **not in charge of production and launch phases**.

This **production model** is typically outside Uruguay, often **in Brazil**.

Fig. 18: Lateral table designed by UNO DESIGN

Examples of this category includes studios MUAR with the Buffet Catalá, commercialised by Saccaro, and UNO design with the table TL2, manufactured by Punto Mobile and commercialised by estarmoveis, both in Brazil.

This categorization reveals several key characteristics of the NPD process in Uruguay. Firstly, with the exception of MOD, all design studios primarily engage in customised projects. Furthermore, in most cases, this modality is complemented by another model, indicating that the majority of studios undertake individual projects for each client.

Regarding manufacturing, the relationship between these actors varies between local and international contexts. When production takes place abroad, typically in Brazil, designers are not responsible for this phase. However, local production falls under the responsibility of the design studios. This means they are not merely providing a service but delivering a final product, and manufacturing companies depend on the projects developed by designers.

Consequently, it can be observed that manufacturing companies do not hire designers to create products. Moreover, the existence of a third actor who hires the design studio for design and a manufacturing company for production, as seen in Brazil with the previous example of table TL2, is not prevalent in Uruguay.

Insights from the interview

During the interview with Carlo Nicola, several topics were discussed, primarily focusing on the influence of product designers in the industry, the characteristics of the design studios' work, the relationship with manufacturing companies, and the vision of the design activity. The aim was to gain a better understanding of the state of the design in Uruguay and to compare Carlo's perspective on design with the gathered information.

Sectors of influence

As observed in the previous part, most design studios in Uruguay operate in the furniture sector, a fact confirmed by Carlo. He mentioned that these studios often collaborate with carpentries, iron workshops, and occasionally upholstery workshops. However, when it comes to plastic production in Uruguay, Carlo stated that there is little room for more than two design studios due to the small domestic market and the high cost of exporting products. On a different note, Carlo highlighted the potential of ceramic workshops to thrive given their basic technology and historical significance in Uruguay's industrial sector. He also mentioned the existence of experimental workshops exploring materials like felt or glass.

Regarding furniture design, Carlo explained that this sector encompasses various areas of work, such as residential and corporate furniture, which contribute to the dynamic and competitiveness of the local market. Carlo pointed out that, following the pan-

demic, high-end furniture produced in Uruguay has similar costs to those produced in Asia. However, Uruguay holds an advantage in terms of shorter delivery times and more customised products, making local production competitive in this sector. Additionally, there are well-established carpentry workshops locally.

Designers' role

A distinctive aspect of furniture design in Uruguay is that each project typically results in a limited number of products, often unique pieces. This characteristic, as seen in the customised project category mentioned earlier, was corroborated by Carlo. He added that the market is not receptive to local standardised production because the effort required is not justified. In furniture design, the primary mode of operation involves selling the service or product on a per-unit basis.

In this dynamic of work, Carlo noted that clients often mistake that design studio as the producer and may not fully understand the distinction between the design and production phases. As a result, clients expect the design studio to deliver the final product, leading design studios to take multiple roles.

Relationship with manufacturing companies

According to Carlo, the relationship between designers and manufacturing companies is typically challenging. His design studio actively seeks approaches to work harmoniously with producers, presenting drawings clearly and proposing innovative solutions without disrupting the established workflow. Carlo mentioned that achieving shared understanding between designers and manufacturers can be challenging due to differing mental models, as an intangible yet crucial aspect of collaboration. He offered a practical example: the design brief is essentially an agreement of an idea that does not exist yet. Thus, making this idea explicit is essential since the producer may lack the tools to do so.

To address the challenge of shared understanding, Carlo suggested that designers need more experience working with manufacturers, even while they are students. Some carpentries may believe they do not need to work with designers internally because they lack prior collaborative experience. For these producers, designers are seen as external to the company, coming in solely to produce and then leave it. In Carlo's view, while this approach can yield economic benefits for carpenters, it hinders the collaboration product development experience.

External vision of the design activity

Carlo shared his experiences working with various productive systems, ranging from the highly artisanal approach in Uruguay to mass production in Brazil. He highlighted key differences between both the two. In Brazil, the system is accustomed to work with designers as a commercial tool and as a source of innovation. Consequently, Brazil employs a more automated production process compared to Uruguay, resulting in less direct interaction with the individuals operating the machines. As a result, the relationship is somewhat less personal.

On the other hand, in Uruguay, the relationship between designers and manufacturers is more direct and personal. This approach has advantages, such as the potential for more artisanal and personalised results. However, it also has drawbacks, including the risk of designers disrupting workshop logistics or making proposals that may not align with manufacturer's possibilities.

Final comments

Based on the findings from the first map and the insights gathered during the interview, it is evident that the furniture holds significant importance in product design in Uruguay. The majority of the design studios operate within this sector, benefiting from well-established workshops, particularly carpentries, which have substantial experience working with designers and architects.

Concerning the NPD process in Uruguay, we identified three distinct categories. Customised projects emerge as the most prevalent approach to product development, primarily due to the minimal risk they pose for design studios, coupled with the constraints of the local market and the emphasis on artisanal production. Consequently, a majority of design studios work within this category.

As previously highlighted, design studios in Uruguay not only handle the design aspect but also take on the production responsibility, reflecting the client's desire for a final product rather than just a design service. This necessitates close collaboration between designers and manufacturers, with both acting as partners during the product development phases. However, during Carlo's interview, certain challenges in the collaboration started to surface.

Results

Part 2: Collaborative work between design studios and manufacturing companies

The objective of the second part of the research is to delve deeper into the interaction between design studios and carpentries during the NPD process. Data collection involved conducting three interviews with both parties involved. Consequently, the findings were divided into four distinct parts: insights about carpenter work, a journey map of the interaction, barriers and enablers for the collaboration, and challenges in the collaboration between these actors.

Insights about carpenter work

The primary aim of this first part is to gain a better understanding of carpentries in Uruguay, a unique sector dedicated to furniture manufacturing. Interviews were conducted with Pablo Ferrer from *Zona M*, Heber Coitinho from *Mundomadera*, and Carlo Nicola from *Menini-Nicola*, during which various topics were discussed to provide a deeper comprehension of this productive sector, with a particular focus on carpentries characteristics and their work practices.

General characteristics of the carpentries

According to Heber Coitinho, who serves as a part of the directive of the carpenters' association, there are approximately 8000 carpentries, including home-based workshops. Out of this number, around 2500 carpentries have employees, and only 80 carpentries have a technical department. Both of the interviewed carpentries fall into the latter category.

Carpentries are accustomed to producing diverse projects for each client, with proposals that are consistently unique and customised. This flexibility, coupled with specialised workforce, makes carpentry workshop versatile spaces. These projects encompass residential and corporate furniture.

In terms of clients, both carpentries work closely with architects and designers. Additionally, Pablo noted that his clients are increasingly companies rather than individual consumers, as had been the case previously.

Modality of work

One of the initial questions that arose in the research was why carpentries in Uruguay do not have their own product lines. During the interviews with these three professionals, they explored potential reasons, all agreeing on a common answer: it is not feasible to maintain a product line in Uruguay.

The primary reasons were associated with external factors, including the small size of the domestic market and the high cost of exporting products. Moreover, the considerable effort required for developing a new product for mass production is often challenging in terms of sales. Additionally, this involves a different set of machinery, logistics, and the need of a dedicated sales outlet.

For the model of work to which carpentries are accustomed –one that relies on specialised workforce and workshop adaptability – customised projects are the ideal fit. This model aligns with the nature of their work.

Role of technical drawings

Throughout the entire interaction process between designers and carpenters, technical drawings play a crucial role in communicating the product. These representations are utilised from the initial quotation phase to the manufacturing stage, undergoing modifications as the process evolves.

According to Pablo Ferrer, the clarity of technical drawings depends on the designers' expressiveness. However, it is essential for these drawings to be unambiguous in terms of dimensions. Furthermore, the use of explanatory notes is highly recommended to enhance comprehension of the product. Therefore, an important aspect of technical drawings is not only to present the product clearly but also to emphasise the fundamental aspects for better understanding.

Moreover, during the interview with Pablo, the concept of a disconnection between the technical drawings and the feasible manufacturing possibilities of the product emerged. Some carpenters hold the belief that designers create aesthetically pleasing technical drawings, but the resulting product is often impractical to manufacture. This represents another point of misunderstanding between the two parts.
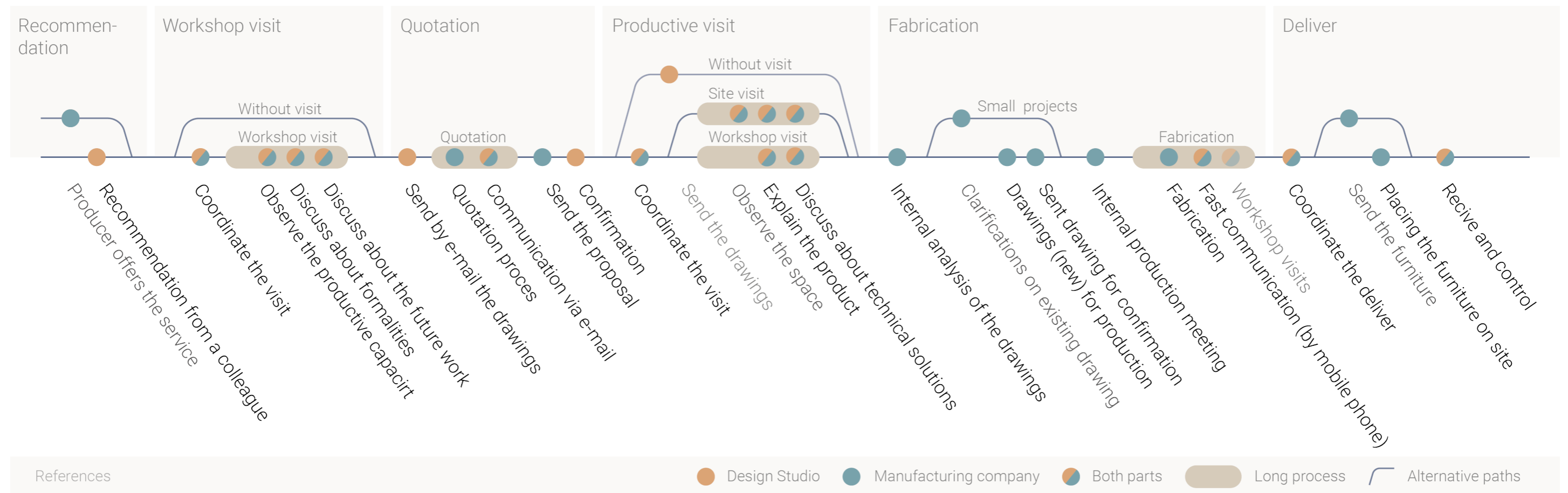
Graph 6: Map of the process of collaboration

Journey map of the collaboration

In the first part of the research, the phases of the NPD process were analysed in relation to the interaction with manufacturing companies, with a particular focus on the production stage. The purpose of this map is to visually represent the entire process of interaction between design studios and carpentries and to observe the phases of their collaboration (graph 6).

The map shows an ideal collaborative situation for the first time, so the parties have no experience working together. When the actors have more experience as partners, some of the steps are not necessary, such as the initial recommendation.

The map is divided into different phases of the collaboration, including recommendation, workshop visit, quotation, productive visit, fabrication, and delivery. Each phase consists of various steps, represented by circles. These circles are colour-coded to indicate the responsible party of each action, either the design studio, the manufacturing company, or both, if it involves both parties. Additionally, longer processes are grouped to indicate that a single activity encompasses multiple steps. Alternatives paths are also represented to demonstrate the different interaction possibilities, depending on the project's size and the level of experience working together.

The map highlights that designers have a more substantial role in the collaboration un-

til the fabrication phase, where the producer assumes the responsibility for product development. Before reaching the fabrication phase, both parties must collaborate closely, allowing the designer to transmit the product's vision, and together can refine the final production details.

Throughout the process, technical drawings play a crucial role, primarily serving as intermediaries between the parties and as a tool to explain the product. During the quotation phase, the designer presents preliminary drawings to the manufacturer, providing an understanding of the idea without excessive details. As they progress to the productive visit, more detailed drawings are presented and discussed. Finally, the manufacturer

develops the final technical drawings, incorporating all the necessary details and translating them to workshop instructions. The product becomes more refined with evolution of the drawings throughout the phases of the collaboration.

Barriers and enablers

Designer's perspective

Enablers	Barriers	Focus / Importance
Recommendation		
Feedback and insights from colleagues who have previously collaborated with manufacturers.	Manufacturers lacks of prior experience in producing similar products.	Designers bear the responsibility of ensuring quality to meet customer expectations.
Workshop visit		
Sufficient and clear communication between the involved parties.	When manufacturers fail to attend or cancel meetings promptly.	Understanding manufacturing capabilities to ascertain the best approach.
Quotation		
Commitment to respond within the set timeframe.	Manufacturers that are not used to work with technical drawings, and request images or sketches.	Pricing products in accordance with market value.
Productive visit		
Willingness to discuss and consider innovative or unconventional solutions.	Manufacturers' assurance of understanding the concept but implementing something different.	Mutual agreement between both parties on how to produce the product.
Fabrication		
Clear communication about essential aspects of the projects.		Trusting the manufacturer to execute the project as agreed.
Deliver		
Limiting on-site assembly, as it can sometimes be challenging to manage.	Lack of time to rectify mistakes once they are discovered.	Avoid stressful situations due to tight deadlines and unforeseen circumstances.

Graph 7: Barriers and enablers from designer's perspective

Carpenter's perspective

Enablers	Barriers	Focus / Importance
Recommendation		
Workshop visit		
When the designer is aware of the supplier and the available production capabilities.	Lack of alignment on vital information that needs to be conveyed.	Understanding whether it is the best option to proceed with the designer.
Quotation		
Comprehensive technical drawings and explanatory notes that thoroughly outline the product.	Drawings that lack necessary details and information.	Understanding the project thoroughly to provide accurate quotes.
Productive visit		
Being receptive, empathetic, and attentive to understand the designer's perspective.	Challenges when the end-client's expectations are unrealistic or infeasible.	Providing guidance to arrive at the best technical solutions.
Fabrication		
Quick and effective communication to address any queries or uncertainties promptly.	Differences between internal technical drawings and those provided by the designer.	Ensuring clarity about the project before the onset of this phase.
Deliver		
Maintaining a professional appearance and ensuring that the furniture arrives adequately protected.		The reputation and customer satisfaction are at stake during this phase.

Graph 8: Barriers and enablers from carpenter's perspective

From the interview, we not only gained insights into how the collaboration process unfolds but also identified the barriers and enablers that are critical at each phase, as well as the important considerations for both actors during their interactions. In this context, enablers refer to actions that facilitate collaboration, while barriers denote actions that obstruct the process.

For the designers (graph 7), a crucial aspect is selecting the right manufacturer for the project, one who possesses the commitment and skills to execute it effectively. Barriers are often based on the manufacturer's experience with similar projects and their level of commitment. Conversely, enables are associated with effective communication between the parties.

For the carpenter (graph 8), the primary focus in each phase is to ensure a clear understanding of the project. Barriers typically arise from misunderstandings and a lack of comprehension between the parties. Enablers are linked to effective communication, especially in explaining technical drawings, as well as showing empathy, listening, and demonstrating flexibility during negotiation.

The designer bears the responsibility of choosing the most suitable manufacturer for the project and effectively transmitting the product's vision through clear communication. Carpenters, on the other hand, are responsible for comprehending the product and successfully producing it. Both parties share the commitment to be open to the others' work and perspectives, fostering a collaborative environment.

Challenges of the collaboration

Designer perspective	Producer perspective

Lack of experience working together

Designing without considering the technical possibilities of the carpentry.

Initially lacking flexibility to innovate with new proposals.

Proposing changes that modify the producer's work-flow dynamics.

The preconception that designers lack knowledge anything and want to instruct manufacturers on how to work.

Frequently changing producers from one project to another.

Knowledge being derived from experience, leading to vary work methods from one company to another.

Not respecting each other's work

Providing insufficient information about the entire project.

Inadequate manufacturing precision in relation to the original proposal, resulting in differences in objectives.

Failing to involve the producer in the process.

Undervaluing the work of the designer, particularly the design process.

Lack of trust on the other's knowledge

Requiring recommendation from a colleague or the need to see similar previous objects.

Not relying on designers' technical solutions.

Graph 9: Challenges of the collaboration

Based on the information collected and analysed, the objective of this section is to elucidate the challenges inherent in the collaboration between both parts, focusing on the primary difficulties experienced during their interactions (graph 9).

These challenges can be categorised into three distinctive types: lack of experience working together, not respecting each other's works, and lack of trust on each other's knowledge. Within each of these problem categories, there are specific challenges for both designers and carpenters.

For designers, challenges are linked to effectively communicating the project's vision and understanding the role that the manufacturer plays throughout the collaborative process. Conversely, manufacturers face challenges related to their willingness to adopt the designer's proposals. By identifying and addressing these challenges, it becomes possible to enhance the collaborative dynamics between designers and carpenters.

Final comments

In this section of the research, we delved deeper into the relationship between designers and carpentries. As observed, carpenters in Uruguay play a significant role in the production of furniture, offering various types of workshops that facilitate the development of furniture design.

Furthermore, this distinctive approach to work on unique or small-scale projects not only fosters close collaboration between the parts but also encourages the creation of a diverse range of products. Consequently, it emphasises the importance of minimising issues and challenges that may arise during their collaborative efforts.

The role of the technical drawings in the interaction process between both actors is crucial, as they serve as a mean of communicating the object. Technical drawings are utilized in different stages of the collaboration and become more detailed as the project evolves.

Results

Part 3: Strengthening collaboration dynamics

Insights as enablers for the tool design

The results from the first phase of the research focusing on design in Uruguay provided insights into the characteristics of the design process for the design studios and their relationships with the manufacturing companies. It became evident that one of the most influential areas for design studios in Uruguay is furniture design, with studios developing specific project while collaborating with the manufacturing companies as a partner in the production phase.

The second part of the research further deepened our understanding of the working dynamics between designers and manufacturing companies. The distinct characteristics of furniture production in Uruguay, including projects customization, small-scale production, unique pieces, flexibility, and adaptability to various productive techniques, underscored the importance of creating collaborative environment to achieve the common objective of production.
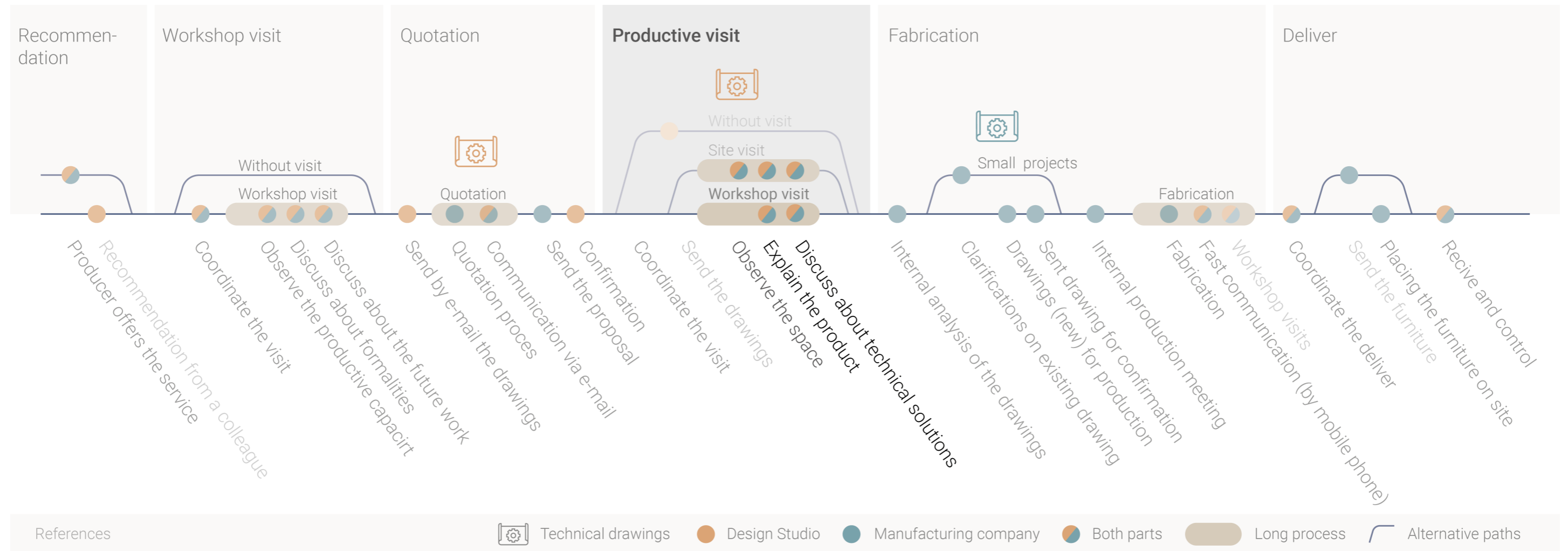
Graph 10: Map of collaboration focus on the productive visit

However, challenges in collaboration during the production phase were also identified. As observed in the second part of the research, the primary issues were related to the lack of prior experience working together and a limited understanding of each other's work. These challenges align with findings from the literature review, which indicated a technological gap in Latin America, including Uruguay. This gap contributes to a disconnection between the industry sector and the scientific and academic system (Cabrera, 2016). Therefore, the collaboration challenges between designers and manufacturing companies can be view as everyday problems, but they also have a structural component tied to the characteristics of the industrialization process in the region.

The challenges in collaboration between both parties are primary associated with their level of experience working together, as it influences their ability to understand each other's work process and to respect their respective processes. Within the framework of the production process, there are specific instances where designers and carpenters come together.

First crucial instance is the on-site visit to the workshop, which occurs before the beginning of the production (graph 10). While this event may not occur on every occasion, it was emphasized by the carpenters as being essential for comprehending work modalities, exploring productive possibilities, and building mutual knowledge. Furthermore, having this opportunity to visit the workshop helps to foster synergies and the development of a shared understanding (Le Dain et al., 2020).

The second significant instance is the productive visit, during which both parties must engage in discussion to define an innovative and feasible product. This meeting is a pivotal step in the establishment of common understanding, as it represents a phase of knowledge integration. Up to this point, each party has constructed its own frames for both problems and solutions. The productive visit marks the inception of the convergent phase, where actors must share their knowledge, resulting in the creation of common frames (Kleinsman, 2006).

During this productive visit, it is common for the designer to visit the manufacturer's workshop, taking advantage of the availability of materials samples and assemblies details. However, sometimes these meetings may occur at the location where the furniture will

be placed. Typically, these meetings revolve around the technical drawings, which serve as essential tool for explaining and comprehending the product. At this stage, both parties are already familiar with the product, so the focus shifts toward discussing technical solutions and details. This negotiation process involves the creation of frames to facilitate effective decision-making and knowledge integration. Frames help structure the discussion by defining the problem (Kleinsmann, 2012).

Technical drawings play a crucial role in various stages of the collaboration, including the quotation phase, the productive visit and the fabrication process. Specifically, during the productive phase, there is an exchange of ideas between designers and manufacturers, with technical drawings serving as intermediaries of these discussion. They act as a means to standardize the communication. However, there are limitations in the use, as they may not convey all critical information explicitly. Therefore, verbal explanations often complement them (Adereasen et al., 2015).

Another important consideration for understanding these meetings is that knowledge creation in crafts often relies on experimentation and learning by doing. Therefore, during these meetings, designer can acquire tacit knowledge trough collaborative experience (Temeltas and Kaya, 2021). However, it is crucial to align the explicit knowledge between the actors and to be systematically communicated.

At this stage of the research, we have gained a comprehensive understanding of the de-

sign situation in Uruguay, particularly the dynamics of collaboration between designers and carpenters in furniture production. It is evident that a pivotal moment in this collaboration is the productive visit, as it represents an opportunity for designers and manufacturers to work together and integrate their knowledge effectively.

With this understanding in mind, we considered the development of an intervention for this phase of the process, aimed at strengthening the collaboration between the parts. The productive visit serves two primary objectives: ensuring that the manufacturer comprehends the product and defining the product in a feasible manner.

Analysis of existing tools

To improve the collaboration between design studios and manufacturing companies during the productive visits, various tools were analysed. The goal was to enhance shared understanding between multidisciplinary teams and facilitate their interaction.

According to Stenfors et al. (2004), tools are instrumental in solving practical problems by supporting effective interaction. While their research primarily focused on executive contexts within companies, these principles can be applied to situations where professionals from different sectors need to collaborate.

Their study identified key features for the usability of such tools:

Simplicity: tool should be easy to understand and learn.

Support for social interaction: They should create an environment conductive to communication.

Connections to the actual context: Tools should be linked to the specific context where they are used.

Flexibility: Tools should only be used when needed (Stenfors et al., 2004), .

Furthermore, tools from the IDEO were examined (Design Kit, n.d.-b). While not directly addressing the thesis problem, they provided some valuable insights:

Quick sketches, drawings and graphs: These can bridge language barriers and convey ideas effectively (Tool: Draw it).

Conversations starters: Words or images that stimulate reactions and guide discussion (Tool: Conversation starter).

Objectives: Writing down objectives helps align shared understanding and maintain focus (Tool: Align on your impact goals).

From these tools was possible to identify insights, such as the use elements to identify topics to discuss, the inclusion of drawings to support ideas beyond verbal language, and the importance of maintaining focus to align the mental models and guide the discussion.

Additionally, various other tools were analysed to gain a broader perspective on creating shared understanding and supporting

decision-making in multidisciplinary teams. Although these tools were developed for slightly different scenarios, they offered some interesting elements for the development of the new tool:

Tangible brief and the positions, perspectives and priorities: These are artefacts that encourage spontaneous discussion and negotiation, creating infrastructures for the collaboration (Andersen & Mosleh, 2021).

Kantjil game: A simulation-based training that assigns participants roles, making negotiation essential to establish common objectives. The results highlight the need to develop the ability to share and integrate of knowledge (Kleinsmann et al., 2012).

Organisational kit game: A simple game that uses cards to discuss meaning and create common understanding (Brandt, 2006). It may serve as conversation starters to align mental models.

Floor it: A tangible tool that fosters idea development without personal attachment, promoting collective solutions involving all parties (Van Dijk & Van Der Lugt, 2013).

The analysis provided by these tools offers a broader perspective on the process of creating shared understanding within a team and supporting negotiation. The first scheme (graph 11) demonstrated how these theoretical concepts were applied in practical actions in the tools, serving as reference for the development of the new tool.

Meanwhile, the second scheme (graph 12)

Tool	Focus	How
The tangible brief (Andersen & Mosleh, 2021)	Encourage negotiation and spontaneous discussions.	Divide and organise the aspects to discuss.
Positions, perspectives and priorities (Andersen & Mosleh, 2021)	Discuss with actors with different perspectives.	Promote negotiation and prioritization of different requirements.
The Kantjil game (Kleinsmann et al., 2012)	Negotiation with actors with different roles and objectives.	Through negotiation, create a balance between each participant's objectives.
The Organisational Kit game (Brandt, 2006)	Creation of shared understanding.	Use visual elements to create shared meaning among the participants.
FLOOR-IT (Van Dijk & Van Der Lugt, 2013)	Creation of innovative solutions within a team.	Combine ideas without personal attachments.

Graph 11: Analysis of the tools

divided the tools into three categories associated with the challenges found in the collaboration between design studios and furniture producers, namely lack of experience together, lack of respect for each other's work, and lack of trust in each other's knowledge. These divisions allowed for the recognition of the specific aspects each tool focuses on.
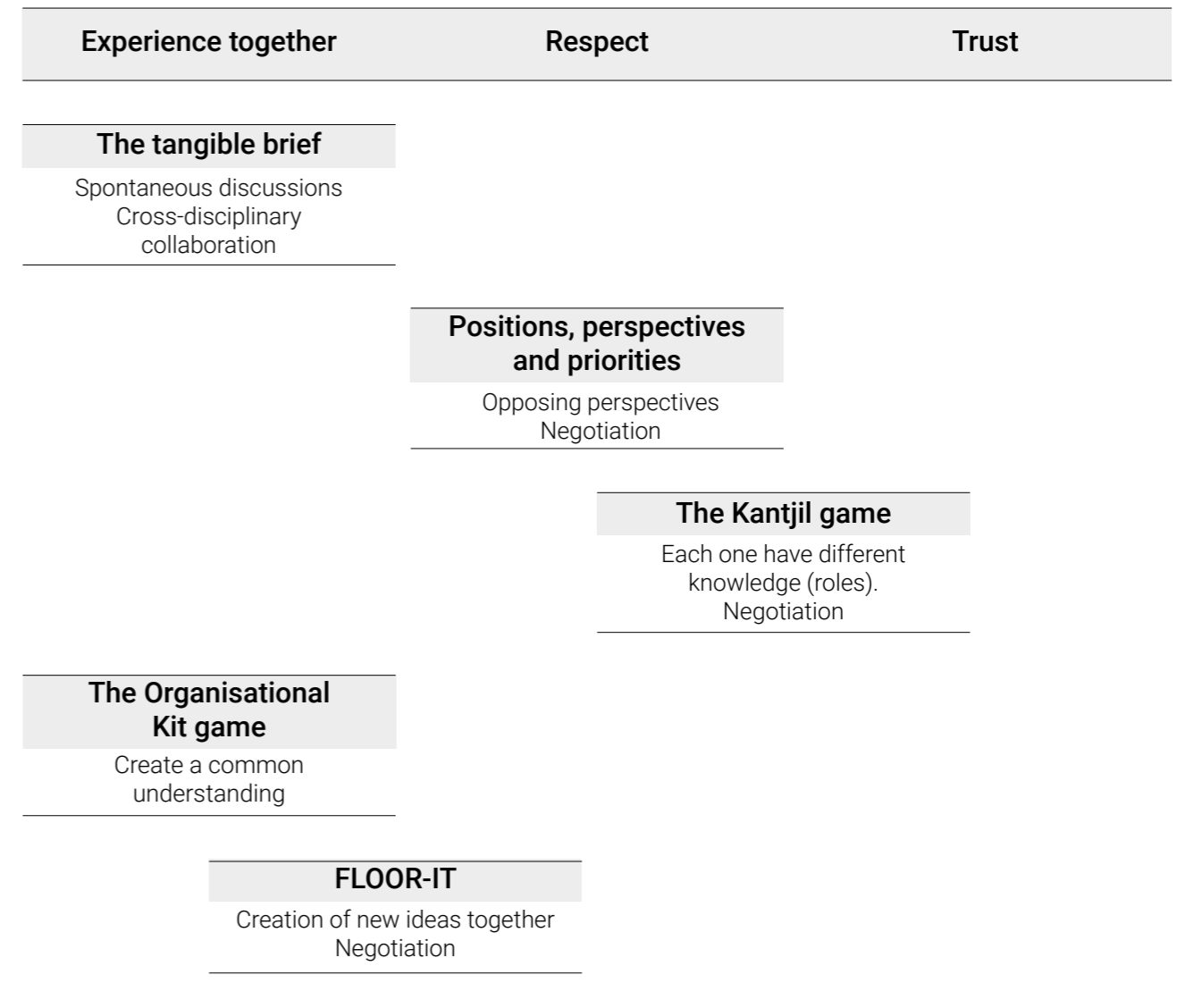
The tools that place a central focus on the experience of working together promote collaboration through the development of common shared understanding and the generation new ideas together. To ensure respect for each other's work, the employed strategies involve negotiation and understanding of diverse perspectives on the same prob-

lem. Moreover, in cultivating trust in each other's capabilities, the emphasis is on being confident in the knowledge of the other party to achieve common objectives.

Final comments

Throughout this section, it becomes evident that productive visit is a crucial step for creating shared understanding and knowledge integration, serving as it is the moment where design studios and manufacturing companies share their ideas and define the project details.

Moreover, three main challenges are founded in the collaboration:

Experience together	Respect	Trust
The tangible brief Spontaneous discussions Cross-disciplinary collaboration		
	Positions, perspectives and priorities Opposing perspectives Negotiation	
		The Kantjil game Each one have different knowledge (roles). Negotiation
The Organisational Kit game Create a common understanding		
	FLOOR-IT Creation of new ideas together Negotiation	

Graph 12: Categorization of the tools according with challenges in collaboration

- The level of experience working together
- Respect for their respective process
- The ability to trust on each other's work processes

In the development of the tool, through the previous analysis of existing tools, some considerations were observed:

- Regarding the experience working toge-

ther, the tool should promote the creation of shared understanding by aligning the knowledge of the participants.

- To foster respect between them, the tool should propose negotiation to arrive at new ideas that align with the expectative and requirements of both actors.

- To build trust, the tool should encourage negotiation and showcase capabilities so decisions can be made collaboratively.

Thesis solution

Requirements

To develop a tool for strengthening collaboration between design studios and carpenters during the productive visit, several requirements were established to guide the process. These requirements are classified into three main areas: general expectations of the tool, characteristics of the tool itself, and specific features related to the form and functionality (Graph 13).

The first category of requirements is centred around the general aspects of the tool. It should provide structure to the meeting, facilitate the integration of the manufacturer into the decision-making process, offer a broader perspective of the entire project, and possess the flexibility to support discussions on various aspects of the project. Those characteristics were derived from insights gained from interviews and aim to address the challenges faced in collaboration, such as the lack of manufacturer involvement in the process, changes in production dynamics, and the need for more comprehensive project information.
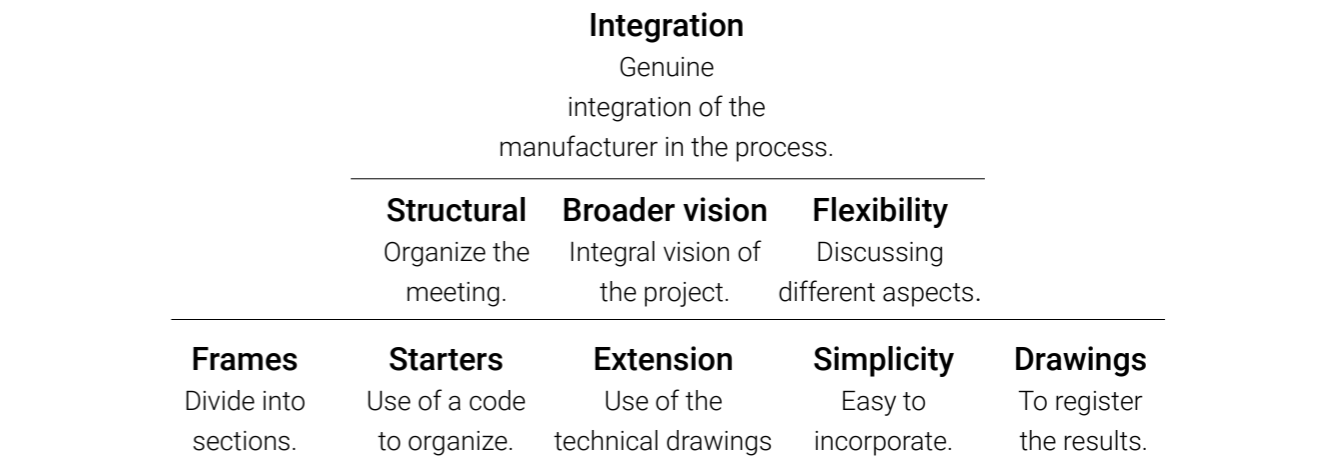
The second category pertains to the tool's intrinsic qualities. It should be easy to understand and not require much additional effort, ensuring a smooth adoption as a valuable asset in the collaboration. Furthermore, the tool should serve as an extension of the

The collaboration between design studios and carpentries is fundamental in achieving shared objectives making the productive visit a decisive step for knowledge integration and the establishment of common mental models. This tool should provide frameworks for the alignment of the knowledge and enhance decision-making processes.

General	
Structural	**Integration**
Provide a structure or framework for conducting the meeting.	Involve the manufacturer in the decision-making process and support discussions.
Broader vision	**Flexibility**
Promote an integral vision of various aspects of the project.	Be open to discussing different aspects of the project.
Tool-specific	
Simplicity	**Frames**
Be easily understandable from the first interaction.	Divide explanations and discussion into distinct sections for precision.
Extension	**Adaptation***
Serve as an extension of the technical drawings.	Be adaptable to different work platforms, whether digital or on paper.
Form and function	
Starters	**Drawings**
Include element that invite spontaneous discussion.	Encourage the use of drawings to bridge language barriers.
Aligners	**Visual codes**
Help to maintain discussion focus on specific problems or objectives.	Implement a code system to classify the topic being discussed.

Graph 13: Requirements

Integration				
Genuine integration of the manufacturer in the process.				
Structural	**Broader vision**	**Flexibility**		
Organize the meeting.	Integral vision of the project.	Discussing different aspects.		
Frames	**Starters**	**Extension**	**Simplicity**	**Drawings**
Divide into sections.	Use of a code to organize.	Use of the technical drawings	Easy to incorporate.	To register the results.

Graph 14: Organization of requirements

technical drawings, making optimal use of the materials available during the meeting to enhance their utility. This category also emphasizes the breaking down the discussion into smaller, manageable frames. This approach simplifies the discussion of topics and avoids disrupting existing productive structures, aligning to the concept of framing to facilitate effective decision-making and integrate the knowledge (Kleinsmann, 2012).

Even though the meetings currently involved printed technical drawings in a physical presence, it is worth exploring the possibility to digitalizing the meeting or adopting a hybrid approach that combines both paper and digital elements. Although this requirement is not explored at present—since previous steps need to be taken before digitalization—future exploration can expand the capabilities of the tool and offer more flexible options of collaboration.

The final category focuses on specific attributes of the tool. It suggests the incorporation of "starters", which are elements that promote the discussion, and a visual code for easy recognition of discussion topics and problem type. Additionally, it recommends the use of aligners or keywords to define the topic and maintain focus on one problem at the time. Lastly, the tool should be flexible in terms of the outputs of the meeting, allowing for both written and drawn representations. This approach is inspired by the analysis of various tools, as drawings can bridge language barriers and facilitate the expression ideas.

All these considerations are instrumental in the development of the tool, with the primary goal of promoting genuine integration between design studios and manufacturing companies during the productive visits. This achieved by structuring the meeting, fostering an integral vision of the project, and facilitating discussing on various aspects of the projects. To accomplish this, frames are utilized to divide sections, a code is employed to organize topics, technical drawings act as an extension of the tool, and the system is designed to be flexible in the registration of the results, while also being simple to incorporate (graph 14).
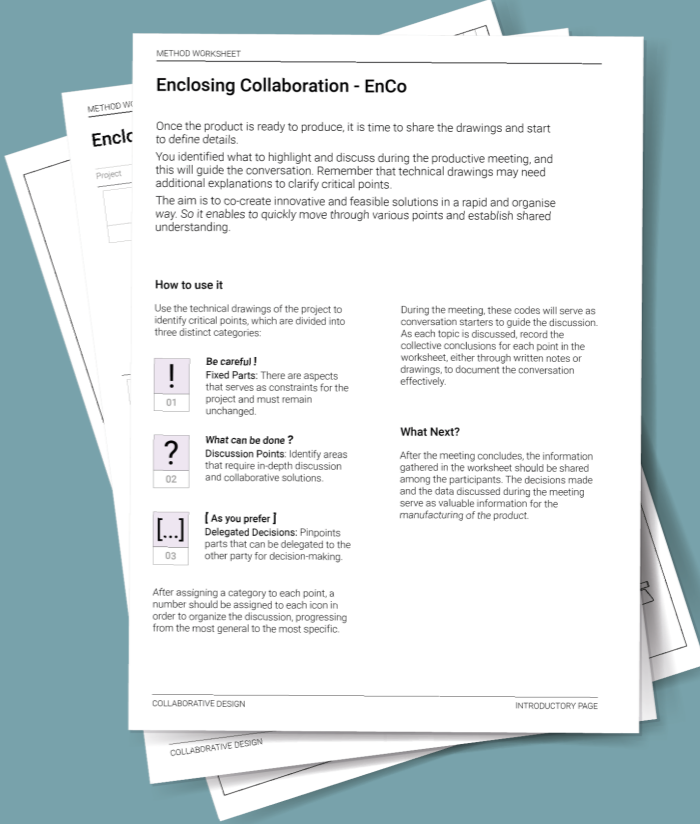
Enclosing Collaboration

Enclosing Collaboration (EnCo) is a tool designed to strengthen collaborative practices between design studios and manufacturing companies during the productive visit, during which both parts discuss and define project details while aligning their mental models (graph 15). The aim of this tool is to facilitate the decision-making process by supporting knowledge integration through the encouragement of knowledge sharing (i.e. prompting meaningful conversation about technical details).

This tool assists both parties in effectively structuring the meetings through a flexible methodology that guides the discussions about the product using technical drawings. This flexibility enables its use in various scenarios, involving different actors.

The specific context in which EnCo is designed for is the collaborative interaction between two parties: design studios and furniture producers in Uruguay. Initially, it is proposed for implementation by the design studios due to their experience working with this type of tools. Nevertheless, manufacturers can also adopt it.

This paper-based tool consists of two distinct parts: the first page that explains how to use the tool (graph 16) and a second page to record the results of the meeting (graph 17). The last page can be printed in the necessary number of copies.

Graph 15: Tool presentation

Enclosing Collaboration - EnCo
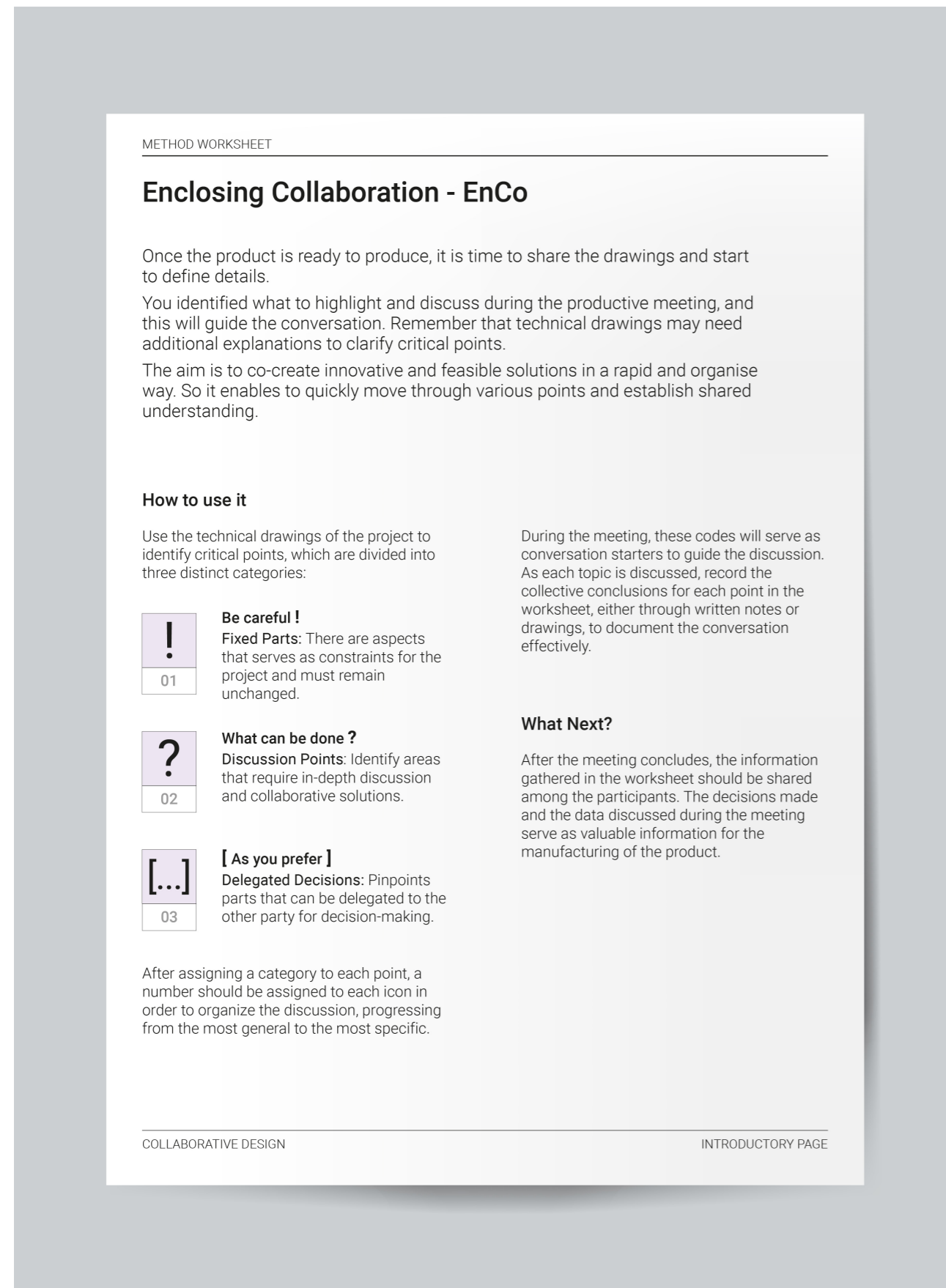
Structure
Conduct structured meetings.

Flexibility
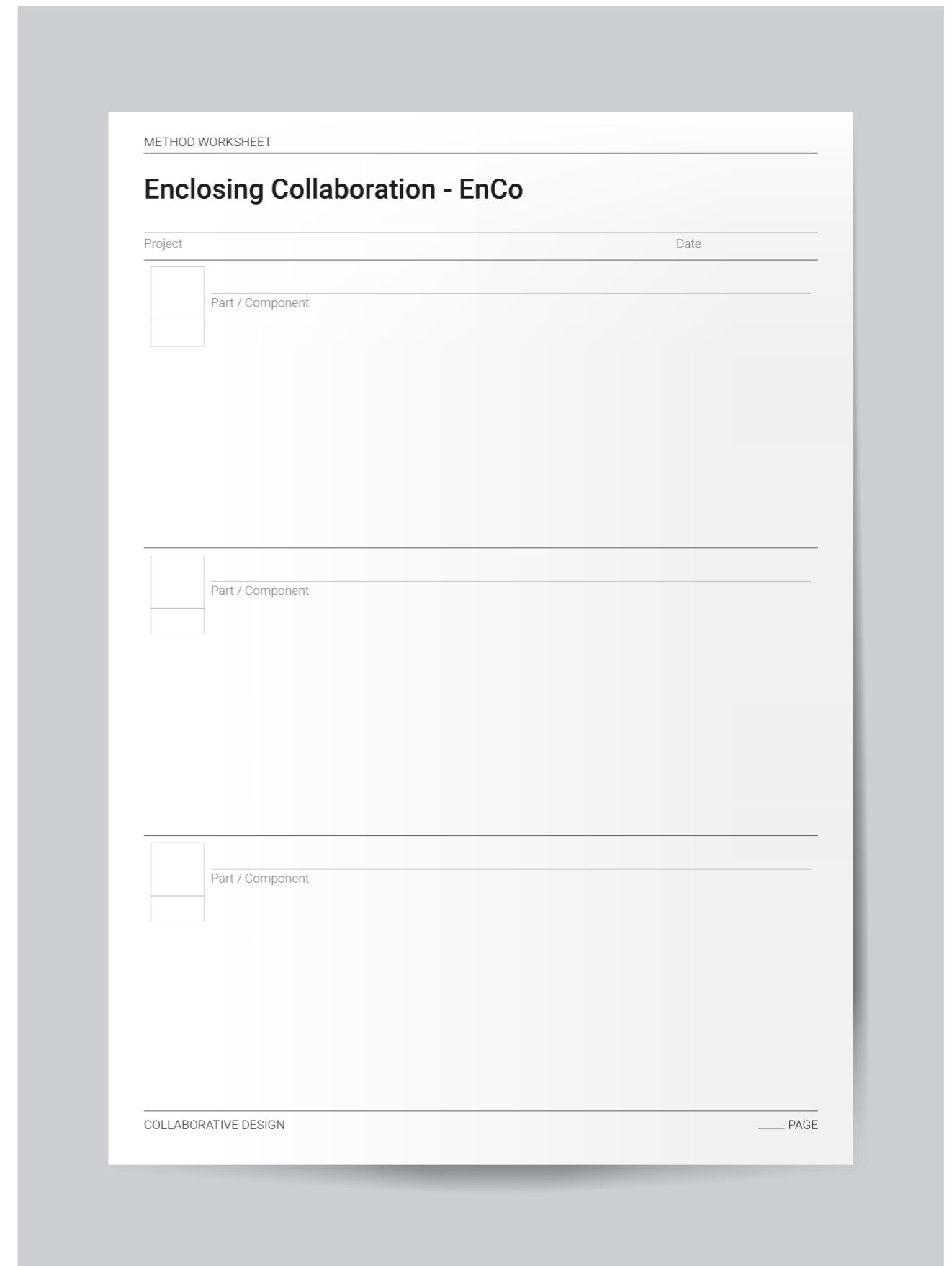Adapt to discuss different topics.

Wider vision
Provide a integral vision of the project.

Graph 16: First page - explanation of the tool

METHOD WORKSHEET

Enclosing Collaboration - EnCo

Once the product is ready to produce, it is time to share the drawings and start to define details.

You identified what to highlight and discuss during the productive meeting, and this will guide the conversation. Remember that technical drawings may need additional explanations to clarify critical points.

The aim is to co-create innovative and feasible solutions in a rapid and organise way. So it enables to quickly move through various points and establish shared understanding.

How to use it

Use the technical drawings of the project to identify critical points, which are divided into three distinct categories:

!
01
Be careful !
Fixed Parts: There are aspects that serves as constraints for the project and must remain unchanged.

?
02
What can be done ?
Discussion Points: Identify areas that require in-depth discussion and collaborative solutions.

[...]
03
[As you prefer]
Delegated Decisions: Pinpoints parts that can be delegated to the other party for decision-making.

After assigning a category to each point, a number should be assigned to each icon in order to organize the discussion, progressing from the most general to the most specific.

During the meeting, these codes will serve as conversation starters to guide the discussion. As each topic is discussed, record the collective conclusions for each point in the worksheet, either through written notes or drawings, to document the conversation effectively.

What Next?

After the meeting concludes, the information gathered in the worksheet should be shared among the participants. The decisions made and the data discussed during the meeting serve as valuable information for the manufacturing of the product.

COLLABORATIVE DESIGN   INTRODUCTORY PAGE

Graph 17: Second page - register of the results

METHOD WORKSHEET

Enclosing Collaboration - EnCo

Project   Date

Part / Component

Part / Component

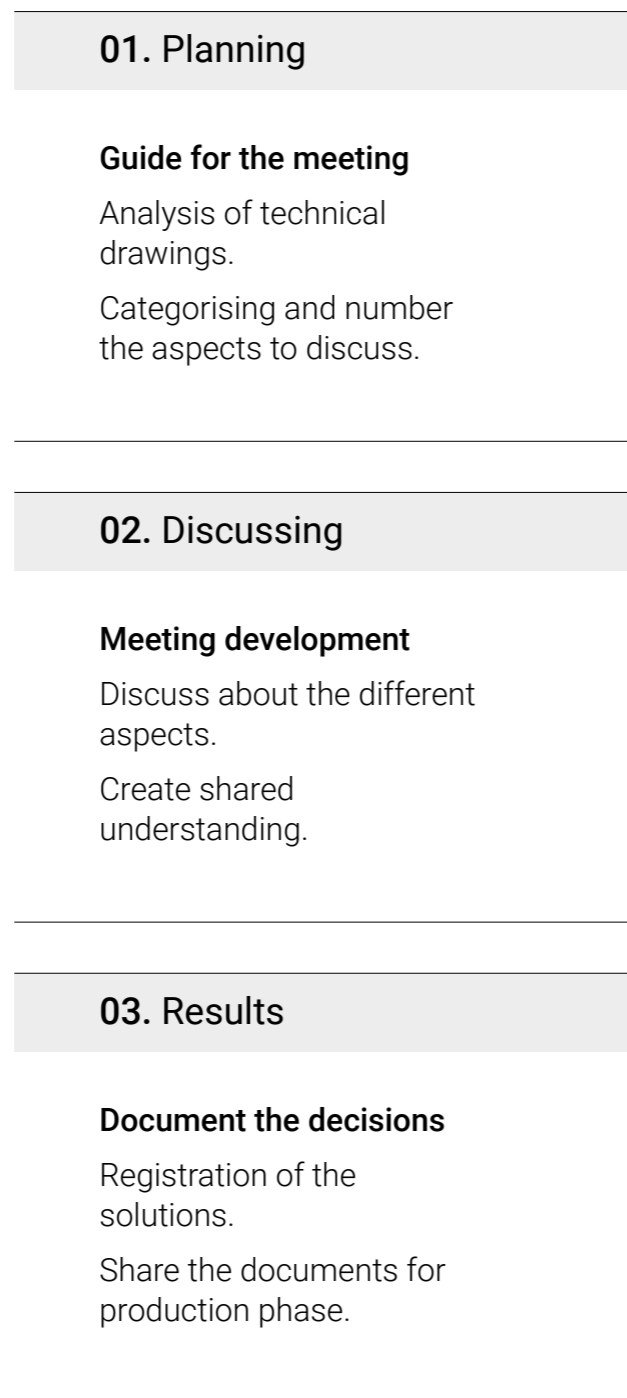Part / Component

COLLABORATIVE DESIGN   ____ PAGE

Sequence of use

The sequence of use is organized into three stages (graph 18):

Planning: This initial stage involves the analysis of technical drawings before the meeting. It is ideally done prior to the meeting to allow design studio to identify and categorize potential issues. Creating frames, as suggested by Kleinsmann (2012), is a useful practice to enclose problems and assign names to important elements that need explicit attention.

Discussing: This phase take place during the productive meeting and centres about the critical points previously identified in the technical drawings. The meeting involves exploring issues, developing solutions, and questioning decisions. It is a process of moving and reflection aimed at knowledge integration (Kleinsmann, 2012). In line with the findings of Temeltas and Kaya (2021), artisans possess the ability and the flexibility to identify productive solutions efficiency. Therefore, collaborative knowledge integration and solution exploration are crucial.

Results: This is the final stage of the process but should be conducted after discussing each problem. It is the most effort-intensive step, as it requires explicitly outlining the solutions and agreements between both parties on how to proceed. This is a pivotal step, underlining the importance of making it as seamless as possible. The use drawing-based communication is proposed to complement verbal communication and simplify the process.

01. Planning

Guide for the meeting

Analysis of technical drawings.

Categorising and number the aspects to discuss.

02. Discussing

Meeting development

Discuss about the different aspects.

Create shared understanding.

03. Results

Document the decisions

Registration of the solutions.

Share the documents for production phase.

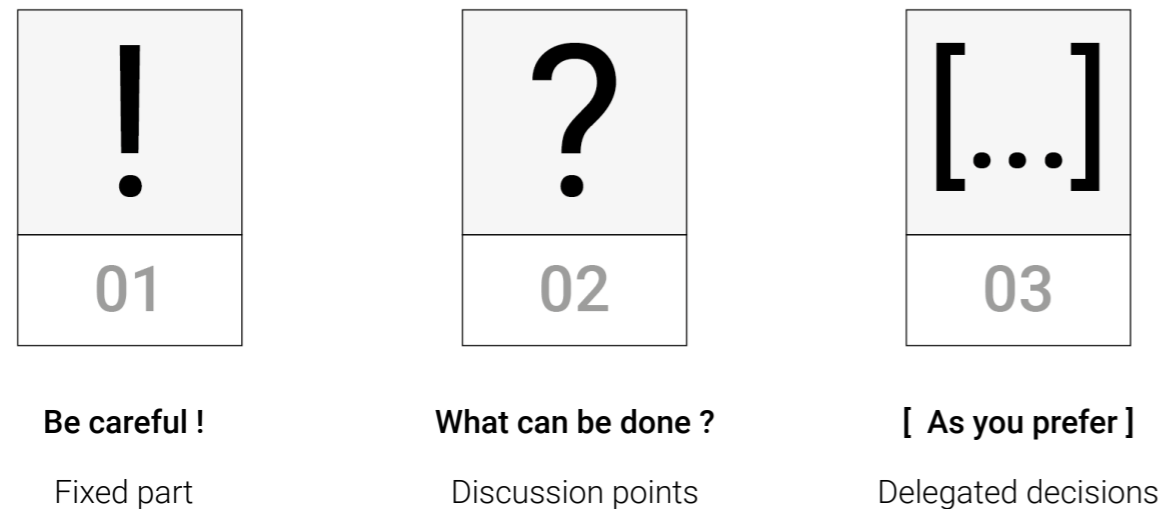Graph 18: Scheme of the steps

Story board

Before the meeting
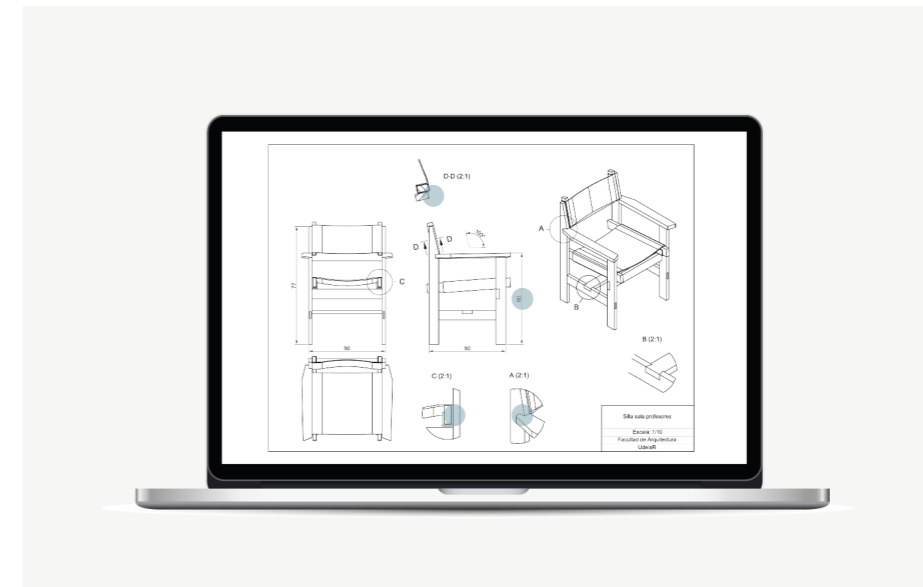
01. Identify the aspect to discuss.

02. Assign a category to each point for discussion and a number to organize from general to specific.

Story board

During the meeting

03. Complete the worksheet with the information of the project.

04. Using the technical drawings each point is discussed. Others icons can be added if necessary.

05. After each point discussed, document the decision made in the worksheet.

06. When all the points are discussed, share the document with the resolutions.

!	?	[...]
01	02	03

Be careful !

What can be done ?

[As you prefer]

Fixed part

Discussion points

Delegated decisions

Graph 20: Signs to categorize the aspects to discuss.

Code system

A code consisting of three signs has been developed to provide improved organization of the elements to be discussed (graph 20). These signs were designed to meet two primary requirements: simplicity to ensure that anyone can confidently draw them by hand if necessary, and the ability to complement verbal communication by visually highlighting points of emphasis. Each sign corresponds to a specific approach to a crucial point:

Fixed parts: This represents aspects of the project that are constraints and must remain unchanged. It is denoted by an exclamation mark, signifying the need to exercise caution and respect the set limits. These critical elements are sometimes overlooked in explanations but play a vital role in providing an overall view of the project, as was noted in the collaborative challenges.

Discussion points: This represents areas requiring in-depth discussion to arrive at collaborative solution. They are indicated by a question mark, signifying the need for dialogue to address the question: "What can be done?" Discussing those points is essential during the meeting to reach mutually agreeable, feasible solutions.

Delegated decisions: This denotes aspects that can be left to the other party for decision-making. They are not intended for in-depth discussion during the meeting. Instead, they invite the other part to make their preferred choice. They are presented as a type of brackets, indicated that they contain more detail but can be developed by the other part.

The tool is paper-based, consistent with how both parts currently work during the productive meetings. Designers bring printed technical drawings to the meeting, and this new tool is seamlessly incorporated to this format. Typically, standard printers are used to produce A4-sized, colourless documents. The tool's document comprises two main sections: one for guidance on it usage and another for recording results.

Regarding the incorporation of these signs in the technical drawings, three alternative methods have been explored to offer flexibility:

Digital format: The signs are digitally incorporated before printing the documents, where they can be added as a block using drawing software (graph 20).

Drawing by hand: The simplicity of the signs enables anyone to add them at various points, even during the meeting if necessary. This alternative provides the most flexibility as it does not require any additional elements (graph 21).

Added mark: Another option is to use stickers (graph 22) or a seal (graph 23) to apply the signs, making the process more practical and clear.

These diverse incorporation methods are presented to ensure that the tool remains flexible, as its intent is not to have a rigid but adaptable to various situations.
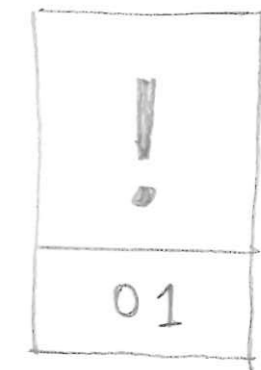
Graph 21: **Drawing by hand**
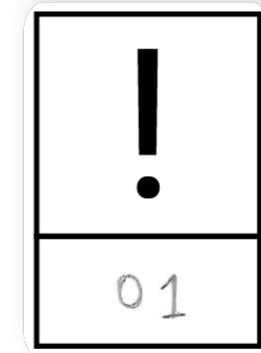
Graph 22: **Added mark**
Sticker mark
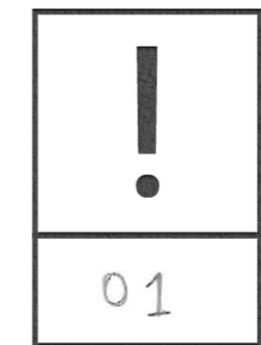
Graph 23: **Added mark**
Seal mark

Validation of the tool

The tool was validated through interviews with both involved parties, Carlo Nicola representing the design studios and Pablo Ferrer and Heber Coitinhio representing the carpenters, enabling meaningful feedback on the tool and its potential implementation. Initial impressions of the tool were positive from both perspectives. Participants noted that, despite typically seeking order in the meetings, this tool helped develop discussions in a more organised and effective manner.

General requirements

To gain more in-depth feedback, opinions were sought of the initially defined requirements of the tool. This aimed to provide a more precise validation of whether the tool was meeting its objectives.

Simple to understand from the first interaction

Answers were positives. Carlo, representing the designers, added that the tool is easy to integrate into their routine as it enhances an activity that they regularly perform. Carpenters also found the tool simple, quickly understanding its dynamic of use.

Flexibility to discuss different topics

All interviewees agreed on the tool's versatility in covering various aspects of the project. Pablo, carpenter from *Zona M*, mentioned its potential use for different project types and suggested the tool's expansion during the meeting.

Integral vision of the project

Concerning the broader vision of the product, producers expressed interest. Heber, carpenter from *Mundomadera*, highlighted the tool's value in not only identifying points for discussion but also recognizing aspects that must remain unchanged.

Integration of both parts on the discussion

Carlo noted that integration is standard in all their projects. Therefore, the discussions about project details result in a important step, as the acquired knowledge is applied in subsequent projects.

The different aspects to discuss

To better organize the meeting, the aspects to discuss have been dividing into three categories:

Fixed parts: aspects that must remain unchanged.

Discussion points: areas that require an in-deep discussion.

Delegated decision: aspects that can be left on the other part decision.

Regarding this division into categories, all agreed on the fact that all possible situations are covered in them. When symbols for each category were explained to carpenters, they quickly grasped their meaning and started using them during conversations. Pablo suggested an order for discussing categories during the meeting, emphasising unchanged aspects at the beginning to understand project limitations, progressing from the most general topics to the most specific topics.

Positive aspects	Improvements
• Easy to integrate into their routine.	• Discuss topics in order from the general to the specific.
• Simple implementation.	• Share results after the meeting in a way that allow ongoing exchange between the parts.
• Adaptable to different types of projects.	
• Provide guidance and organization for the meeting.	

Graph 24: Synthesises of the validation

Usability of the tool

Concerning usability, Carlo emphasised the clarity of the rules from the beginning. For both carpenters, the tool's most useful aspect was having a guide for the meeting, ensuring all points were discussed.

However, some aspects were considered challenging to implement. Carlo underscored two points. Firstly, there are instances where they lack the time for in-person meetings, leading to the loss of the meeting information. Secondly, he noted concerns about the documentation of the meeting results. Although crucial for the production phase, it has the potential to slow down the meeting. On the other hand, Heber faced challenges related to having the guide before the meeting, as it contributes to understanding the project and making it more effective. Pablo expressed difficulties associated with sharing information after the meeting.

Improvement opportunities

Improvement opportunities were identified for both the tool itself and information sharing after meetings.

Tool itself

• The list of discussion points in the meeting can be proposed by both actors, not just the designers, for a more collaborative meeting.

• There should be an order for discussing all topics for better organisation, starting from the macro to the micro.

• A method to identify in technical drawings which aspects were already discussed was suggested.

These points were adapted in the tool. The change includes icons placed first in technical drawings, followed by a numbering system, ensuring organised discussions that progress from the most general to the most specific and discuss all the points.

After the meeting

Concerns were raised about what happens with the information after the meeting. To address this, the proposals included the use of a platform to share the results and engage in short conversations about the tasks after the meeting.

Discussion

Strengthening the collaboration

At the beginning of the research, the literature review and initial findings confirmed that the furniture sector stood out as the most influential domain in product design in Uruguay. Project customization emerged as a prevalent approach to new product development, characterised by small scale production, skilled workforce, and adaptability to various manufacturing techniques. This approach necessitated close collaboration between designers and furniture producers to share the goal of creating unique projects each time.

Upon a thorough analysis of the relationship between these actors, numerous challenges in the collaboration became apparent. These challenges were not only inherent in their daily work but also had structural implications, as evidenced in the literature review that highlighted the gap between the scientific sector and the industry (Cabrera, 2016).

The primary focus of this thesis was to strengthen the collaboration between designers and manufacturing companies. To achieve this, a tool was developed to align common understanding and reinforce collaborative practices. The main requirements proposed before development were to pro-

vide structure to the meeting, integrate the producer into the decision-making process, promote an integral vision of the project, support the discussion of various topics, and be simple to understand and implement. Those concepts guided the development process and received affirmation during validation, with the tool garnering positive comments.

The challenges of introducing a tool for the producers were associated with a lack of knowledge about the design process and openness to implementing innovative solutions. However, the tool met the carpenters' expectations, as it did not significantly alter their workflow dynamic, utilised familiar tools (paper-based tool and technical drawings), and provided structure to the meeting, facilitating an integral vision of the project and effective decision-making.

Unexpected results emerged during the tool's validation, particularly concerning how to continue the exchange after the meeting. Sometimes not all the topics are resolved during the meeting, necessitating further research or seeking the opinion of external actors. Therefore, exploring this direction in future research could enhance the collaboration, extending its impact not only during meetings but also afterward.

The primary objective of this tool was to strengthen the collaboration between design studios and furniture producers, with specific goals aimed at conducting structured meetings, integrating the opinions of both parties, providing a comprehensive vision of the project, and fostering flexibility in discussing diverse topics.

The tool's structured meeting format facilitates the creation of frames, a concept derived from Kleinsmann (2012), which helps encapsulate problems and solutions, guiding actions for effective decision making. Consequently, the tool breaks down the project into manageable points, enabling focused problem-solving without disrupting the work-flow dynamics of the producer.

Integrating the distinct visions of designers and producers is inherently challenging due to differing expectations, requirements, and project knowledge. Through the examination of various tools, negotiation emerges as a fundamental aspect supporting interaction and the creation of shared meaning. The tool addresses concerns voiced by carpenters during interviews regarding their limited participation in decision-making process. It proposes a framework that accommodates both parties, levering familiar elements such as paper-based documentations, technical drawings as communication bridge, and discussions centred on the producer's field of expertise.

Producer emphasis on having a broader vision of the product is considered critical for enhancing collaboration and improving the production process. Integrating knowledge between actors ensures awareness of different project aspects, contributing to a more effective production process. The categorization into three sections not only facilitates discussion of unresolved points but also enables the sharing of valuable information about the project limitations.

The tool suggests a flexible methodology to address various project aspects, with cate-

gories linked to the type of problem for discussion rather than the specific problem itself. This ensures that all problems can be addressed within a designated category. The focus of meeting structuration is to cover all discussion points while remaining flexible in addressing the unique nature of each problem.

Based on the theoretical framework and the research results, specific features of the tool have been defined in order to accomplish the main objective of the thesis. Although further development is required to enhance its implementation, the central focus of the tool lies in strengthening the collaboration.

Relevance

During the research process, and specifically in the design of the tool, the focus has been on proposing a tool adapted to this particular context. Specific challenges in the collaboration between design studios and manufacturing companies have been identified, and strategies were implemented to strengthen the collaboration.

To improve the experience working together, the tool proposes the creation of frames to align knowledge on different aspects of the project, not only on topics requiring in-depth discussion. Moreover, the tool promotes discussion and negotiation, allowing both parties to acquire knowledge from each other that can be applied in next projects.

To foster respect between them, the tool aims to gain a broader vision of the project

by using categorization, ensuring everyone understands the nature of the aspect to discuss and their role in the project.

To build trust in each other's work, the tool encourages spaces for discussing topics in a way that is familiar to both parties, with technical drawings playing a central role in bridging communication barriers. Therefore, both actors feel comfortable with the way discussions are conducted.

With these features, the tool aims to minimise the gap between design studios and manufacturing companies and reduce the challenges in the collaborative practices to strengthen the collaboration. Moreover, the relevance for the implementation lies in adaptability to their work dynamics, focusing on using familiar elements such as technical drawings as a mediator, paper-based documents, and centring discussions on the producer's field.

Limitations

The limitations of this thesis can be categorised into those associated with the research and those related to the tool itself.

Research limitations

The decision of selecting specific manufacturing companies influenced the type of problems and requirements considered. While these producers were chosen for their influence and experience, there are diverse realities and practices in the design field. Moreover, the emphasis on the productive visit was deliberate, recognizing its impact during fabrication, but it is acknowledged that collaboration can manifest in various areas and contexts.

Tool limitations

The tool, by design, cannot cover all possible situations, and certain decisions were made that restrict its applicability. It was specifically designed and tested with a particular type of producer – carpentries with a technical office. While this study provides valuable insights, there is a potential for expansion through a quantitative perspective to enhance comprehensiveness and generalizability. Despite its specificity, this effort represents an initial step in the broader goal of strengthening collaboration.

Further improvements

The goal of this research has been to comprehend and strengthen the collaboration between designers and manufacturing companies in Uruguay. While the research process required a focus on a more specific topic for thesis development, there exist several intriguing avenues for further exploration within this domain. Potential areas included other types of products, different stages in the NPD collaborative process, exploration of furniture producers with distinct characteristics, and investigating collaboration dynamics within manufacturing companies.

Specifically, regarding the proposed tool, there is room for further enhancements in its digitalization, as suggested by insights from interviews with Carlo Nicola and Pablo Ferrer. While a paper-based tool appears most suitable for the context, various options for a digital tool can be analysed. Notably, furniture manufacturers in Uruguay do not commonly use uniform software for drawing or internal organisation. Given the diverse interactions between design studios and manufacturers, finding a software solution suitable for all parties poses a challenge. Although requiring deeper study, certain software characteristics and alternatives were explored.

The digital adaptation of the tool can be approached in two intervention phases: a digital tool to support online meetings and a tool for sharing documents and planning post-meeting. For online meetings, templates can be used to support this methodology of work on existing platforms like Miro, Figma, or One Drive. While these platforms offer adaptability and flexibility for visualising documents and sketching, transitioning to digital tools could pose a significant change for producers, necessitating a radical shift in their work modality.

Supporting exchange post-meeting involves sharing documents and facilitating communication between designers and producers. While potential digital alternatives need further in-depth study, certain platforms present a suitable foundation for this methodology. Crucial to success is not just the characteristics and usability of the digital tool but also the commitment and effort required to ensure widespread adoption among designers and furniture manufacturers.

Conclusion

This thesis delved into the realm of design in Uruguay, and particularly its relationship with the furniture sector, to comprehend how to strengthen the collaboration between design studios and furniture producers.

As a result, *EnCo*, a tool, was created to bridge the existing gap between designers and manufacturing companies, a divide identified throughout the research. The objective was to foster genuine integration and mutual respect of each other's work, by facilitating the negotiation process and knowledge integration between the parties.

The research process involved understanding the design landscape in Uruguay, exploring the dynamics between designers and manufacturing companies, and formulating strategies to strengthen the collaboration. Interviews with designers and furniture manufacturers provided insights, leading to the design and testing of a tool aimed at guiding the decision-making process and integrating both perspectives during productive visits.

While recognizing that a tool alone cannot solve all the collaboration challenges, it represents an initial step toward comprehending the Uruguayan context and proposing solutions adapted to this environment. The goal is to encourage further exploration of collaboration between designers and manufacturing companies in Uruguay, inspiring designers to formulate strategies for connection and facilitating better understanding of design practices by manufacturers. The aspiration is for this research not to exist in isolation but to contribute to minimising the gap between the scientific sector and the productive system.

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Annex I: Tool

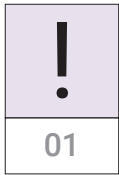# Enclosing Collaboration - EnCo

Once the product is ready to produce, it is time to share the drawings and start to define details.

You identified what to highlight and discuss during the productive meeting, and this will guide the conversation. Remember that technical drawings may need additional explanations to clarify critical points.

The aim is to co-create innovative and feasible solutions in a rapid and organise way. So it enables to quickly move through various points and establish shared understanding.

How to use it

Use the technical drawings of the project to identify critical points, which are divided into three distinct categories:
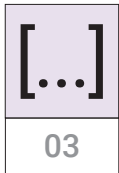
!	**Be careful !**
01	Fixed Parts: There are aspects that serves as constraints for the project and must remain unchanged.

?	**What can be done ?**
02	Discussion Points: Identify areas that require in-depth discussion and collaborative solutions.

[...]	**[As you prefer]**
03	Delegated Decisions: Pinpoints parts that can be delegated to the other party for decision-making.

After assigning a category to each point, a number should be assigned to each icon in order to organize the discussion, progressing from the most general to the most specific.

During the meeting, these codes will serve as conversation starters to guide the discussion. As each topic is discussed, record the collective conclusions for each point in the worksheet, either through written notes or drawings, to document the conversation effectively.

What Next?

After the meeting concludes, the information gathered in the worksheet should be shared among the participants. The decisions made and the data discussed during the meeting serve as valuable information for the manufacturing of the product.

Enclosing Collaboration - EnCo

Project   Date

Part / Component

Part / Component

Part / Component

Annex II: Script interviews

1st Interview

Participant: Carlo Nicola.
Interview platform: Google Meet
Date: 26-05-2023

Objectives: To have a comprehensive perspective on Industrial Design in Uruguay and explore the relationship between design and manufacturing companies.

Script

Introduction:
I am working on the thesis of my master programme. The aim is to strengthen the collaboration between manufacturing companies and designers, in Uruguay. For this reason, I contacted you in order to understand better the actual situation in the country and know your experience working on the sector.

Questionnaire:

About the actual situation:
- Which are the roles of the designers nowadays in Uruguay?
- Share the map of the design, this scheme has all the companies' members of the CDU and the role that they have during the design process. Do you agree with it? Why (not)?
- Which are the sectors in which product designers have influence/work?
- In my opinion, furniture is the sector that product designers have more influence in Uruguay nowadays, do you agree? Why? Which are others sectors that can be develop?
- Which is your opinion about manufacturing companies in Uruguay and

their relationship with the design? Do you know the opinion of the manufacturing companies about the implementation of design in the company? And specifically during the NPD?

Definition of collaborative design:

"Collaborative design is the process in which actors from different disciplines share their knowledge about both the design process and the design content. They do that in order to create shared understanding on both aspects, to be able to integrate and explore their knowledge and to achieve the larger common objective: the new product to be designed." (Kleinsmann, 2006, p. 30)

According with the definition there are 3 building blocks:
* Knowledge creation and integration between different disciplines
* Communication between the actors
* Creation of shared understanding about design content and design practice

* How do you think that is the collaboration between designers and manufacturing companies from these 3 different points?
* Do you think that the lack of shared mental models can be a problem in the collaboration during NPD, between designers and manufacturing companies?
* Are there institutions or programmes that collaborate in the contact between both parts?
* Do you know the program "Impulsa+Diseño" developed between CDU and ANNI? If yes, do you know the result of the implementation?

Personal Experience
* Which are the different service that you and Agustin offer in your studio?
* How is your experience, as a designer, advising companies?
* What kind of companies contact you?
* How is the process when you work advising companies? Do you think that the designer has a role of facilitator, supporting team interaction and arranging team's cooperation?
* Which is the easiest part about the collaboration with manufacturing companies?
* Which are the challenges of working with manufacturing companies?
* Have you ever use a tool to facilitate the understanding? Do you use or

know any software that facilitates the collaboration?

Future
* In your opinion, which are the challenges for the designers in the future in Uruguay?
* Which should be the ideal way to align shared understanding between designers and manufacturing companies?

2nd Interview

Participant: Carlo Nicola.
Interview platform: Google Meet
Date: 21-06-2023

Objectives: To better understand the working process between furniture designers and manufacturers in Uruguay.

Script

Introduction:
The focus of the research will be on the relationship between the furniture designer and the furniture manufacturer (carpenter) and on how to create shared understanding. In other words, the idea is to enhance collaboration between designers and carpenters, particularly emphasizing mutual understanding between the parties. So, I wanted to ask you some questions to better understand how the interaction takes place.

Questionnaire:

Relationship with manufacturers

- Is it more common for the designer to contact the manufacturer, or does it sometimes happen the other way around?

- What is your opinion on the relationship where the designer approaches a manufacturer and asks them to produce their product? Do you consider it ideal?

- In the previous interview, you mentioned strategies for approaching the manufacturer without offending them. Can you share what those strategies are?

Journey Map Questions:

Can we discuss a case (not necessarily 100% real, it can be representative) where the designer interacts with the manufacturer? Describe the entire process of the relationship with the manufacturer at all stages:

- They approach the manufacturer with a not yet finalized idea to explore production possibilities.

- They present the proposal for a budget.

- Manufacturers provide a budget.

- Details are adjusted together (to what level of detail?).

- Designers present adjustments again.

- Manufacturers present prototypes or samples. Details are decided (does the designer generally have the final say since they are the ones contracting the service?).

- The finished project is delivered.

Details to explore:

- Stages, location or medium of the encounter, documents used.

- Moments of tension, problems, the nature of the relationship.

- How could the process be more collaborative? Is collaboration more prevalent in some cases than others?

Identifying Mental Models:

- Can you identify any mental models that are different between manufacturers and designers that hinder collaboration between the two?

- What negative preconceptions do designers have about manufacturers, and vice versa?

- Do you think the collaborative working process is more akin to rational decision-making or a negotiation process?

3rd Interview

Participant: Pablo Ferrer from Zona M
Interview platform: Google Meet
Date: 11-07-2023

Objectives: To comprehend the work process from the manufacturer's perspective and understand potential difficulties in collaboration.

Script

Introduction:

I am an industrial designer, graduated from the *Centro de diseño*, and completed the furniture design postgraduate program at the Faculty of Architecture, where we visited your workshop. I also worked for 7 years at Heber Coitinhio's carpentry (Mundomadera).

Currently, I am finishing a master's degree in design and engineering, focusing on a thesis that initially investigated the state of design in Uruguay and evolved towards the collaboration between designers and furniture manufacturers, specifically examining how the exchange between both parties occurs.

Questionnaire:

Carpentry

- How is your team composed?
- Who are your clients? End consumers, architects, designers (with whom you work more)?
- Do you have your own product line, or do you specialize in producing projects when contracted? If yes, how does it work? If no, why not?
- What are your thoughts on the market logic where carpentry shops produce on a project basis?

Regarding Collaboration:

- How is the working process with a designer?
- Do they contact you first to do a job and then meet with the designer to get to know them and show them the workshop?
  - How is that initial exchange?

- Are there signals you look for to understand how they work?
- Provide a quote for the job
  - What is the quoting process like?
  - Do you use any software or formulas for quoting?
  - Do you generally understand the drawings, or are there missing details?
- Productive meeting
  - After confirming the job, do you have an in-person meeting?
  - Are some technical aspects negotiated?
  - Do you encounter difficulties interpreting the drawings they provide? Why?
- During production
  - How is communication? Are you contacted if an issue arises? Do they send photos? Do you coordinate visits to the workshop?
  - Do you redraw? Do you have any software for carpentry?
  - Are there internal discussions to decide how to produce particularly unusual parts?
- Delivery
  - Are there any challenging moments during this stage?
  - Do tensions arise?

- In your opinion, what is the most challenging moment in this process?
- Where can misunderstandings occur the most?
- Do you think there are factors that hinder the exchange with designers? What are they? Why do you think these barriers exist?
- Do you think there are factors that facilitate teamwork? What are they?
- Do you think that sometimes designers come with ideas on how to manufacture that are not the most suitable for the production reality? How is that negotiation? What is the willingness for exchange?
- Do you think that sometimes designers come to disturb or propose ideas that change the production logic of the workshop? On the other hand, is there some resistance to change from carpentry shops?
- Do you think there are negative preconceptions about working with designers?
- Do you think designers have negative preconceptions about carpenters and how they work?

4th Interview

Participant: Heber Coitinho from Mundomadera
Interview platform: Google Meet
Date: 19-07-2023

Objectives: To comprehend the work process from the manufacturer's perspective and understand potential difficulties in collaboration.

Script

Introduction:
I am working on a thesis that examining the collaboration between designers and furniture manufacturers, specifically focusing on how the exchange between both parties takes place.

Questionnaire:

Overview of Carpentries in Uruguay:

- Do you have an estimate of how many carpentries operate in Uruguay? How many of them have greater capacity or are more professionalized (not just individual carpenters but those with administrative and design personnel)?

- Do you believe there are different types of carpentries? What are the characteristics of each group, and what types of work do they typically undertake?

- Is it possible, in your opinion, for carpentries to have their own product lines? Why?

- Do you think the fact that most carpentry shop owners are directly involved influences the made-to-order work model?

- Is carpentry the craft for producing products that has developed the most in Uruguay? Any theories? For example, are there other crafts like metalworking or upholstery, but the development of the craft is much lower?

- How would you describe the relationship between designers and carpenters?

Collaborative Work Process:

[Show the map of the collaboration]

- Do you agree with this map?

- What is the most challenging/critical moment for carpenters?

- Where can misunderstandings arise?

- What aspects hinder collaborative work during the definition of detail visits? Why?

- What aspects help improve collaborative work? Why?

- Thinking about the last meeting of this nature (productive meeting with a designer client), were there any issues with understanding?

- Do you think there are factors that hinder the exchange with designers? What are they, and why do you think these barriers exist?

- Do you think there are factors that facilitate collaborative work? What are they?

- Do you think that sometimes designers come with ideas on how to manufacture that are not the most suitable for the production reality? How is that negotiation? What is the willingness for exchange?

- Do you think that sometimes designers come to disrupt or propose ideas that change the productive logic of the workshop? On the other hand, is there some resistance to change from carpentry shops?

- Do you believe there are negative preconceptions about working with designers?

- Do you think designers have negative preconceptions about carpenters and how they work?

5th Interview

Participant: Carlo Nicola
Interview platform: Google Meet
Date: 03-08-2023

Objectives: To verify the map of the collaboration and the schemes of the collaboration.

Script

Introduction:
Based on our discussions, along with Pablo and Heber, I created a map outlining the entire collaboration process. I wanted to show it to you to get your opinion on the completed map.

Questionnaire:

Map of the collaboration

[Show the map of the collaboration]

- Do you agree with the entire process?
- The most challenging part for carpenters is the quoting. What are your thoughts?
- Do you agree that the productive visit is the most crucial part for knowledge integration?
- Do you feel that something is missing?

Challenges of the collaboration

[Show the diagram of barriers, enablers, and the importance of challenges in collaboration.]

- What do you think? Do you find the concepts appropriate based on your experience in the sector?
- The majority of the problems seem to revolve around the experience of working together; do you agree?
- Do you think all carpentry shops have different ways of working, or can it be generalized that all workers operate in the same way

6th Interview

Participant: Carlo Nicola
Interview platform: Google Meet
Date: 06-10-2023

Objectives: Show the tool developed

Script

Questionnaire:

Tool presentation

[Present the tool]

- What is your opinion on the meeting documentation process?
- How do you use technical drawings?
- What do you think about it being on paper?
- What is your opinion on the digitalization of the tool? Do you think it would be easy for manufacturers to adapt?
- Do you think it could be adapted to an existing digital platform?
- Do you think it could be tested in one of your projects?

8th Interview

Participant: Carlo Nicola
Interview platform: Google Meet
Date: 08-11-2023

Objectives: Show the tool developed and verify it.

Script

Questionnaire:

Tool verification:
- How well do you think the tool meets the initially established requirements?
  - Simplicity for understanding and implementation.
  - Flexibility to discuss different aspects of the project.
  - Allowing both parties to have a broad view of the project.
  - Integrating the producer into the process.
- Which aspect of the tool do you find most useful?
- What would be the most challenging aspect to implement?
- What opportunities for improvement do you see for the tool?
- Regarding a project you have recently developed:
  - Do you think the tool could have been implemented?
  - Could the aspects discussed in the meeting have been categorized into any of these criteria?
  - In what aspects could it have been helpful?

9th Interview

Participant: Pablo Ferrer and Heber Coitinho. The interviews were conducted individually.
Interview platform: Google Meet
Date: 09-11-2023

Objectives: Show the tool developed and verify it.

Script

Questionnaire:

Tool verification

[Present the tool]
- Do you find it simple to understand and implement?
- Do you think this meeting organization allows for a comprehensive view of the entire project?
- What is your opinion on the three categories to divide the topics to be discussed?
- Do you think the tool could be implemented in a project?
- What would be the most challenging aspect to implement?
- Which aspect of the tool do you find most useful?
- Do you think the tool could be used digitally?
- What opportunities for improvement do you see for the tool?