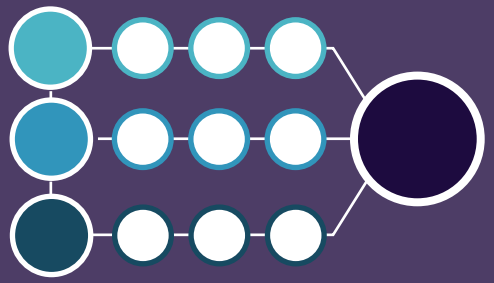

Collaboration in healthcare:

Building effective transdisciplinary collaborations in open innovation initiatives

Master thesis
Regina Morán Reséndiz
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Preface from UIDT

This graduation project presents a comparative study between practices in the Netherlands and Mexico in open innovation initiatives in healthcare. This study helps us identify the factors needed to improve collaborations between actors from different disciplines. By exploring how open innovation initiatives in the Netherlands work, we can compare and identify what can we learn from those initiatives and the other way around, what can we add to them.

The Research and Technological Development Unit (UIDT, from Spanish) at the General Hospital of Mexico “Eduardo Liceaga” (HGMEL, from Spanish) was established in collaboration with the Applied Sciences and Technology Institute (ICAT, from Spanish) which belongs to the National Autonomous University of Mexico (UNAM, from Spanish) in 2012.

Eight years have passed since the unit started, during which it has achieved relevant contributions in biomedicine and biotechnology. Actors (e.g. researchers, physicians, students) from different disciplines like medicine, science, physics, and design, collaborate in this unit.

Currently, there are still some challenges to solve. For instance, the unit has the desire to increase and improve the collaboration between actors while delivering high standard results. The challenge is to find the best way to way to do it, and here is where design can play a role.

Hence, this study is composed by a series of reunions, calls and collaborative sessions with multiple actors from the unit. This research contributes to having a better understanding of how the unit is working and which are the barriers and enablers present.

The results present a strategy to help the unit build effective collaborations between actors. It consists of three strategic lines and a series of steps to guide the actors to the desired future vision. The aim is that this strategy gets implemented to help consolidate the unit and build effective transdisciplinary collaboration inside UIDT.

Dr. Raúl Serrano Loyola
Deputy General Director

Dr. Crescencio García Segundo
Full Researcher at ICAT

M.A. Vanessa Satele Gunther
Full Professor at CIDI

Entrance to the General Hospital of Mexico ‘Eduardo Liceaga’

Executive Summary

Emerging diseases like the current pandemic, COVID-19, and the increasing number of chronic diseases around the world are putting considerable pressure on the healthcare system, demanding for more services, with higher quality and more efficient. Hence the healthcare system needs to transition towards sustainable healthcare.

An approach to achieve a transition towards sustainable healthcare is the Quadruple Aim. It is a practical framework that focuses on improving the health of the population, improving the work-life of care providers, enhancing patients experience and reducing health cost. To implement these four aims, it is necessary the collaboration between multiple disciplines and the implementation of an innovative approach.

Open innovation provides a space for transdisciplinary collaboration and innovation to occurs. Hence, this graduation project explores transdisciplinary collaborations in the healthcare sector, focusing on open innovation initiatives. The research question for this study is *how to build effective transdisciplinary collaborations in healthcare?*

This graduation project took place in two countries, the Netherlands and Mexico. In the Netherlands, I realised interview research in eight open innovation initiatives. Later, in Mexico, I did a case study at the Research and Technological Development Unit inside the General Hospital of Mexico 'Eduardo Liceaga'. Afterwards, I realised a comparative analysis between both studies, followed by a design phase to build effective transdisciplinary collaborations in healthcare.

The results of the two studies present a future vision and a future-oriented strategy for the Research and Technological Development Unit to improve collaboration between actors. The future vision contributes to the alignment of the actors involved in the unit so that they can work in the same direction.

The strategy is formed by three strategic lines: organisational and project development support, building a knowledge community, and promote and consolidate the unit. These strategic lines aim to guide the actors towards the future vision by suggesting a series of steps. The success of this initiative could contribute to boost innovation in healthcare. A suggestion for future research is on how design can facilitate the implementation of the strategy by considering the collaboration of all the actors present in the unit.

Abbreviations

AR	Augmented Reality
CIDI	Centre of Research in Industrial Design
COFEPRIS	Federal Commission for Protection against Health Risks
CONACYT	National Council for Science and Technology
HC / HCD	Human-centred approach or Human Centred Design
HGMEL	General Hospital of Mexico “Eduardo Liceaga”
ICAT	Applied Sciences and Technological Development Center
JART	Journal of Applied Research and Technology
MX	Mexico
NL	Netherlands
PM	Project Manager
UIDT	Research and Technological Development Unit
UNAM	National Autonomous University of Mexico
VR	Virtual Reality

Reading guide

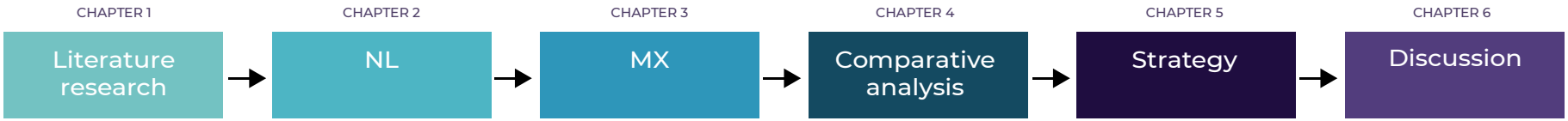

Figure 0.1 Chapters included in this report

This report consists of six chapters, starting with the literature research and project approach (see Figure 0.1). Each chapter describes the purpose at the beginning. Then, the introduction includes the research sub-questions (from Chapter 2 to 5) and an overview of the process for each chapter.

Afterwards, each chapter includes methods, outcomes, and discussion. At the end of the chapter, I briefly explain the takeaways.

For a quick read of this thesis, follow Chapter introductions, you can easily identify them because the whole page has a coloured background. The quotes expressed by the actors are in boxes in dark green (see Figure 0.2). Finally, look for the takeaways at the end of each chapter (see Figure 0.3). All the takeaway boxes have an orange frame. You can also detect the outcomes by identifying the highlights in orange for titles and visuals.

TAKEAWAYS FROM CHAPTER 1

- Healthcare systems around the world are under pressure and need to be transformed. The Quadruple Aim is a framework suggested to transition to a sustainable healthcare system by improving the health of the population, improving the work-life of care providers, enhancing patients experience and reducing health cost.
- For the implementation of the Quadruple Aim, transdisciplinary collaborations and innovation are necessary.
- Open innovation initiatives provide spaces to build transdisciplinary collaborations and innovate by sharing knowledge and learning from others.

Figure 0.3 Example of takeaways in Chapter 1

'Because we do not have shared projects, there is not a sense of community. There is not a structure that guides us in the same direction.'

- Full Researcher at ICAT

Figure 0.2 Example of quotes expressed by actors during the interviews

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CHAPTER 1

Literature Research and Project Context

This chapter aims to explain the challenges the healthcare systems are facing and some relevant concepts used for this graduation project. Besides, it describes the context where the studies take place, open innovation initiatives in healthcare. I start the chapter by introducing the challenges in healthcare and introducing innovation and transdisciplinary collaborations as approaches to transitions towards sustainable healthcare. Then I describe the approach I took for this graduation project and present the organisations involved.

1.1 Pressure on the healthcare systems

The increasing complexity around the world is changing the way we interact with people, the way we work at organisations, and the way systems around the world operate. Besides, complex problems are continually emerging. These problems are deeply embedded in our society where diverse actors are involved, and a variety of interests coexist (Rotmans & Loorbach, 2009).

Multiple problems are present in different sectors, like finance, agriculture, education, and health. In the health sector, the world is currently facing a 'historical challenge', as Hamblin published in The Atlantic (2020) referring to the COVID-19 pandemic we are facing.

Besides this pandemic, emerging diseases and the increasing number of chronic diseases around the world are putting considerable pressure on the healthcare system; demanding more services, with higher quality and more efficient. For example, hospitals in Spain have been forced to implement telehealth monitoring in a time frame of two weeks due to COVID-19 (Bau, 2020). This example demonstrates how the cost of care is continuously increasing, and it is turning to be unsustainable (Porter & Lee, 2013).

Additionally, in Latin America and the Caribbean, the ageing process of the population is accelerating. For instance, in Chile, the number of adults over 65 will double in the coming 20 years. The problem is that people over 65 require more care services, resulting in higher demand for care professionals (Cruz-Aguayo et al., 2018).

Each country is trying to tackle these challenges in a different way. There is a big difference in how emerging countries and developed countries are innovating and planning the future of their healthcare services; for instance, Mexico and the Netherlands. Challenges in Latin America differ from challenges in Europe or Asia. In most cases, Latin America has a larger population, less economic resources and more fragile health systems. Therefore, scientists and medical providers are constantly challenged to develop solutions for complex problems with fewer resources.

1. 2 Approaches to sustainable healthcare

Due to these challenges, scholars suggest approaches to a sustainable transition in healthcare. The concept of value-based care presents an opportunity of transforming the healthcare system by providing value for patients at a lower cost (Porter & Teisberg, 2006).

Based on this concept, value-based care, a practical framework called the Quadruple Aim was defined. It is a framework that suggests four aims to transition towards a sustainable healthcare system. The four aims

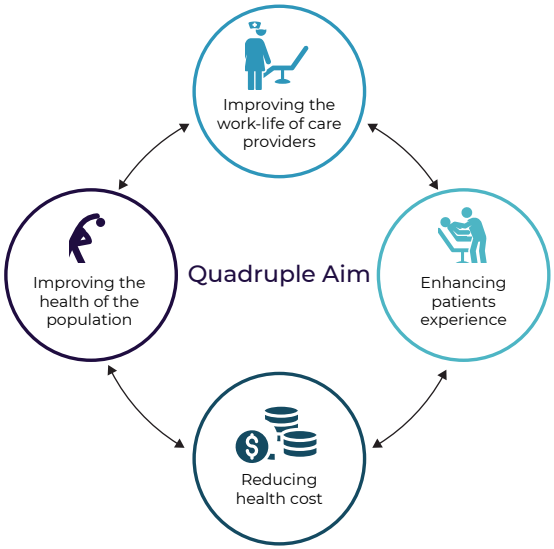


Figure 1.1 The Quadruple Aim (adapted from Rupp, 2018)

are, improving the health of the population, improving the work-life of care providers, enhancing patients experience and reducing health cost (DiMatteo et al., 1993; Pannunzio, Kleinsmann, & Snelders, 2019; Porter & Kramer, 2011) (see Figure 1.1).

The implementation of the Quadruple Aim is challenging for health providers because they need to balance between their daily tasks and the implementation of the four aims. Therefore, they need support from other disciplines to implement the four aims. For example, in the USA, Information Technology professionals have contributed to enhancing patients experience by providing telehealth solutions during this pandemic (COVID-19). However, this contribution has demanded to double the number of Information Technology professionals at Geisinger, a healthcare provider in the USA (Padmanabhan, 2020).

To implement the Quadruple Aim, innovation and transdisciplinary collaborations could play an important role. Multiple disciplines need to collaborate to meet the demands the healthcare systems face (Choi & Pak, 2006). For instance, multiple actors can contribute with their perspectives to explore different approaches and suggest novel solutions for the implementation of the Quadruple Aim. In the following lines, I will introduce innovation and transdisciplinary collaborations in healthcare.

1.3 The role of innovation in healthcare

Innovation initiatives in the health sector experience some challenges to generate outcomes that impact and contribute to the health sector. Some reasons for failure could be government regulations, technologies that do not work as expected and lousy management decisions (Jackson, 2015).

Another problem is that the implementation of innovations in the health care sector is slower in comparison to other sectors (Berwick, 2003; Herzlinger, 2006; Porter & Teisberg, 2006). Therefore, stakeholders often find it frustrating and difficult to innovate in healthcare

(Boru, Smulders, Joore, and Dijkstra 2015).

Barriers change from country to country. As mentioned above, in an emergent economy like Mexico, the main barriers are related to fragmentation, non-compliance with regulations and financial limitations (Pérez-Orive & Ibarra Ponce de León, 2019). In the Mexican healthcare sector, there are significant lags regarding innovation.

According to the Science, Technology and Innovation Indicators, Mexico is placed below other emergent economies like Brazil and Argentina. Most of the advances in public health, resulting in new products and services, are a result of scientific research. However, there is a lack of communication and collaboration between the scientific world and private companies.

In the Netherlands, the challenges are different. According to the Euro Health Index, the Dutch healthcare system is located among the top healthcare systems in the world due to its accessibility, the rights of patients and the outcome of care (Faber, van Geenhuizen, & de Reuver, 2017; Gerrits, 2019).

In the Netherlands, professionals rely on evidence and expert advice for decision-making; hence, healthcare research is well developed (Kroneman et al., 2016). However, they face some challenges like inequality. Less well-educated people are more likely to be less healthy than people with a higher level of education (Kroneman et al., 2016).

Regarding technology, the Netherlands is working towards the implementation of eHealth. Hospitals and health organisations still need to develop strategies to implement eHealth solutions successfully (S. R. Faber, 2014). Existing initiatives, like the National eHealth Living Lab (NeLL), explore the implementation of eHealth through scientific research, validation and evaluation (Medical Delta, n.d.).

Some barriers for implementation of e-health solutions are cost, organisational structures and professional resistance (Wildevuur, Dijk, Hammer-Jakobsen, & Äyväri, 2015). Hence, the adequate technical infrastructure is necessary to function. Besides, health providers must be convinced of the positive impact of eHealth to be willing to collaborate (Faber, van Geenhuizen, & de Reuver, 2017).

In the current pandemic we are living, COVID-19, people around the world are waiting for the cure to get ‘back to normal’. However, in the mid-time, hospitals are overcrowded, and health professionals are saturated with high workload demand. For instance, one challenge hospitals are facing is to reduce the number of patients in hospitals and provide support health providers. Therefore, to be able to realise a fundamental change in healthcare, innovation can be a critical factor (Janssen & Moors,

2013).

For years, innovation in healthcare had focused mainly on the treatment and the treatment regimes for patients (Mark & Snowden, 2006). For instance, as mentioned above, finding a cure for COVID-19 or developing low-cost ventilators for COVID-19 patients (Dong, Hu, & Gao, 2020; Gao, Tian, & Yang, 2020). However, innovation in healthcare goes beyond treatments and technological developments.

The innovation can contribute to the implementation of the Quadruple Aim at the organisational and systemic level. For example, to explore possibilities that reduce service cost or to provide a better experience to patients. Designers could contribute by understanding why things are the way they are and explore new approaches.

Although the challenges present in both countries are different, in both cases, an approach to deal with those challenges could be by collaborating with stakeholders and multiple disciplines to support each other and explore new possibilities together.

1.4 Effective transdisciplinary collaborations

The health systems are composed of multiple organisations (e.g. hospitals, clinics, pharmaceutical companies, insurance companies, and governments). An organisation is described as an open system that interacts with its environment (Vega González & García-Segundo, 2019); it is formed by people, structures, resources and purpose to accomplish their goals (Junginger, 2008). For instance, in healthcare, the goal for care providers is to improve the health of the population (Pannunzio et al., 2019), which is one of the four aims.

When we think about hospitals, we tend to think of physicians and nurses; however, professionals with different disciplines collaborate in health organisations like administratives and project managers.

Transdisciplinary collaboration refers to a collaborative effort where it is not possible to identify individual efforts (Choi & Pak, 2006). It is like a cake, where the result is quite different from the initial ingredients. It transcends disciplines to look at the system dynamics and form new knowledge (Soskolne, 2000; in Choi & Pak, 2006).

These type of collaborations are an opportunity to learn from many disciplines by sharing methods and principles that can be adopted and adapted to complex challenges (Dorst, 2018). Transdisciplinarity is about learning and sharing.

In healthcare, transdisciplinary collaborations should be promoted

to combine scientific knowledge with commercial outcomes (Pérez-Orive & Ibarra Ponce de León, 2019). Furthermore, the collaboration is not only among professionals from multiple disciplines working together, but it is also across organisations. For instance, a university collaborates with a hospital to achieve efficiency and develop technology (Valkengurb, 2000; in Kleinsmann, 2006; Vega González & García-Segundo, 2019).

A model called the Quadruple Helix suggests that the collaboration between citizens, government, academia, and commercial parties generate an innovation system (Carayannis & Campbell, 2009). Collaboration is a shared process in which a group of people work together. However, when multiple people work together, they face difficulties. Choi & Pak (2006) defined some enablers for team success and some barriers to collaborate (see Table 1.1).

Table 1.1. Barriers and enablers to collaborate (Choi & Pak, 2006)

Barriers	Enablers
Poor selection of disciplines	Good team leaders
Poor selection of team members	Maturity
Poor process of team functioning	Flexibility of team members
Lack of proper measures to evaluate the success of the work	Personal commitment
Lack of guidelines for multiple authorship in research publications	Physical proximity of team members
Language problems	Internet and email as supporting platform
Lack of time	Incentives
Lack of funding	Institutional support
Institutional constraints	Changes in the workplace
Discipline conflicts	Common goal
Team conflicts	Shared vision
Lack of communication between disciplines	Clarity and rotation of roles
Unequal power among disciplines	Communication
	Constructive comments among team members

Table 1.2 Research question and sub-questions ›

Additionally, Kleinsmann (2006) suggests that to be able to understand the context of the collaboration, the barriers and enablers are located in three organisational levels; the organisation, the project and the actor level (see Figure 1.2).

The organisation level deals with how the company develop and organises its projects and apply its resources. The project-level focus on planning and monitoring, and the actor level refers to the collaboration between two actors (Kleinsmann, 2006). For this thesis, the word 'actor' refers to all the professionals that belong to an open innovation initiative.

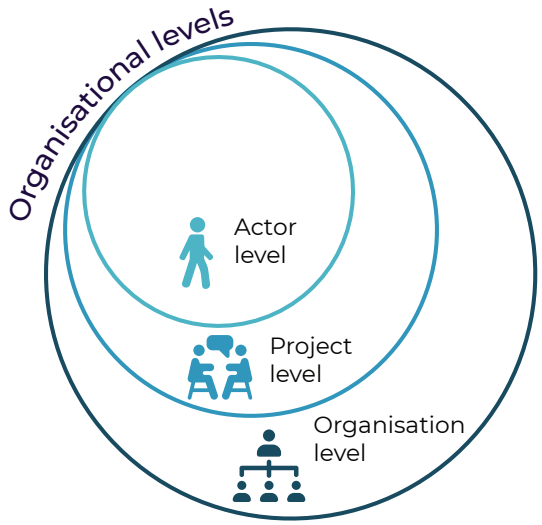


Figure 1.2 Diagram of organisational levels

Some factors in building successful collaborations refer to the use of the 'right language' to reduce confusion and facilitate collaboration. Additionally, creating spaces for dialogue and conversation allow actors to think together (Bradbury & Mainemelis, 2001; Kaats y Opheij, 2014).

Effective collaboration refers to a group of people that not only focus on individual benefits but works together towards collective success (Head, 2003). In Mexico, collaboration in healthcare can contribute to deal with the current fragmented system. While in the Netherlands, the collaboration between multiple organisations and disciplines can help them implement eHealth solutions successfully.

The collaboration between multiple disciplines in the health sector provides opportunities to integrate different perspectives of actors within organisations to boost innovation across organisations to tackle societal challenges. Hence, this graduation project explores existing factors to build effective transdisciplinary collaborations in healthcare.

1.5 Open innovation in healthcare

In recent years, the term open innovation has been popularised, and with this, multiple open innovation initiatives have emerged globally. Open innovation consists of multiple disciplines and organisations working together to solve complex challenges and innovate (Bergema, Kleinsmann,

Research question

How to build effective transdisciplinary collaborations in healthcare?

CHAPTER 2

NL

a. Who are the stakeholders present in open innovation initiatives in the Netherlands?

b. Which are the conditions needed for open innovation initiatives to operate?

c. Which are the barriers and enablers present in open innovation initiatives in the Netherlands?

CHAPTER 3

MX

a. What are the differences and similarities between health open innovation initiatives in Mexico and the Netherlands?

b. How are barriers and enablers present in health open innovation initiatives in Mexico and the Netherlands?

c. What factors contribute to build-ing effective transdisciplinary col-laborations in healthcare?

CHAPTER 4

Comparative analysis

a. Who are the stakeholders present in the unit?

b. How does UIDT operate?

c. Which are the barriers and enablers that have a significant impact on the actors?

CHAPTER 5

Strategy

a. Which are the possible directions to contribute at UIDT?

b. How to design an intervention to build effective transdisciplinary collaborations inside the unit?

** The original brief was modified due to COVID-19 (original brief in Appendix A). The method proposed for field research, Learning History Method, was not used as it was not possible to visit the hospital. However, the scope and outcome of the project are still in alignment with the original brief.*

Figure 1.3 Overview of the method and outcomes

de Bont, & Valkenburg, 2011). Besides, it consists of opening up traditionally closed innovation processes towards multiple actors (Bullinger et al., 2012).

There are different types of open innovation initiatives. For example, 'Innovation Labs', 'Biotech Spaces', and 'Collaborative Networks'. Innovation Labs focus on tackling complex societal challenges with an innovative approach that results in an innovative outcome (Brankaert & den Ouden, 2017). Biotech Spaces or Biotech Hubs provide space and equipment for startups or different initiatives to accelerate their development process (Ledford, 2015). Finally, Collaborative Networks refer to organisations and actors collaborating to achieve goals they would not be able to reach individually (Camarinha-Matos & Afsarmanesh, 2005).

Open innovation initiatives provide a suitable space to boost transdisciplinary collaborations. In healthcare, open innovation practices lead to exciting innovation outcomes. For example, different organisations and disciplines working together to create an affordable vaccine for COVID-19.

However, the collaboration between different actors and stakeholders is complex and also brings new challenges. Hence, in this graduation project I explore how to build effective collaborations in healthcare.

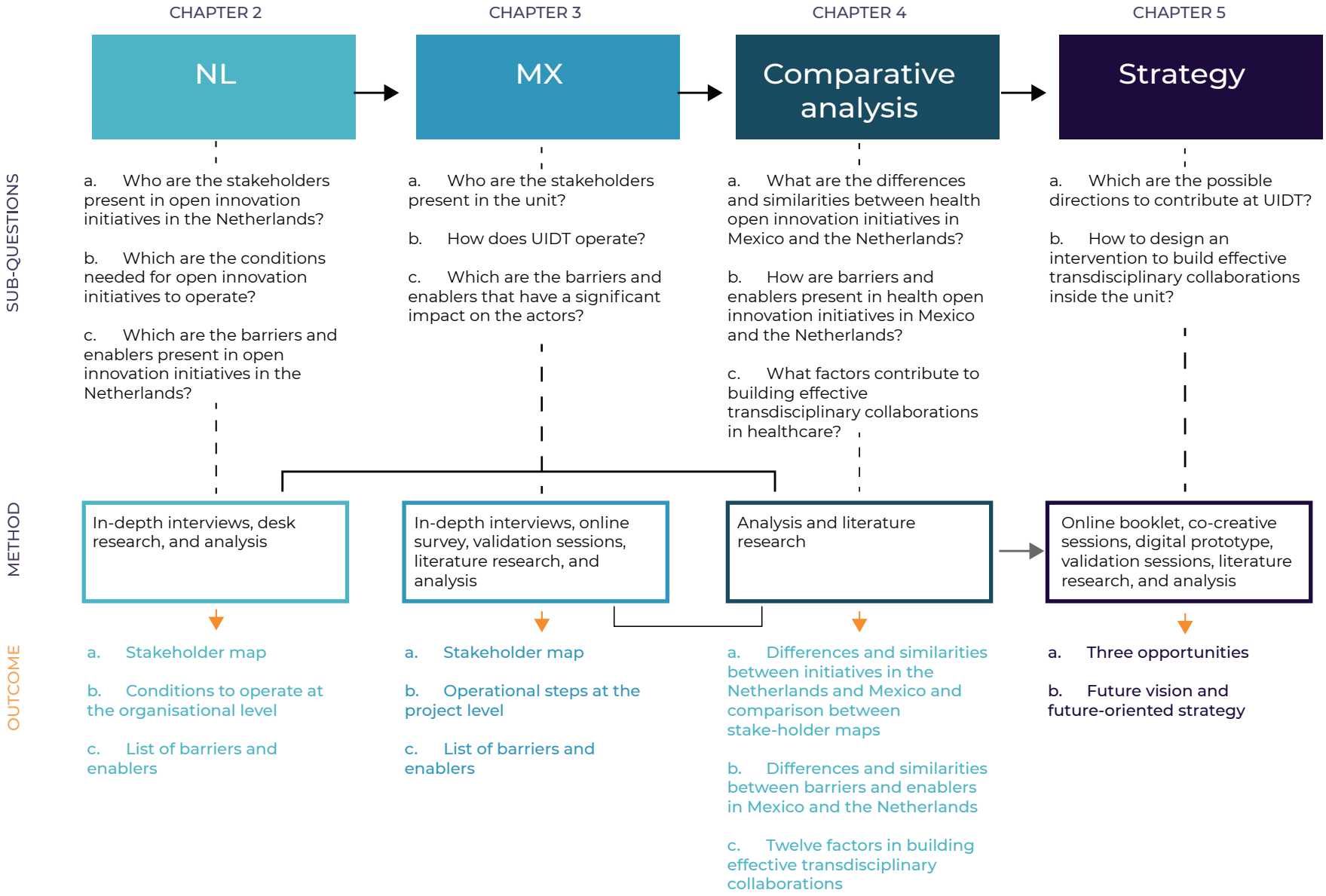
1.6 Project approach

This graduation project explores transdisciplinary collaborations in the healthcare sector, focusing on open innovation initiatives in two countries, the Netherlands and Mexico.

The research question for this study is *how to build effective transdisciplinary collaborations in healthcare?* Four main phases form this research; interview research in the Netherlands (NL), a case study in Mexico (MX), a comparative analysis between countries, and a design phase to build effective collaborations at UIDT. For each phase, I defined different sub-questions (see Table 1.2).

This graduation project explores which are the barriers and enablers present in transdisciplinary collaborations. During the process, I used different research methods. For each sub-question, I defined an outcome (see Figure 1.3). For instance, for the study in the Netherlands, I did in-depth interviews and in Mexico, besides the interviews, I did an online survey and validation sessions.

From those studies I created stakeholder maps, I detected conditions to operate at the organisational level, operational steps at the project level, and I defined a list of barriers and enablers per study. Based on the insights obtained from


CHAPTER 2
CHAPTER 3
CHAPTER 4
CHAPTER 5
NL
MX
Comparative analysis
Strategy
SUB-QUESTIONS
a. Who are the stakeholders present in open innovation initiatives in the Netherlands?
b. Which are the conditions needed for open innovation initiatives to operate?
c. Which are the barriers and enablers present in open innovation initiatives in the Netherlands?
a. Who are the stakeholders present in the unit?
b. How does UIDT operate?
c. Which are the barriers and enablers that have a significant impact on the actors?
a. What are the differences and similarities between health open innovation initiatives in Mexico and the Netherlands?
b. How are barriers and enablers present in health open innovation initiatives in Mexico and the Netherlands?
c. What factors contribute to building effective transdisciplinary collaborations in healthcare?
a. Which are the possible directions to contribute at UIDT?
b. How to design an intervention to build effective transdisciplinary collaborations inside the unit?
METHOD
In-depth interviews, desk research, and analysis
In-depth interviews, online survey, validation sessions, literature research, and analysis
Analysis and literature research
Online booklet, co-creative sessions, digital prototype, validation sessions, literature research, and analysis
OUTCOME
a. Stakeholder map
b. Conditions to operate at the organisational level
c. List of barriers and enablers
a. Stakeholder map
b. Operational steps at the project level
c. List of barriers and enablers
a. Differences and similarities between initiatives in the Netherlands and Mexico and comparison between stake-holder maps
b. Differences and similarities between barriers and enablers in Mexico and the Netherlands
c. Twelve factors in building effective transdisciplinary collaborations
a. Three opportunities
b. Future vision and future-oriented strategy

both studies, I did a comparative analysis, and I defined a list of twelve factors for effective transdisciplinary collaborations. Finally, I analysed all the information collected and presented a future vision and a future-oriented strategy for the unit in Mexico (see Chapter 5).

1.7 Organisations present in the studies

The collaboration of multiple disciplines in healthcare can contribute to tackling challenges in a holistic way. Hence, this research centres around multiples disciplines working in the healthcare domain by realising two studies. The first one took place in the Netherlands and the second one in Mexico.

During the first study, I explored eight open innovation initiatives in different geographical regions of the Netherlands. The initiatives studied include 'Innovation Labs', 'Biotech Spaces', and 'Collaborative Networks', plus a Subsidy Programme.

The second study takes place in Mexico. In the Mexican healthcare context, open innovation initiatives are difficult to find due to the fragmentation in the health system. However, there are some efforts around the country to innovate in the health sector.

An example of an open innovation initiative in Mexico is the Research and Technological Development Unit (UIDT, from Spanish), where the case study takes place. UIDT locates in Mexico City at the General Hospital of Mexico' Eduardo Liceaga' (HGMEL, from Spanish). On 2012, the Applied Sciences and Technological Development Center (ICAT, from Spanish) at the National Autonomous University of Mexico (UNAM, from Spanish) and HGMEL formed a public-public collaboration agreement (Vega González & García-Segundo, 2019).

The UIDT has a physical space of 80 m2 at the hospital (see Figure 1.4) (Vega González & García-Segundo, 2019). By collaborating, researchers and students from ICAT have access to patients for the development and validation of concept testing, validation of technological prototypes, and clinical testing protocols. While medical providers from HGMEL, have access to qualified technical professionals capable of developing new instruments, diagnostic systems and software to provide service to patients and to support physicians (Vega González & García-Segundo, 2019).

The challenge is that researchers and medical providers need to find a balance between their activities (e.g. publishing and caring for patients) while at the same time they need to have the capacity to manage the complex relationships that emerge from the collaboration between

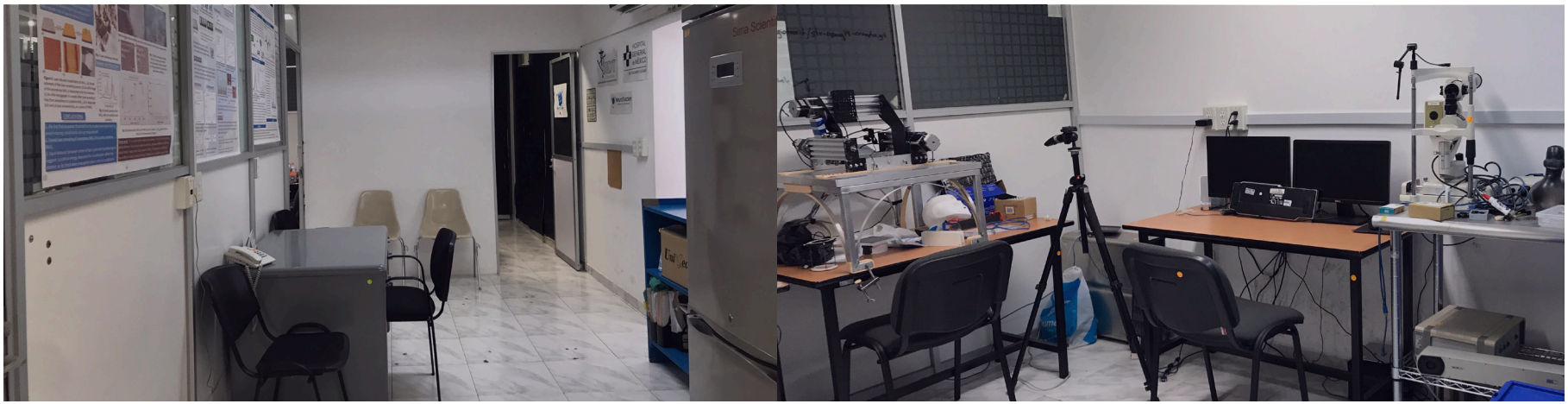


Figure 1.4 Interior of the UIDT

ICAT and HGMEL (Vega González & García-Segundo, 2019). Hence, my contribution aims to suggest a plan to improve collaboration among disciplines.

1.8 Design approach

For this graduation project, the aim is to define an innovation strategy to guide the unit in building transdisciplinary collaborations in healthcare. A strategy provides a plan towards a common goal, for example, a future vision. Having a future visions contributes to the alignment of actors, working in the same direction.

The design approach consists of a co-creative process to present an outcome aligned to their interests and needs. Co-creation places the actors collaborating in the process as real experts in their domain (Sanders & Stappers, 2018). Hence, the collaboration with the actors is constant throughout the process.

The goal is that the strategy supports directors in decision making. Hence it is vital to present a strategy that is desirable, feasible and viable for the unit. Desirable means something that meets the needs and wishes of the people. Feasibility consists of the capacity to implement the solution in a short or long term. Finally, viability means that the proposal could be sustained and generate value. Hence, it is important to define success factors to monitor the implementation (Calabretta, Gemser & Karpen 2018).

1.9
Discussion

Emerging diseases and the increasing number of chronic diseases around the world are putting considerable pressure on the healthcare system; demanding more services, with higher quality and more efficient. Hence, the healthcare system needs to transition towards a sustainable system.

The Quadruple Aim is a practical framework that helps organisations transition to a sustainable healthcare system by improving the health of the population, improving the work-life of care providers, enhancing patients experience and reducing health cost.

To be able to implement the Quadruple Aim, innovation and transdisciplinary collaborations could play a relevant role by integrating different points of view, encouraging collaboration between disciplines and working together towards innovative solutions in open innovation initiatives.

Open innovation consists of multiple disciplines and organisations working together to solve complex challenges and innovate. Besides, they provide spaces for sharing knowledge and learn from others. Hence, this graduation project explores how to build effective transdisciplinary collaborations in healthcare by realising studies in open innovation initiatives; an interview study in the Netherlands and a case study in Mexico.

TAKEAWAYS FROM CHAPTER 1

- Healthcare systems around the world are under pressure and need to be transformed. The Quadruple Aim is a framework suggested to transition to a sustainable healthcare system by improving the health of the population, improving the work-life of care providers, enhancing patients experience and reducing health cost.
- For the implementation of the Quadruple Aim, transdisciplinary collaborations and innovation are necessary.
- Open innovation initiatives provide spaces to build transdisciplinary collaborations and innovate by sharing knowledge and learning from others.

CHAPTER 2

Transdisciplinary Collaboration in the Netherlands: an Interview Study

The goal of this chapter is to understand who collaborates in the open innovation health initiatives in the interview study in the Netherlands, what are the conditions needed to operate, and the barriers and enablers that affect their collaboration (see Table 2.1). This chapter begins with a short introduction to the study. Then, an explanation to the research method, followed by the outcomes that respond to each sub-question; stakeholder maps, four conditions to operate and a list of barriers and enablers.

Table 2.1. Sub-questions for Chapter 2

a. Who are the stakeholders present in open innovation initiatives in the Netherlands?
b. Which are the conditions needed for open innovation initiatives to operate?
c. Which are the barriers and enablers present in open innovation initiatives in the Netherlands?

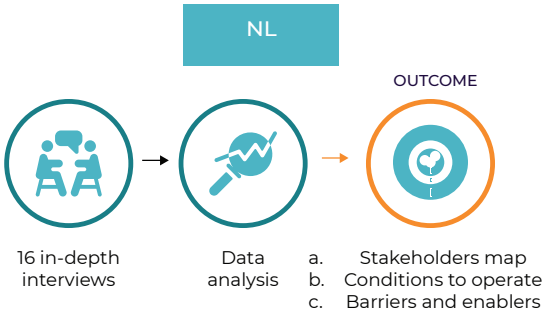


Figure 2.1 Process for Chapter 2

2.1 Introduction

For this phase, a study was realised in the Netherlands to explore transdisciplinary collaborations in open innovation health initiatives. The study includes three different types of open innovation initiatives: Innovation Labs, Collaborative Networks and Biotech Spaces. A total of eight different initiatives are part of this study, plus a Subsidy Programme. The initiatives locate in different geographical areas of the Netherlands.

To detect which actors and stakeholders are involved in open innovation health initiatives, I realised in-depth interviews. Then, the data was analysed to identify the stakeholders involved, the conditions to operate and the barriers and enablers at the initiatives (see Figure 2.1). As a result, I created a stakeholder map, I defined four conditions to operate at the organisational level, and a list of twelve barriers and twenty-one enablers.

2.2 Method

Table 2.2 Data summary

16 actors involved

METHOD

16 In-depth interviews

This study includes three different types of open innovation initiatives: Innovation Labs, Collaborative Networks and Biotech Spaces. A total of eight different initiatives were selected, employing purposive sampling. For each initiative, the purpose and the type of initiative were identified through desk research, filtering the descriptions with terms as 'innovation network', 'collective design', and 'biomedical co-work space'. Additionally, an overarching subsidy programme was included in the study.

METHOD

a) Stakeholders present in open innovation initiatives and conditions to operate

For this step, the aim was to explore who are present in the initiatives and how do they interact. A total of sixteen interviews were conducted (see Table 2.2, 2.3); fourteen semi-structured interviews and two informal interviews. The interviews explored the purpose of the initiative and the role of the actors within the initiative. I asked actors to share examples of how they work on a project and the challenges they face.

For each initiative, I interviewed one to three members with different roles and professional backgrounds to include different perspectives (Ravitch & Carl, 2015). The interviews lasted from 40 to 90 minutes. They were conducted face-to-face (seven), through video call (six), or via phone call (three). All interviews were audio-recorded and transcribed verbatim except for the two informal interviews. I triangulated the interview data through desk research mainly consisting of the consultation of the webpage for each initiative, reviewing news and online publications, and reading papers shared by interviewees.

The analytical lenses through which I analysed the data were 'who is present in the collaboration' and 'how do they collaborate'. For each interview, I selected all the quotes that referred to actors and stakeholders; in that way, I identified who is present in each initiative.

Then, for each initiative, the actors were clustered according to the institution they belong; for instance, a physician and a PhD belonged to a university medical centre. Those clusters were defined as stakeholders. I verified the information by contacting some actors again when I had doubts and by comparing the data with the web page of each initiative. As a result, I created a stakeholder map for each

Table 2.3. List of actors interviewed

Type of initiative	Role	Professional background
Innovation Labs		
Innovation Lab 1	Programme coordinator*	Industrial design engineering
	PhD researcher	Design for interaction
	PhD researcher	Industrial design
Innovation Lab 2	Director*	Medicine
	Scientific co-director	Civil engineering
Innovation Lab 3	Master student	Design for interaction
Innovation Lab 4	Designer and concept developer	Audiovisual and theatre
	Programme developer	Psychology
Biotech Space		
Biotech Space 1	Chief buisness officer	Biochemistry
Biotech Space 2	Director	Industrial engineering

This study was executed before the COVID-19 pandemic.

Type of initiative	Role	Professional background
Collaborative Network		
Collaborative Network 1	Innovation manager	Business information
	Innovation manager	Business innovation
Collaborative Ntework 2	PhD researcher	Medicine
	Medical specialist	Medicine
Subsidy Programme		
Biotech Space 2	Financial advisor	Social geography
	Project manager	Human geography

** Informal conversations*

initiative (see Figure 2.2).

In the maps, I did not use the proper names of the institutions to respect their privacy. I defined three levels for the stakeholders; at the centre, the founders of the initiative, followed by the stakeholders frequently collaborating with the initiative. At the external level, the stakeholders at the ecosystem level who have influence or have an impact on the initiative, although the interaction does not occur regularly.

I later compared, the initiatives with each other to identify the similarities and differences. First, I compared the stakeholders present at the founders level. I placed all the stakeholder maps next to each other and identified the similarities (see Figures 2.8, 2.9, 2.10). I counted how many times was the same type of stakeholder present at each level. For example, at the founders' level, a university of technology was present twice, and another university once.

I then clustered the stakeholders; for instance, I identified the ones in the previous example as academic institutions. Other stakeholders were only present one time (e.g. NGO, med-tech company). Then, at the second level, again, I compared all the maps, counted the number of times each type of stakeholder was present, and then I clustered the stakeholders. For instance; patients, entrepreneurs, care providers, designers & makers, and local community were defined as citizens.

Afterwards, at the outer level, I repeated the same process. In this level, I clustered several stakeholders (e.g. startups, insurance companies, legal organisations, med-tech companies) as companies. Finally, I placed these insights into a new stakeholder map to have an overview of the stakeholders present in open innovation initiatives in the Netherlands. For this map, I used different colours to avoid confusion with the rest of the stakeholder maps.

Afterwards, I used the stakeholder maps to explore the interactions between stakeholders in each initiative. For example, an Innovation

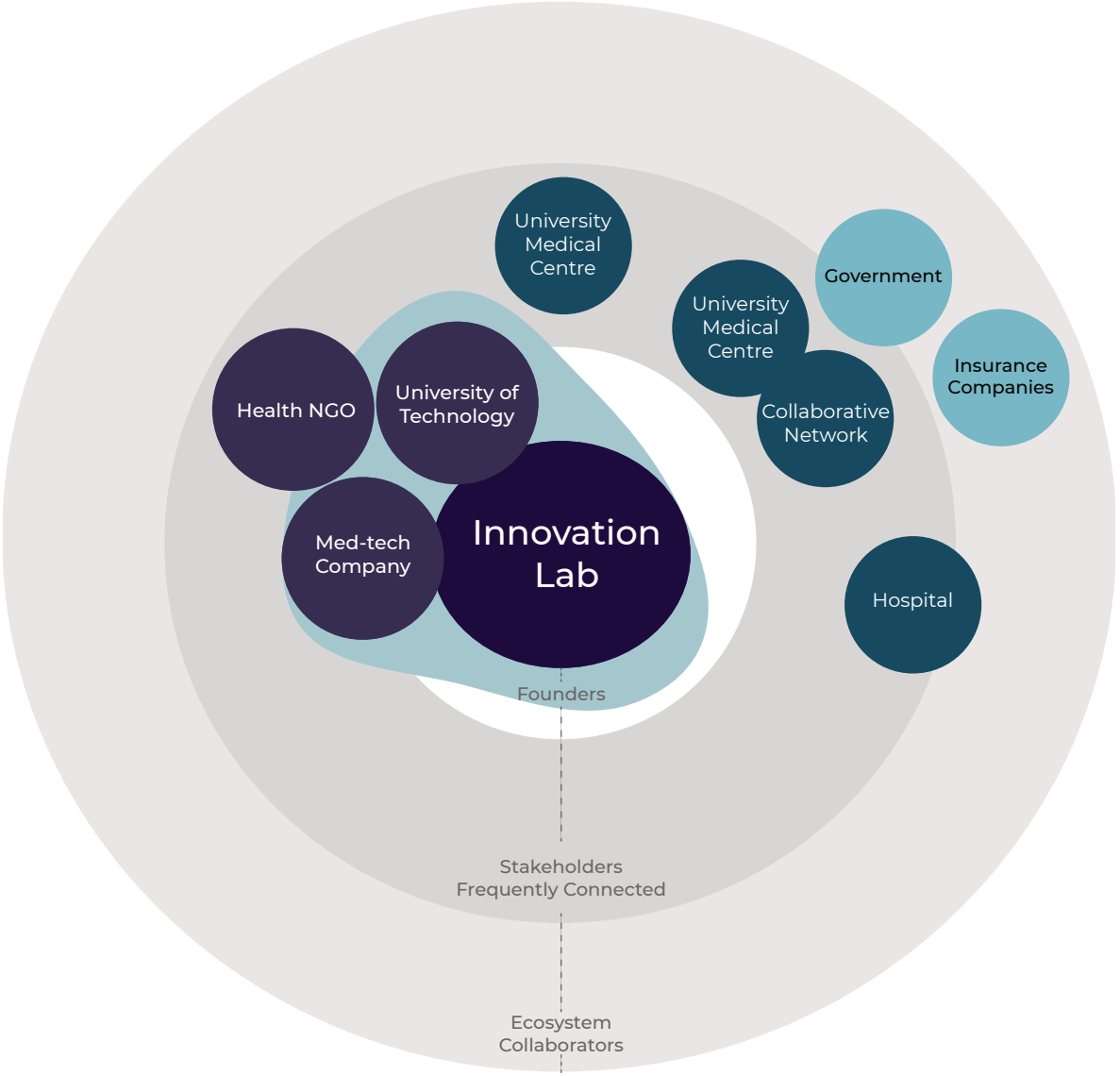


Figure 2.2 Example of stakeholders map

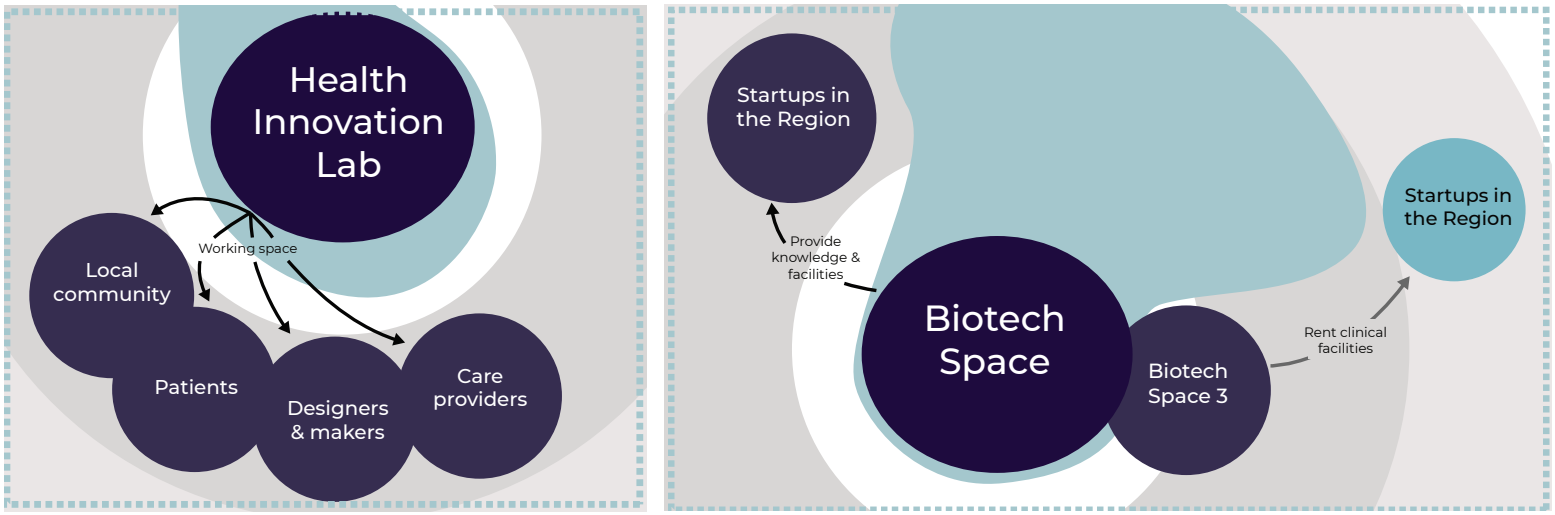


Figure 2.3 Examples of relationship between stakeholders

Lab in the Netherlands contacted a Fab-lab in Italy, and the Fab-lab shared their knowledge with the Innovation Lab (see Figure 2.12). Then, I related all the stakeholders with each other per initiative (see Figure 2.3).

Afterwards, I identified the interactions that occurred more often. I selected four interactions (receiving funding, having a physical space, building a network, and sharing knowledge) and explored each one deeper. For example, for the one called 'receiving funding', I explored how does receiving funding in health initiatives differ from other initiatives. I explored the top sectors in the Netherlands (e.g. agriculture, energy, water, creative industries) by realising desk research, filtering out descriptions as 'funding for innovation in creative industries', 'funding for technological development in agriculture.'

METHOD

b) Barriers and enablers present in open innovation initiatives

For this phase, the aim was to detect which are the barriers and enablers that actors from different initiatives have experienced. Detecting barriers and enablers provide insights into the kind of factors that influence collaborations (Kleinsmann, 2006). For the analysis, the sixteen in-depth interviews realised on the previous step were analysed again. As a result, I defined an overview of the barriers and enablers present in all the initiatives studied.

I went through all the transcriptions; from each interview, I selected all the quotes describing barriers and enablers. For the barriers, I chose all

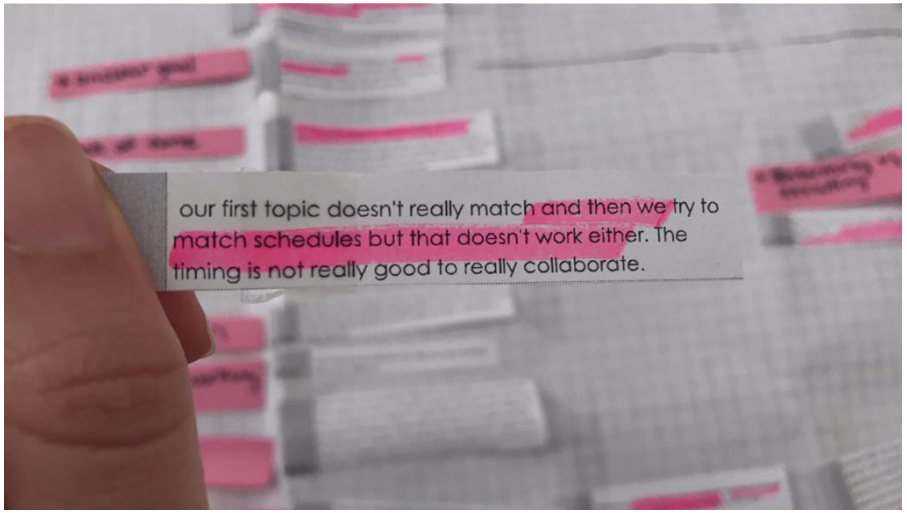


Figure 2.4 Example of a quote selected as a barrier

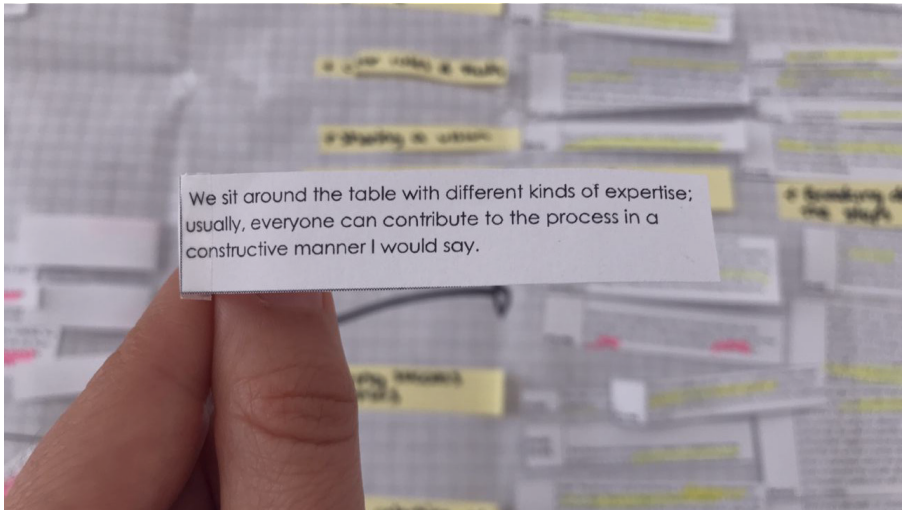


Figure 2.5 Example of a quote selected as an enabler

the quotes explaining challenges, failures, things not working or obstacles to achieving a specific outcome (see example in Figure 2.4). For the enablers, I focused on all the quotes referring to ways of collaborating, achieving something or delivering outcomes (see example in Figure 2.5).

I selected a total of 206 quotes (57 barriers and 149 enablers). All those quotes were printed down and categorised according to the barriers and enablers defined by Choi & Pak (2007); for instance, a barrier was 'lack of funding' and an enabler was 'personal commitment'. During the analysis process, some barriers and enablers did not belong to the existing ones defined by Choi & Pak, so I created new ones. One new category in the side of the barriers was 'having a different view of the world'. Later, I coded new and existing categories by using the theory of 'Process codes' that reflects a sense of temporality (-ing codes) and In vivo codes, making use of the participants' words (Saldaña, 2012). For example, one the barriers from Choi & Pak is 'discipline conflicts' so I changed it into 'not letting go of discipline behaviours or attitudes '.

The last step of the coding procedure was organising the codes according to the three 'organisational levels' (organisation, project and actor level) to have a better overview of the context where these factors take place (see Figure 2.6). Additionally, as some codes did not fit in any of those levels, a new level was added, the 'ecosystem-level' (see Figure 2.7).

The ecosystem level includes a broader range of external organisations and refers to factors that do not entirely depend on the health initiatives studied; for

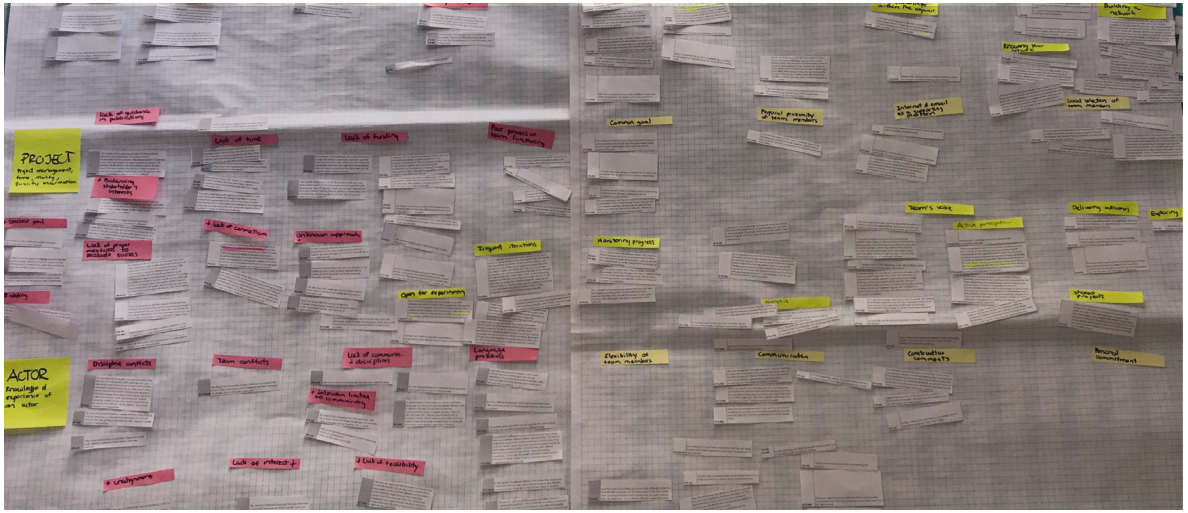


Figure 2.6 Categorisation of barriers and enablers

example, government regulations, international trends, national needs. Finally, I explored the relationship between categories. I noticed barriers and enablers are interrelated at different levels; for instance, the individual evaluations at the ecosystem level could be an explanation of why there is a lack of collaborative structure at the organisation level.

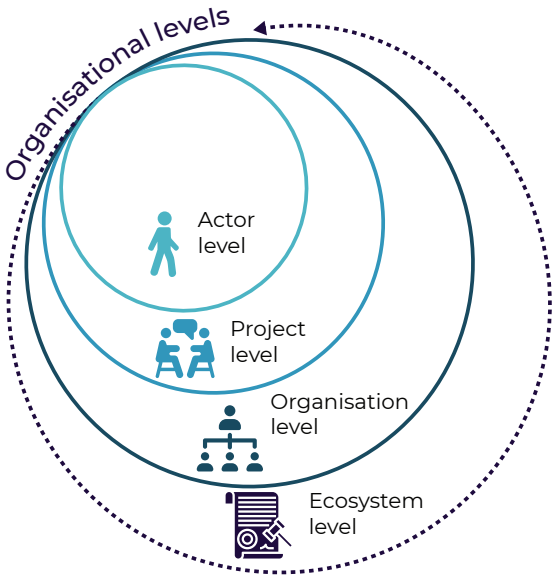


Figure 2.7 Diagram with organisational levels + ecosystem level

2.3 Outcome

OUTCOME

a) Overview of the stakeholders present in open innovation initiatives

Each initiative has a network of stakeholders, despite belonging to the same type of initiative (Innovation Lab, Collaborative Network or Biotech Space) each one operates differently according to their needs and purpose (see Figures 2.8, 2.9, 2.10).

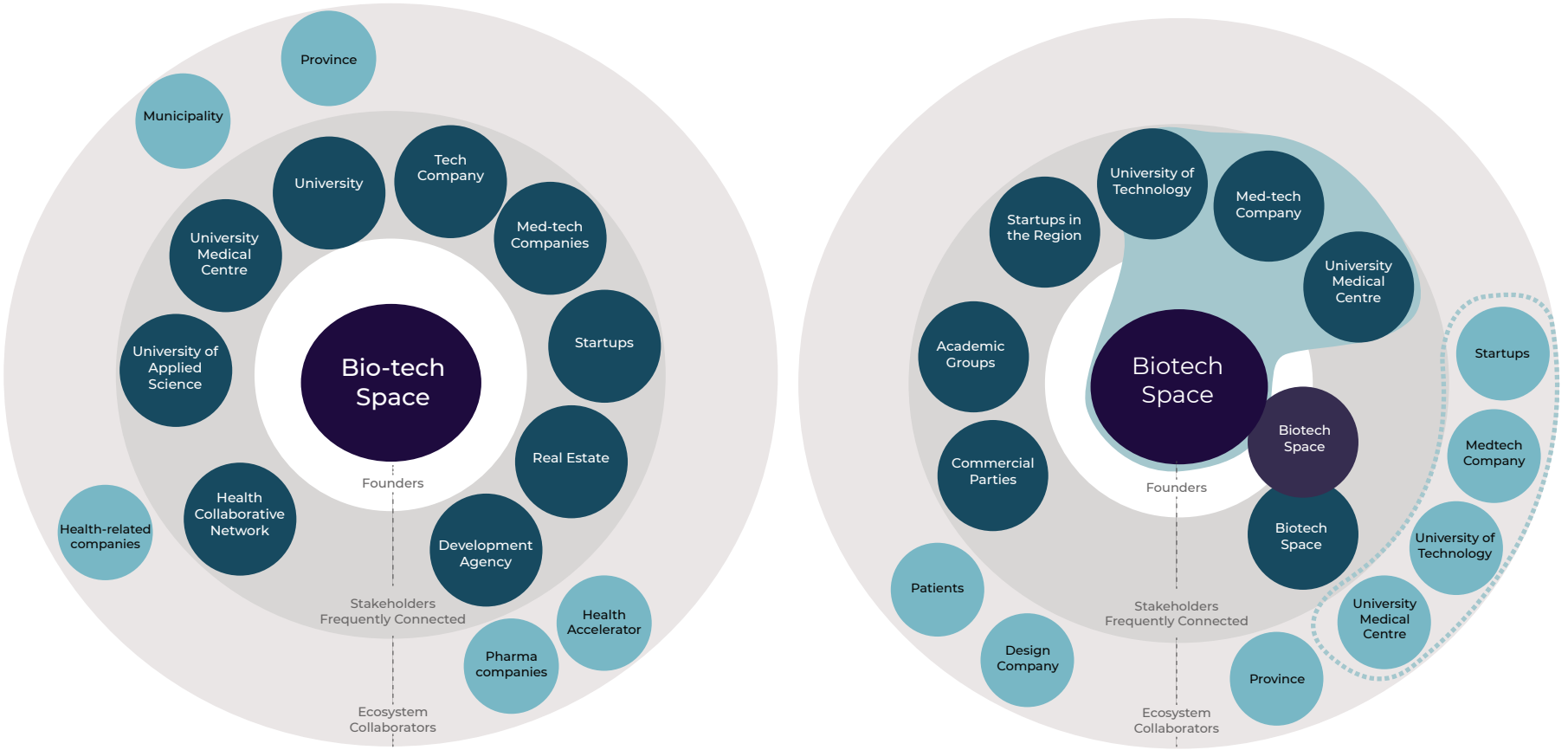


Figure 2.8 Stakeholder maps for Biotech Spaces

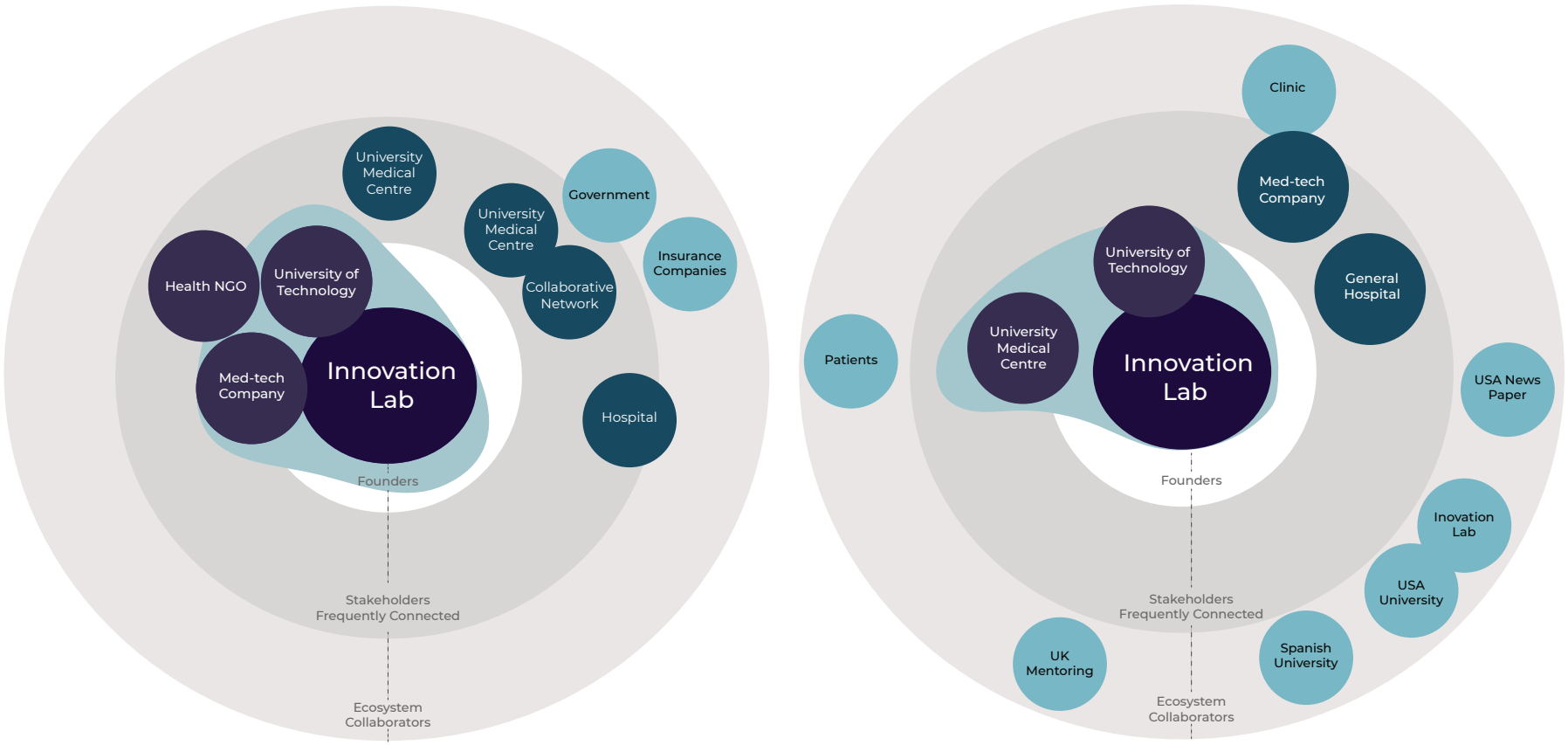
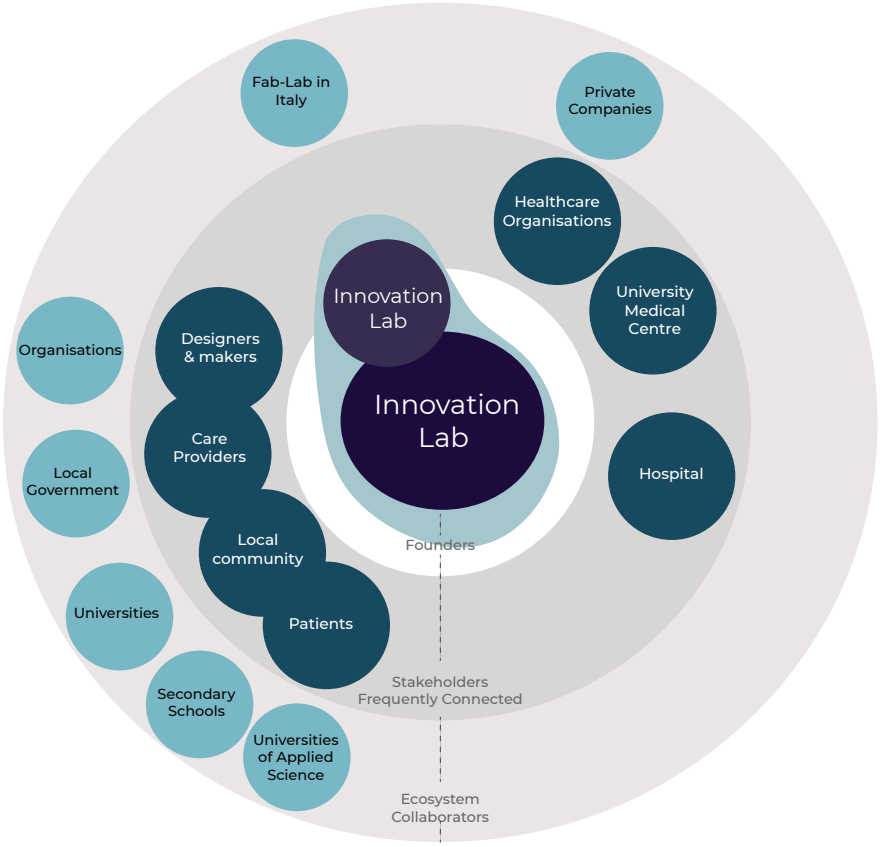
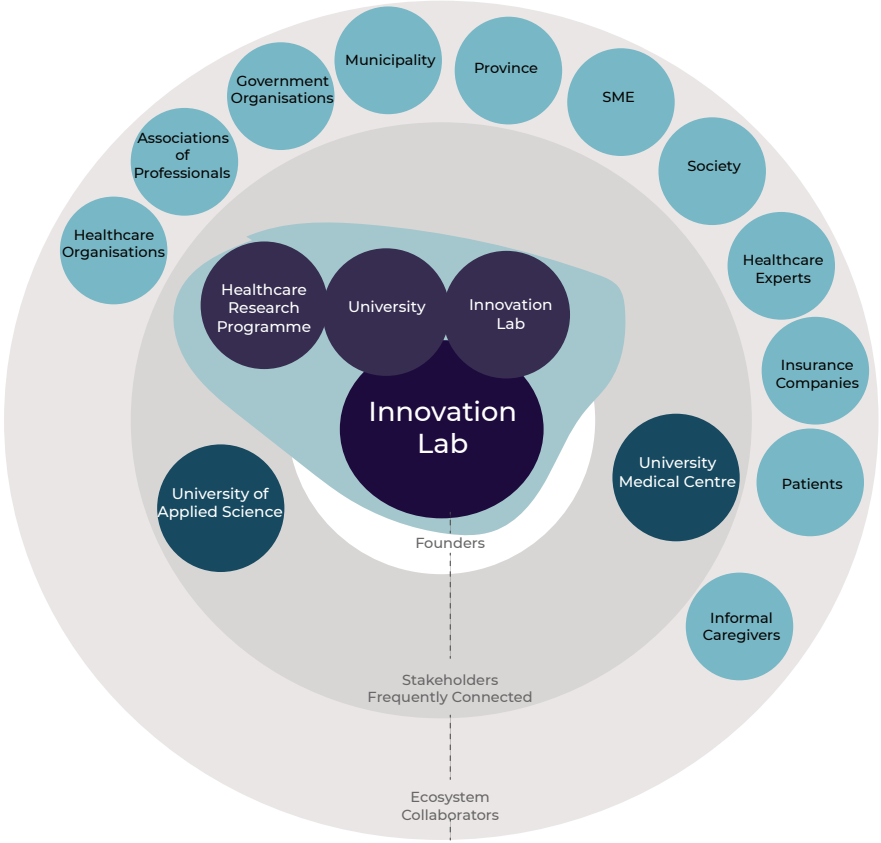


Figure 2.9 Stakeholder maps for Innovation Labs


Fab-Lab in Italy
Private Companies
Healthcare Organisations
University Medical Centre
Innovation Lab
Innovation Lab
Organisations
Designers & makers
Care Providers
Local Government
Local community
Hospital
Universities
Patients
Secondary Schools
Universities of Applied Science
Founders
Stakeholders Frequently Connected
Ecosystem Collaborators


Government Organisations
Municipality
Province
SME
Associations of Professionals
Society
Healthcare Organisations
Healthcare Experts
Healthcare Research Programme
University
Innovation Lab
Innovation Lab
Insurance Companies
University Medical Centre
Patients
University of Applied Science
Informal Caregivers
Founders
Stakeholders Frequently Connected
Ecosystem Collaborators

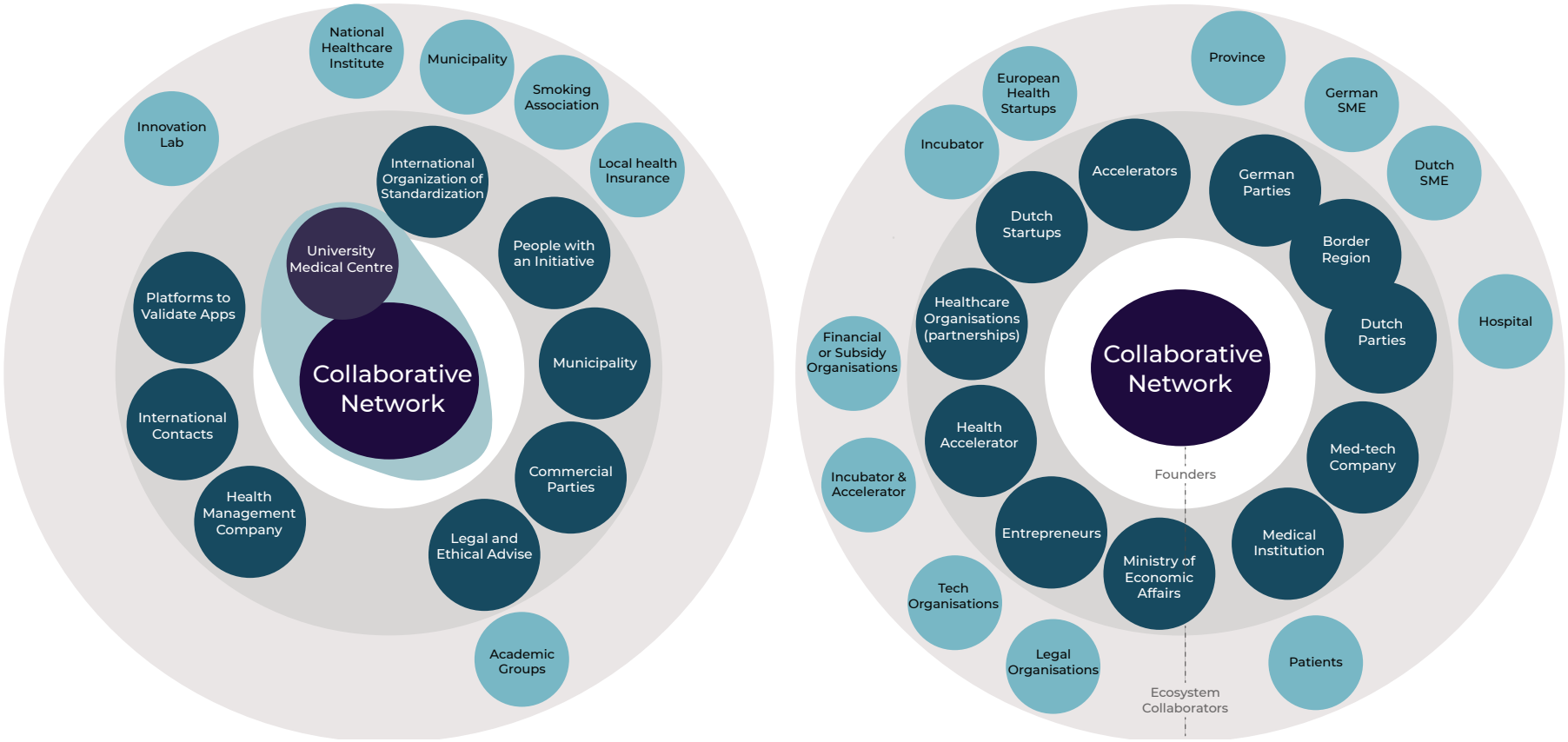


Figure 2.10 Stakeholder maps for Collaborative Networks

However, despite the differences in their networks, they also share some similarities. I was curious to identify which stakeholders are contributing to the creation of open innovation initiatives. Hence, I realised an overarching stakeholder map that provides an overview of the stakeholders present in each of the three levels (see Appendix B).

In most cases, I clustered the stakeholders according to the Quadruple Helix, academia, citizens, commercial parties and government (Carayannis & Campbell, 2010; Leydesdorff, 2012), but I made some exceptions. Due to the nature of the study, I identified 'open innovation initiatives' and 'hospitals'. Open innovation initiatives include innovation labs and fab-labs, and hospitals refer to general hospital and hospital. University medical centres could be placed as hospitals or academic institutions; therefore, I decided to leave it as an independent category.

This study demonstrates that academia is taking the lead founding open innovation initiatives in the Netherlands (see Figure 2.11). At the founders level, the key players are

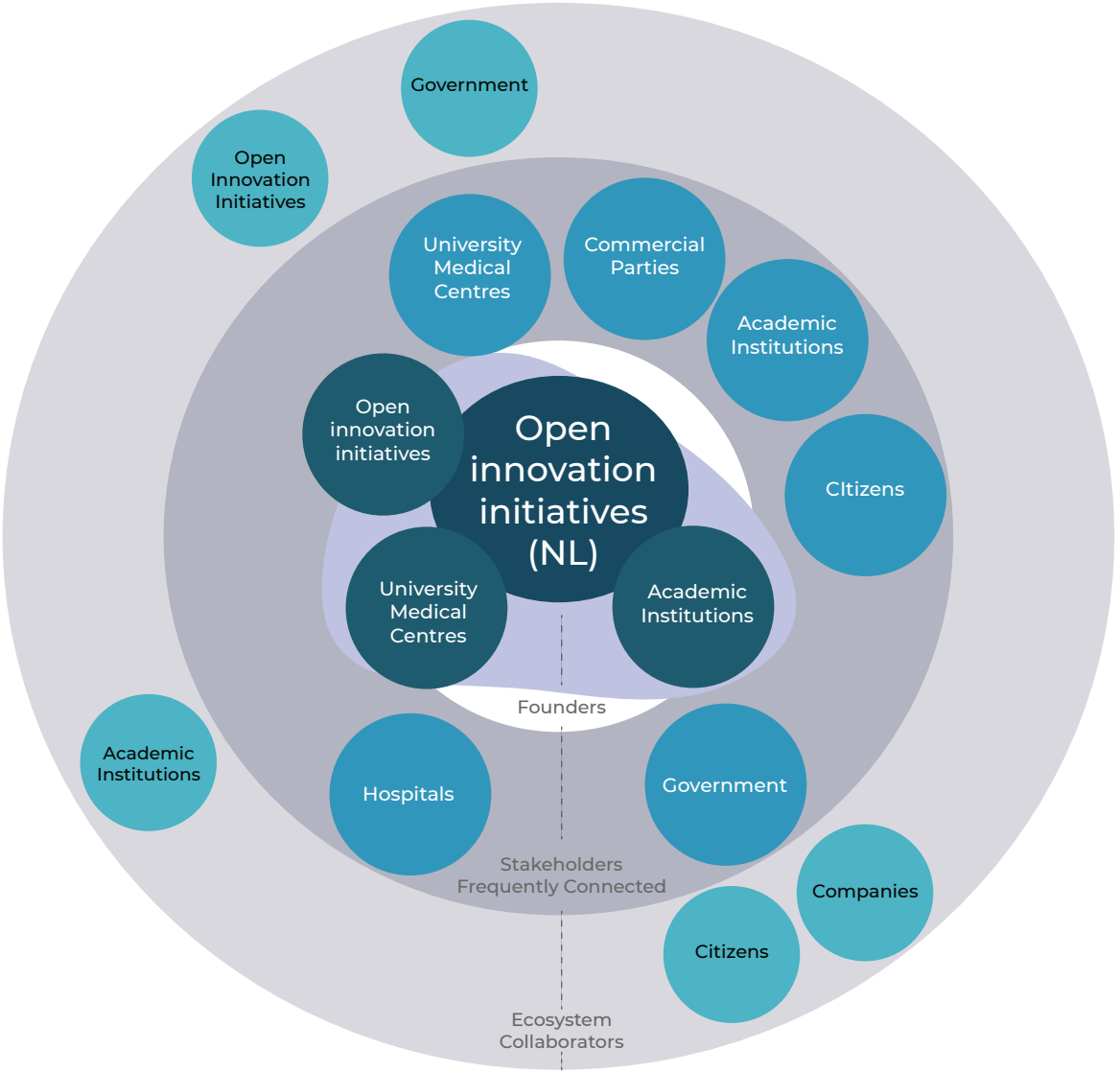


Figure 2.11 Overview of stakeholders present in open innovation initiatives in the Netherlands

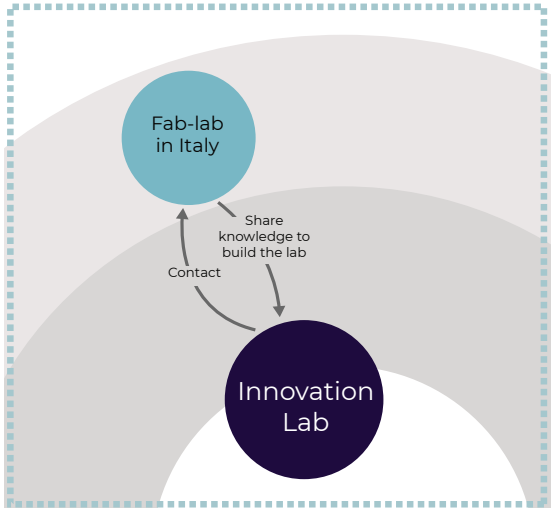


Figure 2.12 Example of interaction between stakeholders

the university medical centres and academic institutions. In most cases, at least one of those stakeholders is collaborating with other stakeholders, such as other open innovation institutions.

The next levels include stakeholders related to academia, government, companies, citizens, hospitals and university medical centres. On the outer level, I identified government organisations, academic institutions, citizens and companies.

Also, I identified other open innovation initiatives; for instance, an innovation lab that had the role of founder, contacted a fab-lab in Italy to ask for advice based on their experience (see example in Figure 2.12).

Two or three organisations are commonly responsible for collaboration agreements; for example, a university of technology and a university medical centre. In most cases, at least one actor from each organisation represents the organisation.

Besides those actors, the variety of disciplines working together varies according to each initiative and the organisation they belong. For instance, for one project, a team was formed by fifteen different actors from a university of technology (six), from a hospital (five), from a private company (three) and from other organisations (one).

The stakeholders in each initiative are clustered into three levels. At the centre, in dark blue, the stakeholders who belong to the formal agreement are placed. On the next level, the stakeholders that frequently collaborate with the initiative; for instance, a med-tech company and a general hospital. Finally, on the outer layer, some organisations or groups that have an impact or influence on the initiative, although the interaction might not be frequent (e.g. patients, clinic, and other innovation labs).

OUTCOME

b) Outcome: Conditions to operate at the organisational level

As a result of this study, I identified four frequent interactions between stakeholders. I named those interactions as operation conditions at the organisational level; receiving funding, having a physical space, building a network, and sharing knowledge (see Figure 2.13). These activities were present in most of the initiatives, although they are not mandatory, they provide better conditions for collaboration.

Receiving funding

Although it might sound obvious, having funding is a critical condition to start and develop an initiative. In all cases, initiatives have received funding from the European Union and the Dutch Government. Besides, some initiatives also receive funding

Figure 2.13 Conditions to operate at the organisational level

from private initiatives. Funding has enormous relevance for most initiatives. The Project Manager of the Innovation Subsidy Programme mentioned;

> *'So funding is always one step in the process but quite an important one. If it wouldn't have happened it is difficult to say what the trajectory would have been, but it would have been slower probably.'*

All the initiatives apply to different programmes to get the resources needed. What is particularly distinctive from the funding in health is the number of calls open.

All the initiatives apply to different programmes to get the resources needed. What is particularly distinctive from the funding in health is the number of calls open.

The webpage of health Holland presents around 60 calls that provide funding for health-related projects (Health Holland, n.d.). Compared to other top sectors in the Netherlands (e.g. agriculture, energy, water, creative industries), the creative industries present around 30 grants and open calls in Stimulerings Fonds (Stimulerings Fonds, n.d.). Although the language barrier might be a limitation, it was not as easy to find a large number of funding calls in agriculture or energy. However, this is an example of the existing support for innovation and research in health.

Another relevant aspect was that some initiatives are exploring how to build sustainable initiatives and not depend only on the funding provided. For instance, a Collaborative Network mentioned they get public money from the provinces, but they also get private money from the partnerships who pay them a fee to be able to assist to the events they organise. In that way, they can use that money to maintain the operations of the initiative.

Having a physical space

Another condition relevant to some initiatives is to have a physical space. Some health initiatives need clean rooms for clinical trials; thus, it is relevant to have spaces available for the different emerging initiatives. The director of a Biotech Space mentioned;

> *'One [contribution] is we provide space, labs, facilities to make sure these companies in the health sector have a place to actually do their job. No housing means no working.'*

For some initiatives, having a space makes the difference between working or not working. Other initiatives expressed that they do not need a physical space to operate. However, those initiatives without an exclusive physical space for the initiative use the installations of one of the stakeholders (e.g. university) to have meetings, realise working

sessions or deliver outcomes.

An interesting finding was that providing a physical space is a condition that can contribute to boosting regional development. An actor mentioned that providing space to other organisations is a way to guarantee those initiatives will stay in the region and will eventually contribute to the regional economy.

Building a network

Results show that initiatives focusing on building collaborative networks play an essential role. However, building a network is not an activity exclusive of Collaborative Networks.

> *'For a lot of other proposals, we sometimes don't have the network available, or we have a partial network, so we need to extend once we get the proposal. [...] What we do is to have a partial network, ask these partners whether they have other contacts that could be of relevance. We use the snowball effect.'*
>
> *- Co-scientific director in Innovation Lab*

Initiatives like Innovation Labs are also looking for ways to expand their network. Every project tackles different needs and requires new collaborations to achieve the objectives defined. Hence, initiatives are continually looking to expand their networks to be able to develop their projects as intended. Having an established network allows the process to be more efficient, as they do not need to introduce each other, and they can directly start working.

Sharing knowledge

Organisations work together for a common purpose by developing projects collaboratively. Besides, open innovation initiatives are continually experimenting for achieving innovations. To generate new solutions, sharing and creating knowledge is necessary; actors experiment and learn from their mistakes. Sharing knowledge among colleagues is necessary to create innovation. Learning from each other can contribute to create new connections and explore the challenges from different perspectives to develop better solutions. Besides, although the initiative does not develop any outcome, in the end, the information could be used to create scientific knowledge; for instance, to publish a paper.

> *'Besides that, we also have a platform where we share knowledge, successes, learnings and mistakes.'*
>
> *- PhD researcher at Collaborative Network*

OUTCOME

c) Barriers and enablers detected in the initiatives

Finally, I identified the barriers and enablers that were present in the eight initiatives studied. The list includes twelve barriers and twenty-one enablers detected within the initiatives studied. In the list, the categories are organised according to the organisational levels (see Table 2.4).

Table 2.4 List of barriers and enablers identified

	Barriers	Enablers
Actor level	3	3
Project level	4	10
Organisation level	2	8
Ecosystem level	3	-
Total	12	21

Barriers at health initiatives in the Netherlands

As a result of the interviews realised with different actors from open-innovation initiatives, twelve barriers were defined (see Table 2.5). Besides, I described each barrier and enabler with an explanation and a representative quote (see Table 2.6). For the complete list, see Appendix C.

Table 2.5 List of barriers in open innovation initiatives in the Netherlands

Actor level	Project level	Organisation level	Ecosystem level
Not letting go of disicpline behaviours or attitudes	Not keeping it interesting for all	Lacking a collaborative structure	Lacking space and tools
Talking but not collaborating	Not having a clear project goal	Unclear organisational purpose	Going through health regulations
Having a different view of the world	Not having time available		Trying to understand the hierarchy levels
	Rotating actors		

Table 2.6 Example of a description of a barrier

Organisational level	Barrier	Representative quote	Interpretation
Project	Not keeping it interesting for all	*'So it needs a lot of planning and also it is always difficult because every stakeholder has another interest. For example, for the company, their primary goal is to have new tubes. For the surgeon, he wants something to protect his hearing. He still wants to use the tools he is used to. But then, there is still the university who wants to publish a paper, for example. So sometimes, these things don't fit together.'* - *Master Student at Innovation Lab*	The collaboration between different stakeholders and actors results in different interests that are difficult to cover at the same time.

Enablers at health initiatives in the Netherlands

As a result of the analysis, twenty-one enablers were defined (see Table 2.7). Besides, each enabler contains a short explanation followed by a representative quote (see Table 2.8). For the complete list, see Appendix D.

Table 2.7 List of enablers in open innovation initiatives in the Netherlands

Actor level	Project level	Organisation level
Having a common goal	Being open for experimentation	Providing facilities and tools
Including multiple perspectives	Breaking down steps	Having support during legal agreements
Having communication channels	Having an iterative process	Having clear roles and tasks
	Define success metrics	Sharing a vision
	Selecting the right members	Assisting and creating events
	Getting funding	Sharing updates
	Having a collaborative process	Building a collaborative network
	Delivering outcomes	Collaboration with external parties
	Having periodical meetings	
	Participating actively	

Table 2.8 Example of a description of an enabler

Organisational level	Enabler	Representative quote	Interpretation
Organisation	Building a collaborative network	*'We have been doing research in this field before, so we already have a quite extensive network with all kinds of healthcare organisations. We collaborate with the University of Applied Science in the region. They also have a very extensive network already with healthcare providers and also direct client organisations.'* - *Innovation Manager at Collaborative Network*	Building a collaborative network was described to be very important for actors. For instance, it can help to start a new project and to collaborate with the right people contributing to better outcomes in the health sector.

2.4 Discussion

The data collected demonstrates that collaboration at Innovation Labs, Collaborative Networks and Biotech Spaces involves multiple stakeholders interacting. Exploring who is present in open innovation initiatives, the conditions to operate and which are the barriers and enablers present provides a better understanding of how open innovation initiatives in healthcare work. By understanding the context, it is easier to contribute to building effective transdisciplinary collaborations.

Sub-question a. Who are the stakeholders present in open innovation initiatives in the Netherlands?

For this study, I classified stakeholders into three levels; founders, frequent collaborators, and ecosystem stakeholders. This last group do not collaborate frequently; however, they have an impact on the initiatives. This study demonstrates that university medical centres and academic institutions are commonly founders of open innovation initiatives in healthcare. It might be that due to the educational approach of these institutions, they are open for experimentation and research; thus, they are keen to participate in open innovation initiatives.

Usually, two or three stakeholders are the founders of the initiative; other stakeholders that could be founders are other open innovation initiatives. The founders collaborate with different stakeholders related to academia, government, companies, citizens, hospitals, and university medical centres. Stakeholders present in the ecosystem level are government organisations, academic institutions, citizens, companies, and other open innovation initiatives.

Sub-question b. Which are the conditions needed for open innovation initiatives to operate?

I identified four conditions to operate at the organisational level; receiving funding, having a physical space, building a network, and sharing knowledge. Those conditions were present in most of the initiatives, and provide better conditions for collaboration. However, they are not mandatory.

Receiving funding allows actors to start and develop an initiative. In all cases, initiatives have received funding from the European Union and the Dutch Government. For some initiatives, having a physical space is necessary to realise clinical trials. Other initiatives use the stakeholders' facilities for working sessions or meetings.

Finally, for all initiatives, building collaborative networks is relevant. It might be an opportunity to open new doors or for starting new projects.

Sub-question c. Which are the barriers and enablers present in open innovation initiatives in the Netherlands?

I defined a list of twelve barriers and twenty-one enablers. Both, barriers and enablers, are distributed into the four organisational levels; ecosystem, organisation, project, and actor. For example, some barriers are 'lacking space and tools', lacking a collaborative structure', 'not having a clear project goal', and 'talking but not collaborating'. Some examples of enablers are 'providing facilities and tools', 'being open for experimentation', and 'having a common goal'.

Although barriers and enablers were categorised into one of four levels, in most cases, they could be present at multiple levels at the same time, and there is an interrelationship across levels. For example, at the ecosystem level, the actors expressed there is a lack of space to realise the clinical trials. Therefore, some initiatives have successfully turned that barrier into an enabler by offering space and tools to allow actors to continue working with their projects. Thus, 'lacking space and tools' is a barrier at the ecosystem level and 'providing facilities and tools' is an enabler at the organisation level.

Limitations and future research

For some initiatives, I interviewed only one actor; hence, I missed a different perspective from another actor to compare results. In this study, I did not get deeper into the ecosystem level; therefore, I missed enablers at that level. That does not mean that there are none enablers at the ecosystem level in the Netherlands.

Future research could be focused on recruiting a bigger sample of initiatives to explore more initiatives and complete the defined list of barriers and enablers present in dutch open innovation initiatives in healthcare.

Summing-up

This study demonstrates that the most frequent founders of open innovation initiatives in healthcare are university medical centres and academic institutions. A third stakeholder could be another open innovation initiative. These founders collaborate with hospitals, government, academic institutions, commercial parties, and citizens.

I identified four conditions to operate at the organisational level; receiving funding, having a physical space, building a network, and sharing knowledge. Although these four conditions are not mandatory, the study demonstrates they provide better conditions for collaboration.

Finally, I defined a list of barriers and enablers present in the open innovation initiatives explored. The study demonstrates that barriers and enablers are present in the four organisational levels, ecosystem, organisation, project and actor.

Besides, there is an interrelationship between them; for instance, an element present in one level could affect another level.

TAKEAWAYS FROM CHAPTER 2

- Academic institutions and university medical centres are commonly the founders of open innovation initiatives in the Netherlands, possibly because they are open to experimentation and to create knowledge.
- I defined four conditions to operate at the organisational level; receiving funding, having a physical space, building a network, and sharing knowledge. Although they are not mandatory, they provide better conditions for collaboration.
- Multiple barriers and enablers are present at four organisational levels; ecosystem, organisation, project and actor. Those barriers and enablers are interconnected; hence, they could have effect on multiple levels.

CHAPTER 3

Transdisciplinary Collaboration: A Case Study in Mexico

This chapter aims to understand who is present at the unit, where the case study takes place. How UIDT operates and what are the barriers and enablers the actors face. I start with a brief introduction to the unit. Then I describe the research methods to answer each research sub-question. Later, I explain the result for each sub-question, and I finished with a discussion on which are the challenges the unit face due to its complexity.

a.	Who are the stakeholders present in the unit?
b.	How does UIDT operate?
c.	Which are the barriers and enablers that have a significant impact on the actors?

Table 3.1 Research sub-questions for Chapter 3

3.1 Introduction

For this phase, the aim was to understand how actors from different disciplines collaborate within one initiative; hence, I decided to focus on a case study.

The case study takes place in Mexico at the Research and Technological Development Unit (UIDT, from Spanish) inside the General Hospital of Mexico' Eduardo Liceaga' (HGMEL, from Spanish). This unit is a result of the collaboration between the Applied Sciences and Technological Development Center (ICAT, from Spanish) within the National Autonomous University of Mexico (UNAM, from Spanish) and HGMEL. Additionally, for each project, the actors from UIDT work with different institutions (e.g. other faculties at UNAM). In this case study, the Centre of Research in Industrial Design (CIDI, from Spanish) is also an active stakeholder.

The goal of this chapter is to understand how transdisciplinary collaboration in the health sector occurs by focusing on the case study described above. For this phase, I defined three sub-question questions (see Table 3.1), similar to the ones in Chapter 2.

The focus is on exploring the collaboration and detecting the barriers and enablers they face. To collect data, I realised seventeen in-depth interviews (Table 3.2), and then I analysed the information and defined a preliminary list of barriers and enablers. Later I did an online survey to present the outcomes and validate the findings (see Figure 3.1). Finally, I analysed all the information. As a result, I defined a stakeholders map, three operational steps and a list of barriers and enablers (see Figure 3.2).

3.2 Method

This empirical study aims to

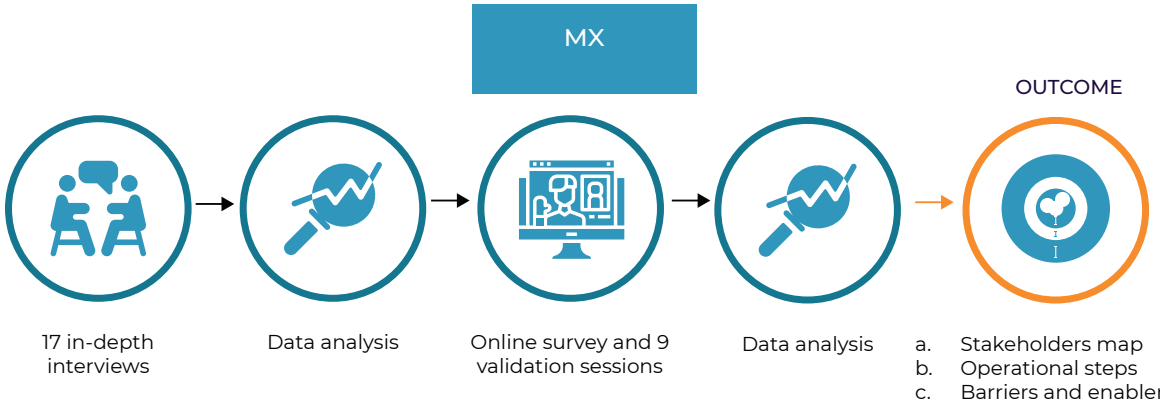


Figure 3.1 Process diagram

Table 3.2 Overview of actors involved and methods used in this study

25 actors involved

METHOD	
5	Informal interviews
12	Semi-structured interviews
14	Answers to the online survey
9	Validation sessions

understand how actors from different disciplines collaborate to develop technologies for the health sector and contribute to building effective collaborations. Hence, two steps took place: a) Exploring how different actors collaborate and identifying operational steps at the project level, and c) Detecting barriers and enablers at UIDT.

METHOD

a) Stakeholders present in the unit and operational steps at the project level

The objective of this phase was to explore, which are the stakeholders collaborating at UIDT and how the unit operates. I conducted a total of seventeen interviews; twelve semi-structured interviews and five informal interviews (one actor was present in both, a semi-structured and an informal interview). I selected the participants through snowball sampling (Ritchie & Lewis, 2003). The actors involved have different roles and professional backgrounds to include diverse perspectives (Ravitch & Carl, 2015) (see Table 3.3). Besides, they belong to the three different institutions, ICAT, HGMEL and CIDI.

I designed the interview to explore the purpose of the unit and the role of the actors. I asked actors to share examples of how they develop projects, followed-up by specific questions regarding the challenges they have faced and their most significant achievements. Finally, the interview concluded with a reflection of how they envision the future of the UIDT. The interviews were realised in Spanish, they lasted between 40 to 90 minutes and were conducted face-to-face (ten interviews) , through video call (four interviews), or via phone call (three interviews).

The interviews were audio-recorded and transcribed verbatim except for the five informal conversations. I supplemented the information by consulting the webpage, the annual reports of the unit and papers shared by the actors.

For the analysis, the analytical lenses used were ‘who is present in the collaboration’ and ‘how do they collaborate’. For each interview, I selected all the quotes that included actors and stakeholders. Then, I placed the actors into clusters based on the institution they belong to (e.g. HGMEL, ICAT, CIDI). Those clusters represented the stakeholders to have an overview of the actors and stakeholders present. I triangulated the information with desk research on the web page of each institution and the annual report published. As a result, I created a stakeholder map for UIDT.

Similar to the maps in the previous chapter, I defined three levels for the

stakeholders. At the centre, I placed the founders of UIDT, followed by the stakeholders frequently collaborating with the unit. In the external circle, I placed the stakeholders at the ecosystem level who have influence or have an impact on the unit, although the interaction does not occur regularly.

Afterwards, the quotes answering the question 'how do they collaborate' were clustered according to the type of activity or behaviour described (e.g. 'having contact with physicians'). Then, sub-clusters were defined; for instance, 'meeting physicians at the seminars' or 'building relationships with physicians'. Later, I explored the relationships between sub-clusters. I noticed that some projects started at the seminar while some others started after having a relationship with physicians (e.g. that relationship was labelled 'starting a project

Table 3.3. Actors interviewed

	Type of initiative	Role	Professional brackground
1	Full Researcher*	ICAT	Atomic Physics
2	Master Student	ICAT	Medical Physics
3	Master Student	ICAT	Physical Sciences
4	Full Researcher	ICAT	Innovation Technologies & Robotics
5	Full Researcher	ICAT	Electrical Engineering
6	Physician*	HGMEL	Cardiology
7	Bachelor Student	CIDI	Industrial Design
8	Full Professor	ICAT	Computer Science
9	Full Professor	ICAT	Biotechnology
10	Bachelor Student	CIDI	Industrial Design
11	Full Professor	ICAT	Organisation Management
12	Full Professor	CIDI	Advanced Product Design
13	Full Researcher	ICAT	Manufacture
14	Full Researcher	HGMEL	Medical Science
15	Full Researcher*	ICAT	Engineering Sciences
16	Full Researcher	HGMEL	Science & Material Engineering

These initial interviews were executed before the COVID-19 pandemic lockdown.
** Infromal conversations*

Figure 3.2 Analysis of barriers and enablers at UIDT

at UIDT'). Based on the relations discovered, I identified three operational steps at the project level.

METHOD

b) Detecting barriers and enablers at UIDT

For this step, the aim was to detect which barriers and enablers are present at UIDT and which are the ones actors perceive to have a more significant impact on their activities.

To detect the barriers and enablers present, I analysed again the sixteen in-depth interviews I realised. From each interview, I selected all the quotes describing barriers and enables, a total of 238 quotes, 108 of them were barriers, and 130 were enablers.

To select the barriers, I focused on the quotes describing challenges, failures, things not working out or obstacles to achieve outcomes. To select enablers, I selected all the quotes that describe ways of collaborating, achievements, or delivering outcomes. All those quotes were printed down and categorised (see Figure 3.2), using the barriers and enablers defined in Chapter 2 (see Table 2.5 and 2.7).

During the analysis, some barriers and enablers did not belong to the existing ones; hence, I created new ones. Besides, some barriers transformed into enablers or the other way around. For example, an initial enabler was 'getting funding', and it changed into 'lacking project funding'. Then, those barriers and enablers were coded and organised according to the organisational levels; ecosystem, organisation, project, and actor.

Lately, I explored the relationship between levels; for instance, 'not having available time' at the project level is a consequence of 'having a heavy workload' at the organisational level. Finally, I documented all those

Table 3.4 Barriers and enablers per organisaitonal level

Scale	Value
Strongly Disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Disagree	5
NA	6

categories of barriers and enablers, defining a list of 46 categories, 23 barriers and 23 enablers (see Table 3.4). Each barrier and enabler contains a representative quote and an explanation, in English and Spanish.

Afterwards, I verified the list of barriers and enablers with the actors. The purpose was to verify my interpretation of the data (Kleinsmann, 2006). Hence, I shared the list of barriers and enablers with the actors from UIDT and asking them to identify the ones that have a more significant impact on their activities at the UIDT.

Due to the limited time actors have, I decided that an online survey was a suitable way to share the information with the actors. I sent the survey to 25 actors, including students, full researchers, full professors and physicians; a total of fourteen answers were collected (see Table 3.5).

I used a five-point Likert scale to design the survey. This type of survey helps to understand the perceptions of participants regarding each category. The five-point scale

Table 3.5 Actors contacted to validate barriers and enablers

	Type of initiative	Role	Professional brackground
1	Full Professor	ICAT	Organisation Management
2	Full Professor	CIDI	Advanced Product Design
3	PhD Researcher	ICAT	Astrophysics, Optics & Electronics
4	Full Researcher	HGMEL	Science & Material Engineering
5	Master Student	ICAT	Medical Physical Sciences
6	Full Researcher	HGMEL	Medical Science
7	Bachelor Student	CIDI	Industrial Design
8	Full Professor	ICAT	Biotechnology
9	Full Researcher	ICAT	Atomic Physics
10	Master Student	ICAT	Physical Sciences
11	Bachelor Student	CIDI	Industrial Design
12	Full Professor	ICAT	Mechanical Engineering
13	Full Researcher	ICAT	Innovation Technologies & Robotics
14	Full Professor	ICAT	Computer Science

La alta demanda de trabajo por parte de la institución limita mi contribución en la UIDT
Tengo otras responsabilidades que me impiden enfocarme al 100% en la unidad

- ○ Totalmente en desacuerdo
- ○ En desacuerdo
- ○ Neutral
- ○ De acuerdo
- ○ Totalmente de acuerdo
- ○ NA

The high workload demanded by the institution limits my contribution to UIDT
I have other responsibilities that do not allowe me to focus 100% in the unit

- ○ Strongly disagree
- ○ Disagree
- ○ Neutral
- ○ Agree
- ○ Strongly agree
- ○ NA

Figure 3.3 Example of statements shared in the survey (left) and its translation (right)

includes the options of strongly disagree, disagree, neutral, agree and strongly agree. It was selected to offer more possibility to participants to choose an answer that is closer to their perception (Joshi, Kale, Chandel, & Pal, 2015). Besides, actors had the opportunity to select the option 'Not Applicable' (NA) if the participants did not relate themselves with a category. I added this option due to the diversity of roles and the different institutions the actors belong to. I phrased each barrier or enabler as a statement, so participants were able to 'agree' or 'disagree' (see Figure 3.3).

The information shared in the survey was divided into barriers and enablers and structured by organisation levels; organisation, project and actor. In this survey, I did not include the ecosystem level as the aim was to focus on factors the actors can have direct influence. However, the ecosystem level is considered in the final phase of this graduation project. The survey consisted of three sections. First, some demographics, then the organisational levels describing the barriers and enablers present. Finally, a reflection section regarding the role of the UIDT in this COVID-19 pandemic (for the complete survey see Appendix E) to detect possible challenges that have not been detected yet.

Before sending the survey to participants, I conducted three pilot sessions (see Figure 3.4) to verify if the information and the structure of the survey were clear. After the pilots, I made some adjustments to the survey before sending it to the actors.

I collected the results from the fourteen surveys. Then, I analysed the information to have an overview and an understanding of the actors' responses. The data used for the analysis consisted of six categories

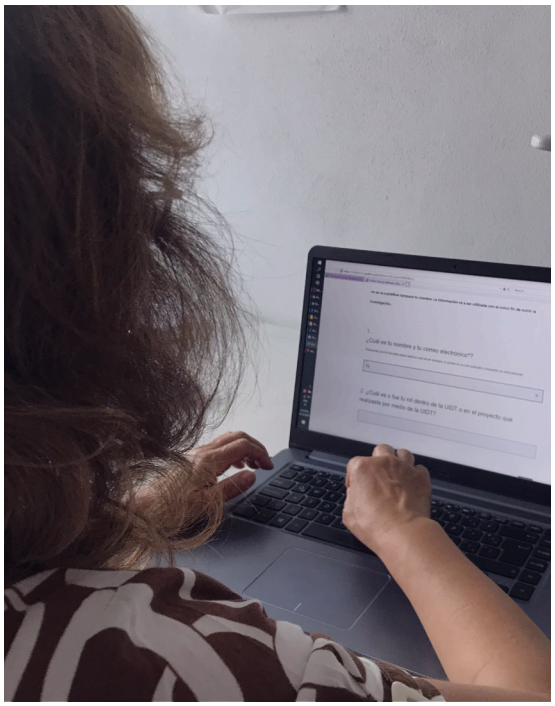


Table 3.4 Participant in a pilot session

(barriers and enablers at the actor, project and organisation level). I defined the percentages of answers per scale point for each factor (see Appendix F).

Later, I visualised the data to provide a clear overview of the answers. The percentages helped in creating a stacked bar chart (see Figure 3.9) to graphically display the data (Heiberger & Robbins, 2014). For each scale point, a value was assigned

Table 3.7 Actors interviewed to validate barriers and enablers

	Type of initiative	Role	Professional brackground
1	Master Student	ICAT	Medical Physical Science
2	PhD Researcher	ICAT	Astrophysics, Optics & Electronics
3	Full Professor	CIDI	Advanced Product Design
4	Full Professor	ICAT	Organisation Management
5	Full Researcher	HGMEL	Medical Science
6	Full Researcher	ICAT	Atomic Physics
7	Full Researcher	HGMEL	Science & Material Engineering
8	Full Professor	ICAT	Computer Science
9	Bachelor Student	CIDI	Industrial Design

(see Table 3.6). Then, the percentages were represented in a graph; on the left side, the negative values, ‘strongly disagree’ and ‘disagree’; at the centre, the neutral answers; and on the right side, the positive values, ‘agree’ and ‘strongly agree’ (Super Data Science, 2017).

The answers that selected ‘not applicable’ were placed on a separate column as they are not included for the analysis; however, it is necessary

Figure 3.6 Value per scale point

Scale	Value
Strongly Disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Disagree	5
NA	6

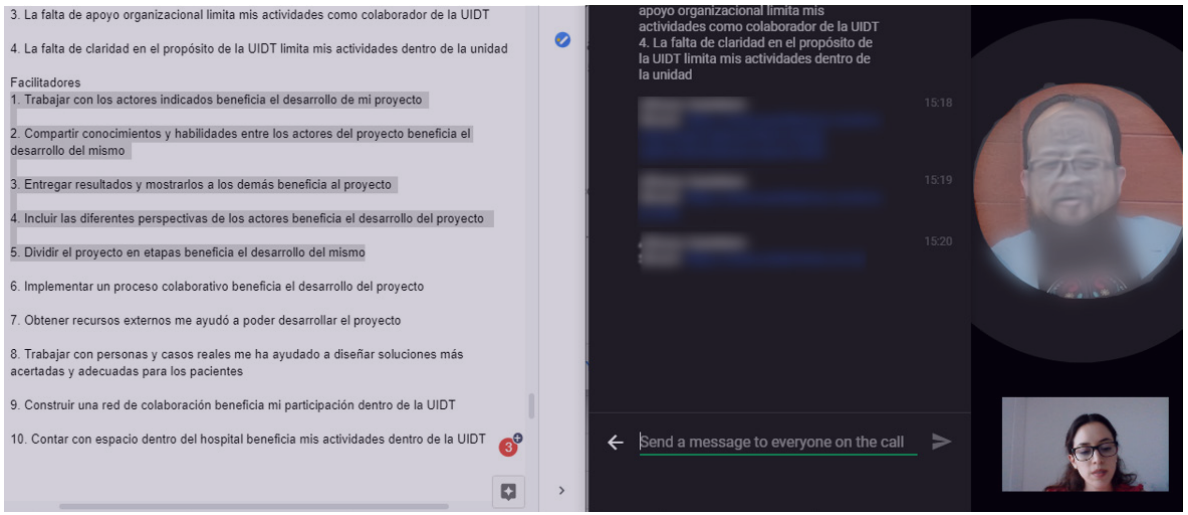


Figure 3.5 Example of a video call with a participant

to show those results in the graph to present reliable data. I added the option of 'not applicable' due to the diversity of roles participating. For instance, the actors on the Linkage and Technological Management area does not develop projects. Hence, they do not need to get projects approved, so their answer could be 'NA'.

After this analysis, I contacted the actors to validate the information collected from the survey. I selected a representative sampling of nine actors (see Table 3.7); at least one Bachelor Student, Master Student, PhD Researcher, Full Researcher and Full Professor. I was not able to contact physicians due to the high work demand result of COVID-19. The sessions lasted from 30 to 50 minutes. I conducted them by call (two) or video call (seven). The sessions consisted of a semi-structured interview supplemented with their answers from the survey. During the session, I sent their answers digitally; for instance, for the two calls, I used WhatsApp to send their answers. For the video call, we used the chat of the app (e.g. Skype, Google Hangouts or WhatsApp video) (see Figure 3.5).

For these sessions, I used the results from the survey. Before each interview, I reviewed the participants' answers and divided them into the 5-scale points (strongly disagree, disagree, neutral, agree or strongly agree). I focused on exploring the factors the participant 'strongly agree' with, for both, barriers and enablers, because they selected those as the factors with more impact on their activities. If they did not select any answer on that scale point, I would move on to 'agree', then to 'neutral' and so on.

I designed the session to explore the three barriers, and the three enablers that the actor perceived had more impact on their activities. During the session, actors shared examples of an experience related to the barriers or enablers selected. Then, they defined what could be their role in a future pandemic as the one we are facing, as a way to detect possible barriers or enablers that have not been included on the preliminary list of barriers and enablers. All interviews were audio-recorded and transcribed verbatim.

Afterwards, I analysed the information. I categorised the comments of the participants according to the barriers and

enablers they mentioned. Then, I compared those comments to the preliminary list and made some adjustments to the preliminary barriers and enablers. For instance, a barrier in the preliminary list was 'lacking communication with others'; however, actors mentioned it was not that they do not communicate at all, but that they fail at doing it. As a result, the barrier changed into 'missing communication'. These validation sessions contributed to have a more accurate list of barriers and enablers.

3.3 Outcome

This study presents a stakeholder map of the actors involved in the unit based on my research. Besides, I present four operational steps in the project level and a list of barriers and enablers present at the unit.

OUTCOME

a) Stakeholders present in the unit and operational steps

According to the information provided by ICAT in their webpage (2020), UIDT is formed by three

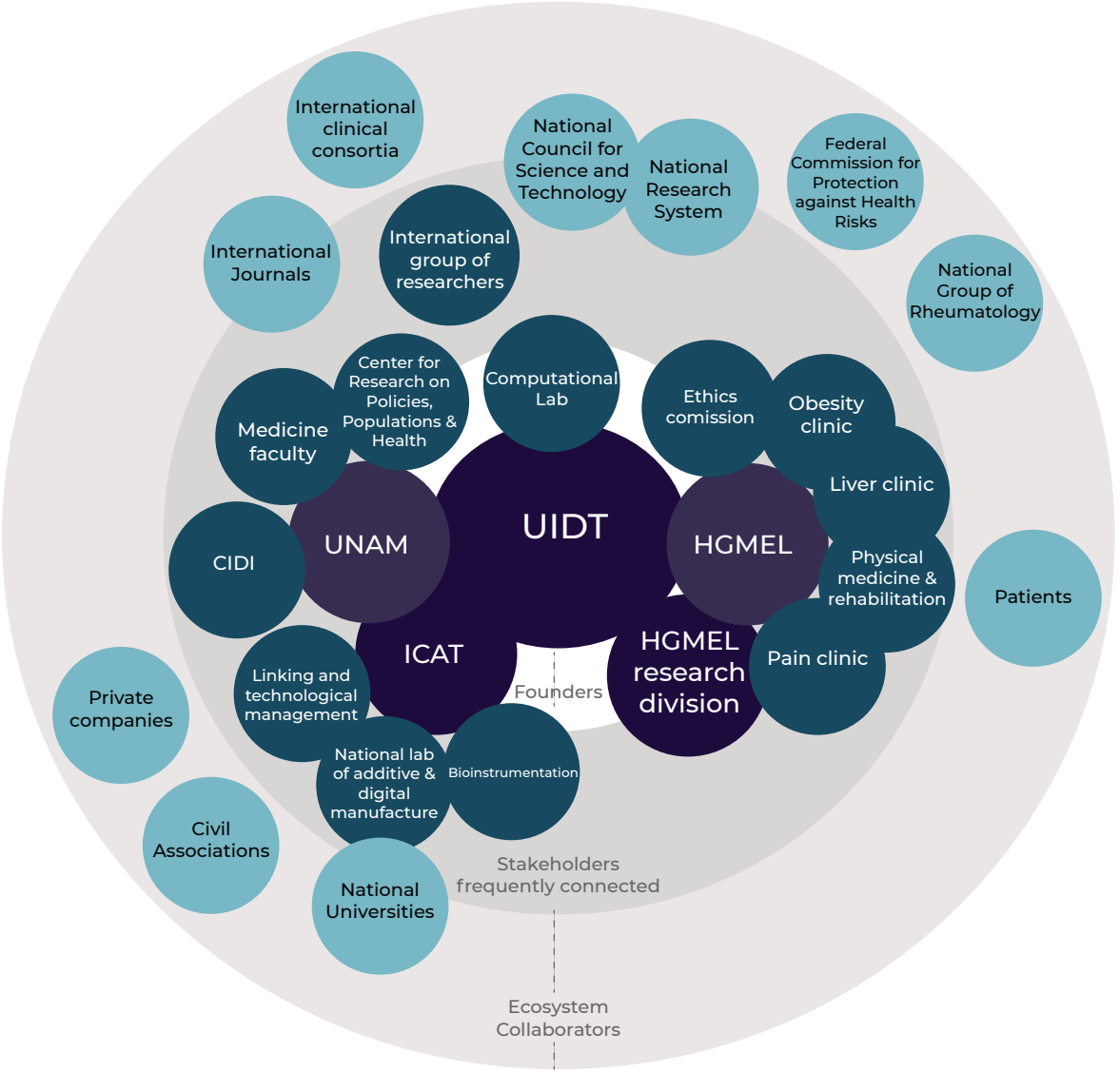


Figure 3.6 Overview of stakeholders present at the UIDT

researchers from ICAT, three researchers from HGMEL and a coordinator from ICAT. Additionally, ICAT provides support to the actors through the Linking and Technological Management Secretary.

Besides, in 2018, eleven professionals from HGMEL and three researchers from ICAT were collaborating in different projects (ICAT, 2020; Vega González & García-Segundo, 2019). For every project, as part of the collaboration agreement, each researcher works with students from Bachelor, Master or PhD level. Each researcher defines whether they need to collaborate with other stakeholders or not.

The collaboration agreement enables different disciplines from different institutions to work together in a project. For example, as ICAT is part of UNAM, they collaborate with other faculties. For this project, the collaboration was with CIDI, where four actors collaborated; a professor with a background in Advanced Product Design and three bachelor students of Industrial Design.

As a result of the interviews and the information collected from desk research, I realised a stakeholder map and placed the stakeholders into three levels (see Figure 3.6). At the centre, in dark blue are mapped the stakeholders who belong to the formal agreement, ICAT and HGMEL. On the next level, I placed the stakeholders that frequently collaborate with the UIDT; for instance, some faculties at the UNAM (e.g. medicine and CIDI) and some clinics at the HGMEL (e.g. pain, liver, obesity).

Finally, on the outer layer, some organisations that have an impact or contribute to the UIDT but their participation is not frequent. One example is the Federal Commission for Protection against Health Risks (COFEPRIS, from Spanish), who is the one responsible for the technological regulations in health.

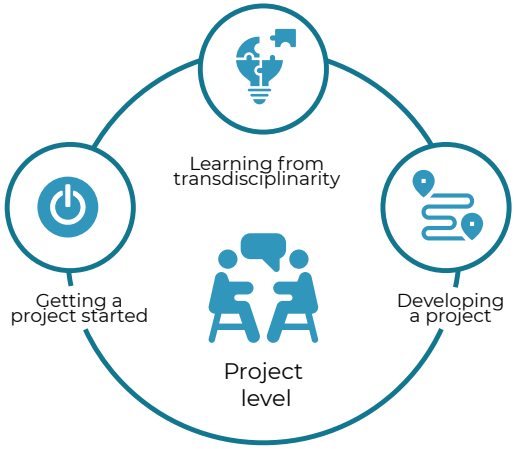


Figure 3.7 Operational steps at the project level

Besides, I also used the data collected from the interviews to explore how actors and stakeholders collaborate. As a result, I defined three operational steps at the project level. Those operational steps describe how a project gets started at the unit, how actors develop projects and how they learn from transdisciplinarity (see Figure 3.7).

Starting a project at UIDT

There are different paths to start a project at UIDT. Some researchers at ICAT mentioned that in their experience, the first approach with physicians was through the seminars that UIDT used to organise.

Nowadays, some researchers already have built a relationship with some physicians, so it is easier for them to start a project together. The initiative of working together could come from ICAT or HGMEL, or it could be an agreement between actors. For example, an actor shared the following:

> *'A lot of what we have been doing since some years ago is also their [physicians] initiative; nowadays, the initiative could come from the unit leaders or the main physicians.'*
>
> *- Full Researcher at ICAT*

Besides, physicians that have already worked at the unit introduce other physicians to the researchers. As a wau to demonstrate their capabilities, researchers show physicians results from previous projects. In that way, physicians can envision possibilities to collaborate.

The way of developing projects varies per researcher

Each researcher has a particular way of working. Some researchers from ICAT, work only with physicians from HGMEL and actors from other faculties at UNAM, while some others collaborate with international groups of researchers; for instance:

> *'Different researchers have considered different philosophies to fill that problem [of managing the projects]. I have decided to join a big international group of researchers, and that is how I gave structure to what we do [at ICAT].'*
>
> *- Full Professor at ICAT*

Despite working with local or international actors, the challenges tackled at UIDT are complex. Hence, researchers try out different ways to approach the problem; for example, by breaking down the project into small steps or being open for experimentation to evaluate the most feasible direction.

Actors learning from transdisciplinarity

No matter if they work with a local or an international team, researchers value working with actors from different disciplines. For instance, in a specific project, researchers

> *'What was interesting is that we, designers, also had a lecture with the cardiologists to understand the pathology of diabetic feet, the symptoms and its implications. Based on that, we had better criteria to avoid suggesting solutions that could affect the patient.'*
>
> *- Bachelor Student at CIDI*

and designers had lectures with physicians:
Besides these particular moments assigned to share knowledge, several actors mentioned discussion tables or periodical meetings were excellent opportunities to learn from other disciplines. A researcher mentioned it was a moment to absorb all the information from different areas and bring that knowledge to his discipline. However, not all the projects implement lectures or periodical meetings.

OUTCOME

b) Detecting barriers and enablers at UIDT

I first defined a preliminary list of barriers and enablers to share with the actors. The purpose was to receive feedback and understand their perception by using a Likert scale (Joshi et al., 2015). Later, I analysed the data collected from the survey and visualised into a stacked bar chart (see Figure 3.8), to visualise the data easily (Heiberger & Robbins, 2014).

On the vertical axis, the five scale-points; strongly disagree, disagree, neutral, agree, strongly agree and the 'not applicable' (NA) option are shown. Each bar contains the percentage of respondents per scale-point. Although the percentages are not significant because the sampling was small, I decided to add the percentages to help the actors understand the visual by knowing it respresents the percentage of respondents per scale point..

I used colour codes to easily identify each scale point (Heiberger & Robbins, 2014); blue tones on the left are for the respondents who disagree, grey tones on the centre for the neutral points and turquoise on the right for the agreement points (agree and strongly agree). On the right side, an extra column shows the percentage of respondents that answered 'not applicable'.

After this survey, I adjusted the preliminary list and defined a list with 23 barriers and 23 enablers that belong to the four organisational levels; ecosystem, organisation, project and actor.

As a result of the interviews realised with different actors from the UIDT, 23 barriers were defined (see Table 3.8). For each barrier, I present a short explanation followed by a representative quote (see Table 3.9 for an example). For the complete list, see Appendix G.

As a result of the interviews realised with different actors from the UIDT, 23 enablers were defined (see Table 3.10). I describe each enabler with a short explanation, followed by a representative quote (see Table 3.11). For the complete list, see Appendix H.

Colour code for Figure 3.8

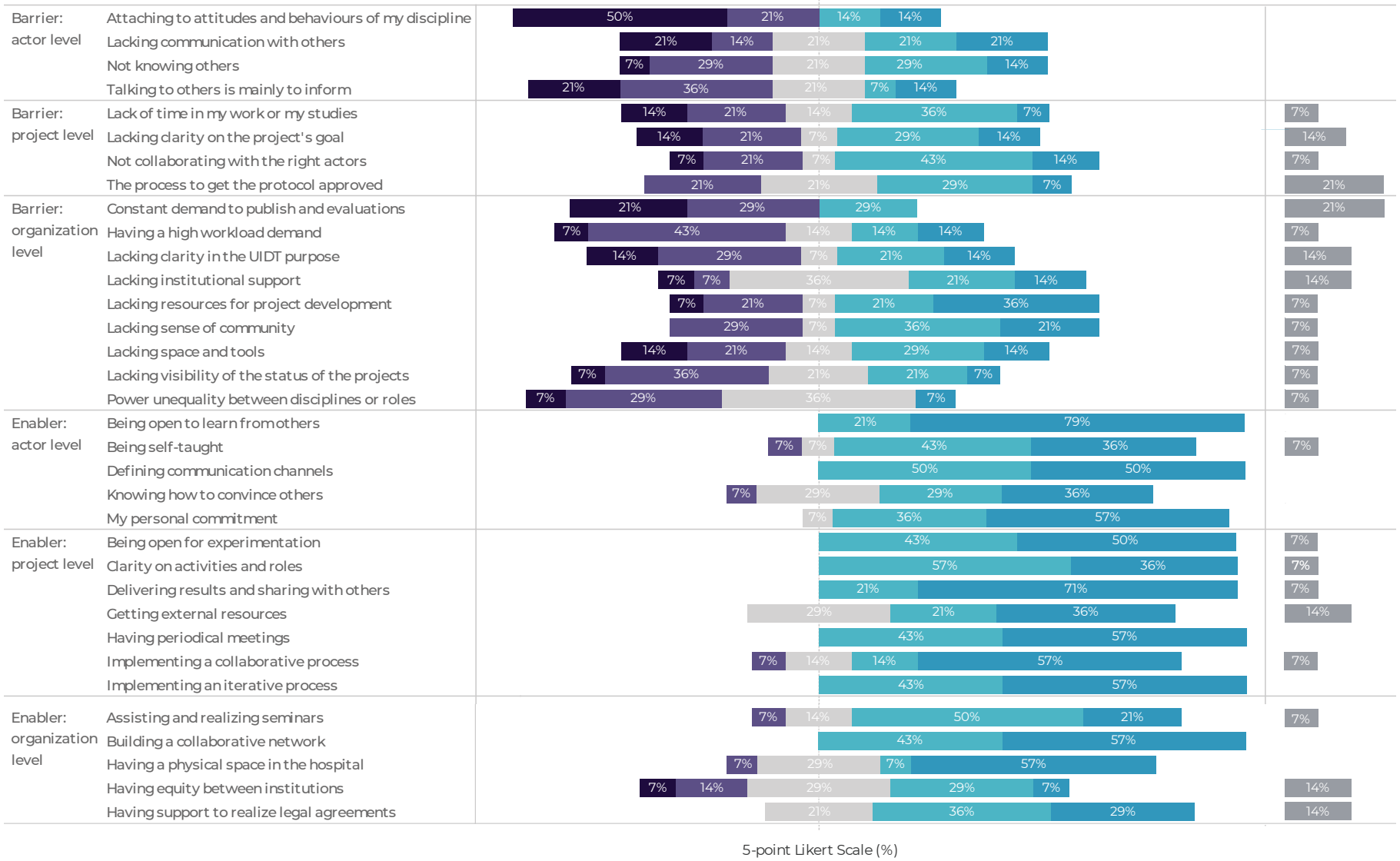


Figure 3.8 The impact of the barriers and enablers according to the actors' perspective

Table 3.8 List of barriers

Actor level	Project level	Organisation level	Ecosystem level
Missing communication	Getting the protocol approved by the commitee	Having a heavy workload	National evaluations demanding short-term results
Attaching to discipline behaviours or attitudes	Not having time available	Lacking a sense of community	Innovations not reaching the patient
Talking but not collaborating	Missing the right members	Lacking organisational support	Lacking recognition to scientists
Not knowing the other's work	Not having a clear project goal	Missing facilities and tools for everyone	Missing resources
		Unclear organisational purpose	Focusing on international trends over local needs
		Unequal power among disciplines	Depending on federal legislations to be approved
		Lacking project funding	
		Lacking projects' overview	
		Contradiction between what is being asked from actors and how they are evaluated	

Table 3.9 Description of a barrier at the organisational level

Organisational level	Barrier	Representative quote	Interpretation
Organisation	Lacking organisational support	*'I identify a problem that could be the umbrella under which you can find other problems. And it is the lack of institutional recognition. […] This unit was formed to be acknowledged by both institutions, but the truth is that there is no follow-up from ICAT or HGMEL. If there would be institutional recognition, we could have bigger projects where each researcher could tackle a problem from a different perspective. But that does not happen; the projects are individual.'* - *Full Researcher at ICAT*	It is not clear for the actors at UIDT how the institutions provide support to develop their projects.

Table 3.10 List of enablers

Actor level	Project level	Organisation level
Defining communication channels	Selecting the right members	Building a collaborative network
Acquiring knowledge from others	Sharing knowledge and capabilities	Providing facilities
Self-learning	Delivering outcomes	Assisting to and organising seminars
Being committed to UIDT	Having clear roles and tasks	Having support during legal agreements
Convincing others	Having periodical meetings	Defining equity between institutions
	Considering multiple actors' perspectives	
	Breaking down the steps of the project	
	Being open for experimentation	
	Having an iterative process	
	Having a collaborative process	
	Matching actors' needs	
	Getting resources for project development	
	Working with real cases and people	

Table 3.11 Description of an enabler

Organisational level	Enabler	Representative quote	Interpretation
Project	Selecting the right members	*'We have big working tables, around ten main researchers who are involved since the beginning of the project. That turns everything to be more modulated, avoiding one person wanting to cover more areas. And we also begin to absorb the knowledge from other areas and start implementing it in our scientific philosophy.'* - *Full Professor at ICAT*	The actors can develop a project effectively when the right members are involved in covering all the different roles needed.

3.4 Discussion

This research study helped me understand how UIDT operates and the perception of the actors about the unit. Besides, I was able to dimension the complexity of the unit due to the number of actors and stakeholders involved.

Sub-question a. Who are the stakeholders present in the unit?

The main collaborators in the unit are HGMEL and ICAT; however, both institutions are formed by different clinics and faculties. For example, at HGMEL, some stakeholders work at the liver clinic and the obesity clinic. At ICAT, some collaborators work at the Secretary of Linkage and Technology Management and the Department of Bioinstrumentation. Besides, as ICAT belongs to UNAM, they also collaborate with other faculties (e.g. CIDI and medicine).

At the ecosystem level, multiple stakeholders have an impact on the unit. For example, in order to develop new projects, the unit needs funding, the primary stakeholder for this is the National Council for Science and Technology (CONACYT, from Spanish).

In the stakeholder map, I placed around 25 stakeholders, and I am aware that I might be missing some stakeholders. Most of the information I collected was from the 25 actors I contacted during these months and the UIDT webpage.

The network of collaborators of the unit includes multiple actors and multiple stakeholders. Some of them have formal agreements, while others do not. Due to the complexity of the unit and its network; it is challenging to have one clear process to make things work out. However, the unit needs a clear overview of its network to take advantage of it.

Sub-question b. How does UIDT operate?

I identified three relevant processes at the unit; how a project gets started at the unit, how actors develop projects and how they learn from transdisciplinarity. At the unit, there are not defined processes that the actors need to follow, so they are free to define their path. For example, the way a project gets started and the way projects are developed is different from project to project. It depends on the preference of the researcher or the actor responsible for the project.

All actors are aware of the value of working with others. For example, researchers mentioned that by working with physicians, they were able to develop solutions that are not possible to realised in a laboratory.

Each actor has a different way to acquire knowledge; for instance, in a project, they had implemented short lectures to share knowledge from different disciplines. It will be valuable to define different ways of learning from others and implement them systematically in each process. This approach could contribute to having a structured learning method instead of only learning from experience.

Sub-question c. Which are the barriers and enablers that have a significant impact on the actors?

In this study, I identified the same number of barriers and enablers,

23 for each list. Even though in the interviews the actors mentioned they perceive there is a big list of barriers at the unit; I identified the same number of enablers. Besides, I was surprised that in the validation the actors perceived the enablers have more impact on their work that the barriers.

Limitations and future research

Due to COVID-19, some of the interviews were realised remotely. Besides, as the actors at the hospital are saturated, I was able to interview a reduced number of actors from the hospital; therefore, the majority belong to ICAT and CIDI.

Future research could focus on exploring how to make the best out of the enablers that have a significant impact on actors' work, and improve the collaboration among disciplines.

Summing-up

UIDT is an initiative that was formed by two big institutions in Mexico. Even though the formal agreement was realised by two stakeholders (ICAT and HGMEL), a significant number of stakeholders are involved; hence, it is difficult to have control over all the relationships going on with stakeholders.

During the study, I noticed that the unit does not have clear processes to operate and to share knowledge between actors. For example, some actors shared that they have implemented short lectures and periodical meetings to share knowledge but these initiatives are not applied throughout the unit.

Although the subjective perception of the actors was that there are many barriers to collaborate; the lists of barriers and enablers contain the same number of elements, twenty-three. Besides, actors shared in the survey that enablers have more impact on their work. Thus, it will be relevant to make the best out of those enablers.

TAKEAWAYS FOR UIDT

- Short lectures and periodical meetings could contribute to increasing sharing knowledge and learning from others.
- Having a clear overview of the network and get to know the stakeholders could result in new projects and better collaborations.
- Actors at the unit perceive the enablers have more impact on their work. Hence, the suggestion is to improve the enablers.

CHAPTER 4

Open Innovation in the Netherlands and Mexico: A Comparative Study

This chapter aims to compare the studies realised in the Netherlands and Mexico to have a better understanding of open innovation initiatives in healthcare. This chapter presents an analysis of the stakeholders present in health open innovation initiatives, funding aspects, operation conditions and steps, and factors to enable collaboration. As a result, I suggest three recommendations for UIDT and a list of twelve factors to build effective transdisciplinary collaborations inside the unit.

Table 4.1. Research sub-question for Chapter 4

a.	What are the differences and similarities between health open innovations initiatives in Mexico and the Netherlands?
b.	How are barriers and enablers present in health open innovation initiatives in Mexico and the Netherlands?
c.	What factors contribute to building effective transdisciplinary collaborations in healthcare?

4.1 Introduction

For this phase, the aim was to explore the differences and similarities between health open innovation initiatives explored in the studies realised in the Netherlands and Mexico. This phase consists of a comparison between stakeholders, funding aspects, conditions to operate and operational steps. Besides, a comparative analysis between the barriers and enablers detected in the Netherlands and the ones identified in Mexico. I defined three research sub-question for this phase (see Table 4.1).

For the data analysis, I compared the results of both studies. Subsequently, I defined a list of factors needed to build effective transdisciplinary collaborations in healthcare.

4.2 Method

METHOD

a) Difference and similarities between studies in the Netherlands and Mexico

For this chapter, I went back to both of the studies previously realised, the interview study in the Netherlands and the case study in Mexico. I compared and contrasted all the preliminary outcomes; the stakeholder maps, the conditions to operate at the organisation level in the Netherlands and the conditions to operate at the project level in Mexico.

Stakeholder maps in the Netherlands and Mexico

In the Netherlands, I realised an interview study that involved eight different initiatives and in Mexico, a case study with one initiative. For this comparative analysis, I considered the overarching stakeholder map (see Figure 2.11)I realised for the interview study in the Netherlands and the stakeholder map for the case study (see Figure 4.5).

I placed both maps together and detected the differences and similarities in each level. I highlighted the stakeholders that were similar in each level; for example, academic institutions are commonly founders of initiatives in the Netherlands, and ICAT, an academic institution, is also a founder in the Mexican case study. I started with the founders level moving from the centre to the outside. I also identified the main differences.

Afterwards, I selected the most exciting findings; similarities at the founding level, an essential stakeholder in the Netherlands that does not exist in Mexico, and the presence of the Quadruple Helix

(government, citizens, commercial parties and academia), in both studies. To explain each of these findings, I went back to the studies and consulted the transcriptions. Additionally, I supplemented the information with existing literature for a better explanation of the findings.

Funding aspects in Mexico and the Netherlands

To realise the comparison of the funding aspects in Mexico and the Netherlands, I collected the results of both studies regarding funding. I considered the barriers and enablers related to funding and the condition of 'receiving funding' defined at the organisational level at the study in the Netherlands.

I also verified the transcriptions to better understand in which context were the quotes selected for the barriers and enablers expressed. Besides, I went back to the literature research section in this report, where I already had information regarding funding for research, science and technology in Mexico.

After having an overview of both studies, I defined what information was missing; for example, the type of funding calls in each country. Hence, I realised desk research to look for the missing information. I looked for funding calls in Mexico and the Netherlands regarding 'research in healthcare', 'innovation in healthcare', and 'technological development in healthcare'. Afterwards, I integrated the new information into the existing findings, and I defined the differences between countries.

Conditions to operate at the organisational level in the Netherlands

As a result of the interview study in the Netherlands, I defined four conditions needed to operate at the organisational level. The conditions are receiving funding, having a physical space, building a network, and sharing knowledge. This step aimed to compare the status of these conditions at the unit in Mexico.

The first condition, 'having funding' was already discussed in the previous analysis, 'funding aspects in Mexico and the Netherlands'. Hence, in this section, I only mention this condition briefly, and I focus on exploring the other three conditions (having a physical space, building a network, and sharing knowledge) in both studies.

I first went back to the description of the conditions written down in Chapter 2, Transdisciplinary Collaboration in the Netherlands: an Interview Study. For each condition, I read the representative quote and consulted the transcription to read the quote in the context. Later, I went through the analysis table; it contains the four conditions with a list of quotes related to each condition.

For both studies, I identified other quotes related to each condition.

Afterwards, for each condition, I reflected on which was the situation in the Mexican context. I first wrote down my observations, and then I verified them by consulting the list I created of relevant quotes for the study. I looked for keywords that could help me collect data for each condition; for example, 'facilities', 'network', and 'learning'. When needed, I also consulted the transcriptions to understand the quotes in the original context and avoid missing some information. As a result, I wrote a comparative paragraph for each condition.

Operational steps at the project level in Mexico

For this analysis, the process was similar to the one previously explained for the organisational level in the Netherlands. However, for this one, I started with the Mexican study and went back to the Dutch study. At UIDT, I detected three conditions to operate at the project level; starting a project, developing a project, and learning from transdisciplinarity. For each of the three conditions, I first took a look to the description of the conditions written down in Chapter 3. Besides, I read the quotes related to each condition and verified the transcriptions when I needed more context to understand the quotes.

Afterwards, I explored the study in the Netherlands. I went directly to the transcriptions because, during the interviews, I had questions related to 'how do you start a project?' and 'which is the process to accept projects?'. The answers to these questions gave me a better understanding of the first two conditions (starting a project and developing a project).

Besides, during the interviews, there was also a moment referring to 'learning aspects'. The answers to that section provided insights related to the condition 'learning from transdisciplinarity'. Finally, with this information, I wrote a comparative paragraph for each condition.

METHOD

b) Comparing barriers and enablers present in the Netherlands and Mexico

For this phase, I explored the similarities and differences between the barriers and enablers present in the Netherlands and the case study in Mexico. Hence, I put together the lists of barriers and enablers from both studies. All those barriers and enablers were printed down and clustered according to the similarities among themes (see Figure 4.1).

Inside each cluster, I identified similarities, differences and relationships between barriers and enablers. Based on the barriers and enablers in each cluster, I assigned a name to the cluster. In the end, I defined eleven different clusters; each cluster represents a factor that needs to be present to achieve transdisciplinary collaboration. Afterwards, I clustered the factors into the four organisational levels (ecosystem, organisation, project,

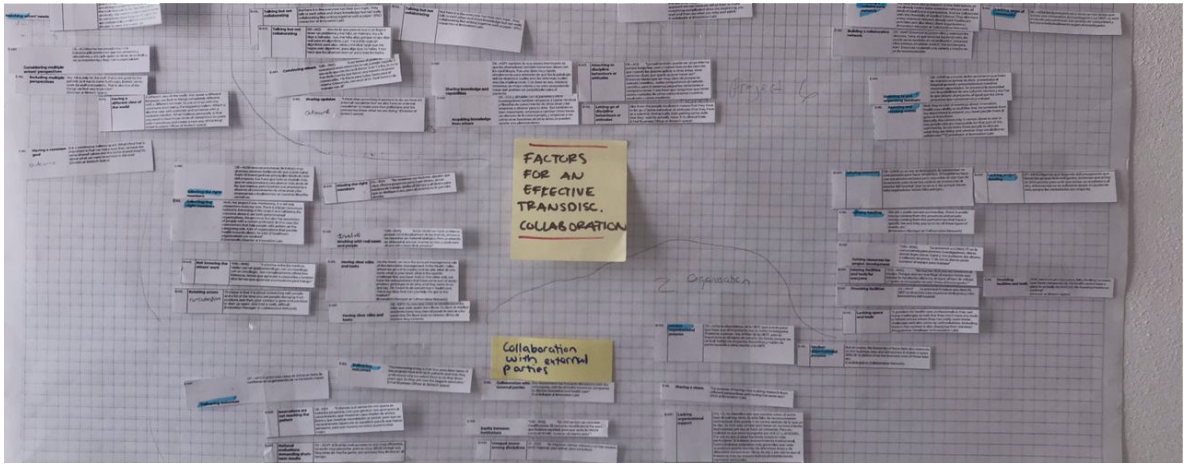


Figure 4.1 Barriers and enablers from the Netherlands and Mexico

and actor).

Later, I documented the printed material to analyse each factor. I analysed the similarities, differences, and relationships among the barriers and enablers present in each factor by using colour codes (see Figure 4.2). Afterwards, I realise desk research to complement and verified the information collected.

For instance, the ecosystem level in the Netherlands does not include barriers, so by doing desk research, I was able to identify how was the situation in the Netherlands in comparison to the barriers identified in Mexico. By making use of the colour codes, it was easy to have an overview of the barriers and enablers that were present in both studies and detect which were similar and which different.

Finally, to verify the list of factors, I defined a validation exercise with actors from the Netherlands and Mexico. I created a digital booklet that I shared with nine actors from each country. The purpose of the booklet was to verify if the factors were clear and to explore if something else was missing. The booklet name was 'A Guide for Transdisciplinary Collaborations in Healthcare'. In the booklet, I first introduced the concept of transdisciplinarity, followed by an explanation on how to make use of the booklet. Then I presented the factors in a visual, explaining the relationship between levels (see Figure 4.3).

Afterwards, I explained each factor with a list of questions. I defined the questions based on the barriers and enablers that created the factor. These questions are a reflective mechanism for actors related to the initiatives where they collaborate. A total of five actors provided feedback to me (see Table 4.2). Three actors sent the booklet back to me, two from Mexico and one from the Netherlands (see example in Figure 4.4.). Besides, two actors from the Netherlands shared their comments via email (see Figure 4.5). To see the complete booklet refer to Appendix I.

After receiving all the answered I collected all the information and put it together. I categorised the answers to identify what was missing in each level. Besides, I clustered all the general comments outside the organisational levels; for example, 'for whom is this list?', 'anyone interested in transdisciplinary collaboration?'. Later I went back to the factors list.

For each factor, I defined a list of concepts that describe the factor; for example, for the factor 'right actors', the concepts describing it are different disciplines, actors availability period, clear roles, and human-centred approach. Finally, I compared the defined list with the barriers and enablers defined by Choi & Pak, 2006. I verified the presence of the barriers and enablers in the factors list. With this, I made the final adjustments to the list and added one more factor..

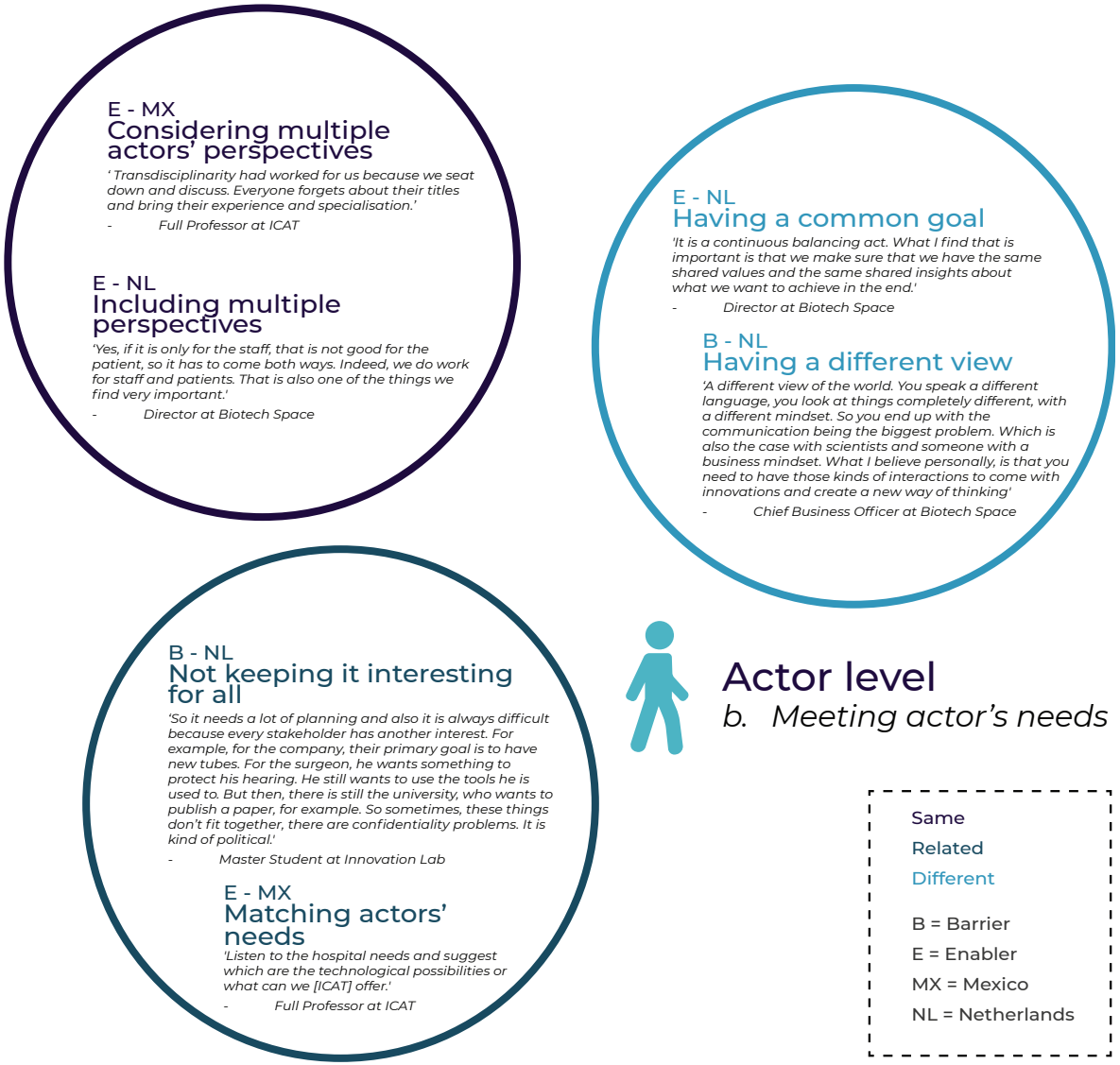


Figure 4.2 Example of analysis per factor

Figure 4.3. Factors for effective transdisciplinary collaboration in healthcare

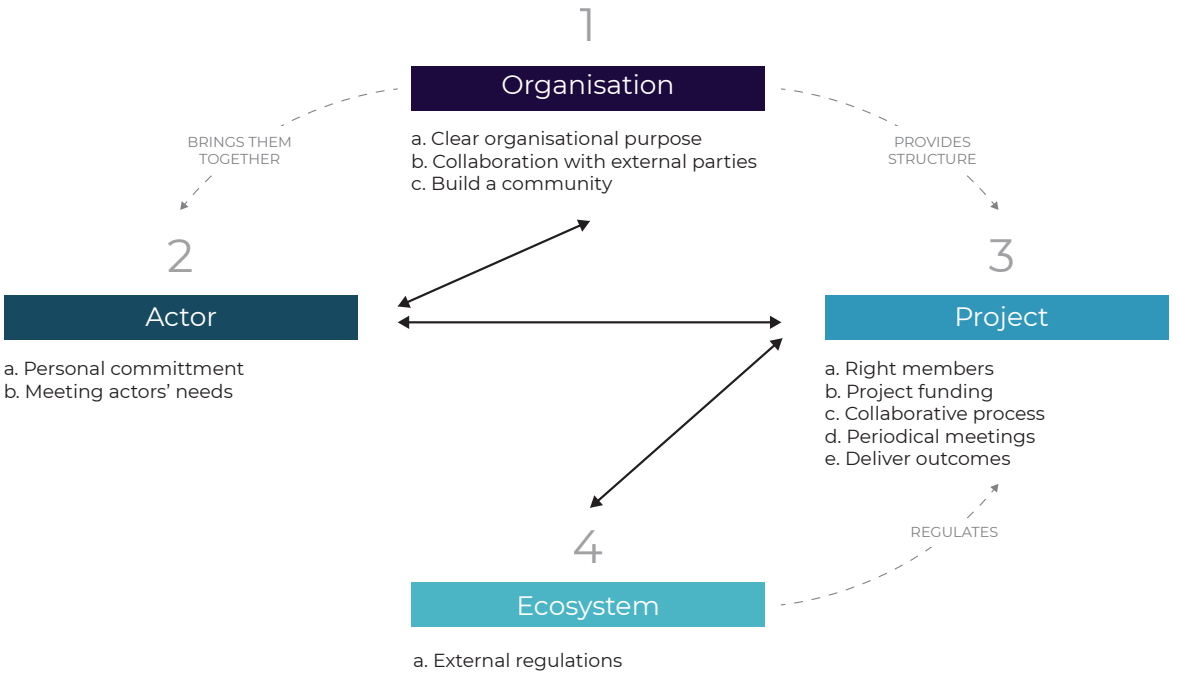


Table 4.2. List of actors collaborating in the validation of the factors

	Role	Organisation	Professional background	Participation
Netherlands				
1	Master Student	Innovation Lab	Design for Interaction	Booklet
2	Programme Coordinator	Innovation Lab	Industrial Design Engineering	email
3	PhD Researcher	Collaborative Network	Medicine	email
Mexico				
1	Full Professor	ICAT	Mechanical Engineering	Booklet
2	PhD Researcher	ICAT	Astrophysics, Optics & Electronics	Booklet

Figure 4.4. Example of an actor's answer in the digital booklet

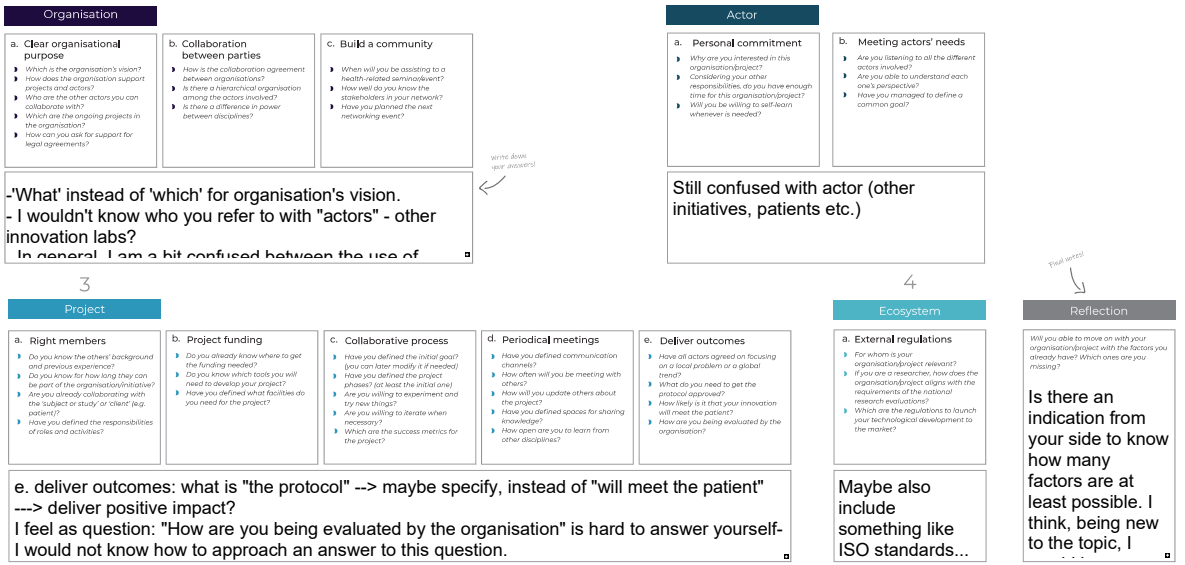


Figure 4.5. Actor's feedback via email

Hey Regina!

How is life? Everything OK with you? And thank you very much for the mail. Interesting and relevant approach. Nice! Some initial remarks:

- Those levels, are they seen in a specific order? Something about the inter dependance?
- And what intrigues me is the nr. 4 Ecosystem - level. As you might know, building of successful ecosystems demands far more than answers to the rather limited 3 questions on page 4. And is not limited to "regulations". I'm aware that you can not integrate as much as you maybe want, but this "ecosystem" is and has been subject of research for many years. Perhaps you could expand on this to help the understanding? To start with some generic success factors maybe?

Ciao,

[redacted]

[redacted]
Chair Graduation Projects
Assistant Professor
[redacted]
Manager Executive Education Program

4.3 Outcome

OUTCOME

a) Differences and similarities between initiatives in the Netherlands and Mexico

In this section, I introduce the analysis of the stakeholder maps in the Netherlands and Mexico, funding aspects in both countries, conditions to operate at the organisational level, and conditions to operational steps at the project level.

Analysis of the stakeholders present in open innovation initiatives in the Netherlands and at UIDT

In the Netherlands, the leading players in open innovation initiatives are university medical centres, academic institutions and other open innovation initiatives. Academic institutions include universities of technology, universities of applied sciences or other universities. In the case study in Mexico, the Institute of Applied Science and Technology (ICAT) that belongs to UNAM founded UIDT in collaboration with the General Hospital of Mexico 'Eduardo Liceaga'.

Hence, the stakeholders that founded the unit are similar to the ones identified as leading players in the Netherlands. However, there are slight differences between the stakeholders.

The figure of 'university medical centre' has a different function in Mexico; it refers to hospitals that provide service to students, but not necessarily promotes research. UNAM has one of these centres. A similar figure to the 'university medical centre' is called 'academic health centre' in Mexico. It refers to an ecosystem where care services, research and education occur. However, it does not necessarily occur at one institution; for example, a private university in Mexico, Tecnológico de Monterrey, has partnerships with hospitals to provide this ecosystem to their students (UNAM, n.d.; TecSalud, 2018).

In the Netherlands, companies, citizens, government and academia are present in the second level, and the third level, meaning most initiatives collaborate with all the stakeholders belonging to the Quadruple Helix (Carayannis & Campbell, 2010; Leydesdorff, 2012). At UIDT, academia is present at the second and third level because they collaborate with other faculties and other universities. Additionally, an advantage of working at the hospital is that they have access to patients that belong to the citizens' group.

The collaboration with government institutions is mainly to get funding and get technological developments approved to be commercialised. Researchers get evaluated by the National Research System. Based on the data collected, the interaction with commercial parties is mainly to transfer technological developments, so it happens at the end of the process.

Although some researchers are

consultants in private organisations, those projects are not always related to the unit. Hence, I perceived the collaboration with commercial parties is less frequent than with other stakeholders because not all projects end up in a commercial product.

Funding aspects in the Netherlands and Mexico

Resources are necessary for these initiatives; they need money and equipment to work. However, the scene in the Netherlands is different from the scenario in Mexico. For instance, in the Netherlands, life sciences and health are considered as one of the nine 'top sectors' defined by the Dutch Ministry of Economic Affairs and Climate Policy.

This sector has its communication channel called Health Holland. In the funding section, I found around sixty open calls for funding regarding innovation and research in health (Health Holland, n.d.). Besides, almost all initiatives studied mentioned they had funding from the European Union and the Dutch Government.

In Mexico, the country does not invest a lot in science, research, and technology. Compared to other emergent economies, Mexico is below countries like Brazil and Argentina (Pérez-Orive & Ibarra Ponce de León, 2019). The primary stakeholder that provides funding for projects is CONACYT; it is an institution from the government that provides support to sciences, technology and innovation.

Every year, CONACYT has annual calls for researchers and students. However, actors mentioned that applying means a long process, and it is difficult to get the money. For example, an actor shared that the process was 'a nightmare'. He applied for funding in 2005 with other partners, and he got the money two years later. CONACYT gave only one-fifth of the total requested, and it was only for him, not for all the partners who applied. Since then, he had decided not to apply to CONACYT calls.

Conditions to operate at the organisational level

In the study realised in the Netherlands, I identified four conditions that allow initiatives to operate; receiving funding, having a physical space, building a network, and sharing knowledge (see Figure 2.13). As mentioned above, the process to get funding in both countries is different. In the Netherlands, getting funding is an enabler; while in Mexico, the lack of funding is a barrier.

Regarding the physical space, most initiatives in the Netherlands mentioned it was necessary to realise clinical trials. Nevertheless, other initiatives mentioned they do not own or need a physical. Although they might not need it for clinical trials, almost all initiatives use the facilities of stakeholders in their

network to work or realise events. In Mexico, UIDT has a physical space inside the hospital. It is a benefit for the actors at the ICAT to have the possibility to realise experiments directly at the hospital.

Although the space at the unit has some limitations, having a physical space is already a good start. It facilitates collaboration with care providers and patients because they do not need to change locations to take part in the studies. Also, it is better not to move the laboratory tests from one institution to another.

Building a network is a condition that all the initiatives in the Netherlands considered relevant. In the Netherlands, the actors focused mainly on expressing the benefits of having a network. For instance, when they have a new project, they can take a look at their network and know whom to contact. In Mexico, the stakeholder map of the unit (see Figure 3.6), demonstrates the unit's network formed by multiple stakeholders. However, I perceived that not everyone is aware of that network; each actor has their partial network, and they are not necessarily aware of the bigger network they belong to as collaborators from ICAT.

Finally, regarding the aspect of 'sharing knowledge', in the Netherlands, most actors consider an experimental process for developing new solutions. Hence, they know their experiments are not always successful, but they consider them learning experiences. In Mexico, due to reduce resources, actors expect to do the most out of every experiment; therefore, they have pressure to deliver results soon.

Operational steps at the project level

In UIDT, I detected three conditions necessary to operate at the project level; starting a project, developing a project and learning from transdisciplinarity (see Figure 3.7). In Mexico, at UIDT, projects can be an initiative of ICAT or HGMEL. The actors involved in the project define how to tackle it; each one has their process; it is not a standardised process throughout the unit.

In the Netherlands, the project could also be an initiative of different stakeholders. However, I perceive a difference in the way of tackling the projects. In the Netherlands, each initiative defines requirements to start a process; and the same process is used throughout the initiative. For instance, an actor at a Collaborative Network mentioned they first verify the project will solve or tackle a problem in healthcare. After that, they consider four aspects to get started 1) involving legal and ethical affairs, 2) defining the right validation process, 3) getting finance, and 4) having the participation of the end-user.

Additionally, developing a project varies depending on the nature and the size of the project. In Mexico, some projects are developed between ICAT and HGMEL, while

some others are international projects. The way of developing national and international projects has some differences. However, in both studies realised in Mexico and the Netherlands, actors agreed on breaking down a complex problem into smaller steps to be able to get started and develop the project.

Finally, 'learning from transdisciplinary' is a similar concept to 'sharing knowledge' previously discussed on the conditions to operate at the organisational level. These aspects repeated in both studies reinforce the fact that both conditions, sharing knowledge and learning from others, are critical in open innovation initiatives. Providing spaces for dialogue and learning allow actors to think together and increase collaboration (Bradbury & Mainemelis, 2001). As a result, new knowledge will detonate new ideas that can result in innovations.

OUTCOME

b) Barriers and enablers in Mexico and the Netherlands

As a result of the comparative analysis between the studies in the Netherlands and Mexico, I defined a list of twelve factors that should be present in transdisciplinary collaborations in healthcare. In this section, I will first introduce the factors. Then, I describe the differences per factor, followed by the similarities and later the relationships among factors. At the end of the section, I shared the aspects covered by each factor.

Factors for transdisciplinary collaborations in healthcare

The factors were divided into four organisational levels (see Table 4.3). A different number of factors form each level; ecosystem (two), organisation (three), project (five) and actor (two).

Table 4.3 List of factors to build a transdisciplinary collaboration in healthcare

Organisational level	Factors for transdisciplinary collaboration in healthcare
 Actor level	a. External regulations b. Society recognition
 Project level	a. Organisational purpose & support b. Collaboration between stakeholders c. Build a community
 Organisation level	a. Right actors b. Project resources c. Collaborative process d. Space to communicate, share, & learn e. Deliver outcomes
 Ecosystem level	a. Personal committment b. Agreements between actors

Differences between barriers and enablers in the Netherlands and Mexico

During the analysis, I detected some differences between barriers and enablers in both countries. In the following lines, I briefly describe the main differences in three of the organisational levels; ecosystem, organisation, and project.

One barrier at the ecosystem level in Mexico is the lack of recognition for science and scientists. According to literature, in Mexico, there is a lack of communication between the scientific world and society (Pérez-Orive & Ibarra Ponce de León, 2019). In comparison to the Netherlands, where they rely on evidence and scientific advice for decision making (Kroneman et al., 2016).

Another barrier relates to the national research evaluations, Mexican actors mentioned that it results contradictory to try to impulse a collaboration while all the evaluations for researchers are individual. In contrast, in the Netherlands, research done in teams is evaluated in teams (Gadd, 2018).

Other differences occur at the organisational level. In Mexico, the fragmentation of the healthcare system limits collaboration between government, citizens, commercial parties and academia. In the Netherlands, actors mentioned having frequent communication with different stakeholders to discuss health-related topics.

> *'We have an institute, which is called the National Health Care Institute. I collaborate in round table discussions. Besides, our department has frequent discussions with the community and with local health insurance companies to discuss innovation and health care. So we also have conversations with them.'*
>
> - *Medical Specialist at Collaborative Network*

At the project level, an important aspect mentioned in the Netherlands was 'defining success metrics'. A Collaborative Network mentioned they have four requirements for each project, and they test the innovations on those aspects. At UIDT, according to my research, each project has the responsibility to deliver results and publish, but they do not have success metrics for the projects.

Similarities between barriers and enablers in the Netherlands and Mexico

Furthermore, I also detected some similarities between barriers and enablers in both countries. In this section, I briefly describe the main similarities in three of the organisational levels; ecosystem, organisation, and project.

One similarity at the ecosystem level is the process for evaluation and approval for technological developments. In Mexico, the Federal Commission for Protection against

Health Risks (COFEPRIS, from Spanish) is the institution responsible for the evaluation and approval of technological developments. However, the process is long and challenging. Therefore, the actors mentioned most of the times, innovations do not end meeting the patients. In the Netherlands, it was also mentioned by the actors that getting innovations through law and regulations is hard.

> *'In healthcare projects, I see that it is really difficult [that innovations reach the market] and that is because of law and regulations. It is really hard to get an innovation through all the tests and to really get it into the system.'*
>
> *- Financial Advisor at Subsidy Programme*

At the organisational level, it was clear that a way to build a community and expand the network is by assisting and creating events such as seminars. The study demonstrates that seminars provide an excellent opportunity to get to know their colleagues and new actors to expand their network. Besides, it is also an opportunity to get to know the work of others which might be useful for future projects.

Moreover, at the project level, I detected multiple similarities. First, having a clear goal of the project contributes to the alignment of actors, everyone working in the same direction. Another important aspect is to have clear roles and tasks defined; to know who will be part of the project and what are the responsibilities of each actor.

Additionally, it is essential to be open for experimentation, knowing that failures are also part of the process. Also, showing progress and delivering outcomes increase trust in others and help actors to notice the value of the collaboration.

Finally, at the actor level, in both studies, actors perceive that they miss collaboration with their colleagues. In Mexico, as discussed in the previous section 'stakeholders present', the participation of patients is still as a subject of study rather than collaborators. In both studies, the purpose of communication is just to inform rather than to collaborate. For example, in the Netherlands, an actor mentioned the lack of a shared space affects the collaboration and the feeling of community among the members. In Mexico, an actor explicitly mentioned there is a lack of sense of community.

> *'As researchers, we tend to forget that we are a research community. UIDT is not working to promote the community, so it works individually for every researcher.'*
>
> *- Full Professor at ICAT*

Relationships between barriers ane enabler in Mexico and the Netherlands

As shared in both of the studies, barriers and enablers are interdependent and relate with one another across levels. For example, at the organisational level, in the Netherlands, they refer to lacking collaborative structure while in Mexico, it was defined as lacking organisational support. Although the concepts are different, I considered they go hand by hand.

For instance, in Mexico, actors from the unit do not perceive support from the organisation, while in the Netherlands, an actor mentioned that no one encourages them to collaborate. These two examples

Table 4.4 Factors for transdisciplinary collaboration and aspects covered per factor

Organisational level	Factors for transdisciplinary collaboration in healthcare	Aspects covered per factor
 Actor level	a. External regulations	Legislations, national evaluations, regulation standards
	b. Society recognition	Opportunities to have an impact, trust in science
 Project level	a. Organisational purpose & support	Organisation vision, organisational support, collaborative structures, projects' overview, suppor for legal agreements
	b. Collaboration between stakeholders	Collaboration agreements, organisational structures, discipline roles
	c. Build a community	Seminars and networking events, having a network, promoting collaborative projects
 Organisation level	a. Right actors	Different disciplines, actors availability period, clear roles, human-centred approach
	b. Project resources	Tools and facilities needed, financial resources
	c. Collaborative process	Project goal, project phases, experimentation, iteration, sucess metrics
	d. Space to communicate, share, & learn	Communication channels, periodical meetings, updates, openness to learning, share knowledge
	e. Deliver outcomes	Approved protocol, impact on society, short or long-term outcome, local or global problem
 Ecosystem level	a. Personal committment	Personal interest, self-learning, having time availability
	b. Agreements between actors	Common goal, consider different perspectives, balance actors' needs

refer to the role the organisation level plays in the actors; the organisation provides a structure and a backup to actors. Without that support, actors might get lost or face more barriers to deliver results.

Explanation of the factors

Finally, each factor is described with keywords that expressed all the aspects covered per factor (see Table 4.4).

4.4 Discussion

In this section, I realised a comparative analysis between the interview study in the Netherlands and the case study in Mexico. As a result, I answered three main questions discussed in the following lines.

Sub-question a. What are the differences and similarities between health open innovation initiatives in Mexico and the Netherlands?

The first similarity has to do with the stakeholders present in the initiatives. In both cases, academic institutions and hospitals play an essential role. Due to the nature of academic institutions focus on basic research for knowledge creation (Carayannis & Campbell, 2010); these stakeholders are open to experiment and learn. I assume this condition makes them suitable candidates to collaborate in open innovation initiatives, where openness to new knowledge is necessary (Bullinger, Rass, Adamczyk, Moeslein, & Sohn, 2012). Besides, hospitals are critical stakeholders because patients go to the hospital to look for a solution. Hence, the hospital can define and share with an open innovation initiative all the challenges needed to be solved.

As mentioned in the analysis, receiving funding in the Netherlands is an enabler and in Mexico, not receiving funding is often a barrier. Hence, UIDT can look for alternatives to have their fund without depending only on the money provided by the government institutions.

For both studies, I followed the same steps identifying stakeholders, detecting conditions to operate and identifying barriers and enablers. However, in the Netherlands, I explored eight initiatives at a higher level (organisational level), while in Mexico, I studied more in-depth one case. Hence, in the Netherlands, I identified four conditions to operate at the organisational level (receiving funding, having a physical space, building a network, and sharing knowledge). In contrast, in Mexico, I identified three operational steps at the project level (starting a project, developing a project, learning from transdisciplinarity). Although I identified some differences between the studies, the conditions at the organisational level and the steps at the project level are applicable for both countries.

Sub-question b. How are barriers and enablers present in health open innovation initiatives in Mexico and the Netherlands?

In both studies, I detected a long list of barriers and enablers present at the four organisational levels; ecosystem, organisation, project, and actor. While doing the analysis, I identified several similarities and differences in the barriers and enablers present. Some differences in Mexico are the lack of recognition for science and scientists and

individual evaluations to research despite working collaboratively. Both of these differences occur at the ecosystem level.

A relevant difference at the organisational level is that open innovation initiatives in the Netherlands are already integrating stakeholders from academic institutions, government, commercial companies and cities; while in Mexico, the integration of all stakeholders is slower. For instance; some researchers are already considering patients at a certain phase of the study, but they are subjects of study instead of collaborators.

For future projects, the collaboration with patients and other stakeholders should start since the beginning of the process to integrate different perspectives throughout the project. In this way, UIDT can implement a participatory approach actively involving different stakeholders (Sanders & Stappers, 2018).

According to the dutch initiatives, at the project level, it is important to define success metrics for delivering better outcomes. This aspect could help UIDT in future projects to monitor results, not only at the project level but also to monitor the results the unit is delivering. Hence, success metrics can help quantify the value generated (Calabretta, Gemser & Karpen 2018).

Despite the difference between Mexico and the Netherlands, I detected multiple similarities between barriers and enablers. Initiatives in the Netherlands shared that having facilities enabled collaboration by offering spaces to work, realise workshops or present outcomes. In Mexico, UIDT has a physical space at the hospital, providing room for collaboration between actors from both institutions, so this factor is already a competitive advantage for the unit.

Also, in both countries having periodical meetings allow actors to stay updated about the projects, and provide space to share and learn. Besides, building a collaborative network contributes to forming a community of actors for future collaborations.

Sub-question c. What factors contribute to building effective transdisciplinary collaborations in healthcare?

After this analysis, I detected twelve factors (see Table 4.5) that were present in both studies and have had an impact on encouraging and building effective collaboration among actors. Those factors are present in the four organisational levels (ecosystem, organisation, project, and actor) and are interrelated; meaning they relate from one level to another. The suggestion is that the presence of these factors contributes to building effective collaborations in health open innovation initiatives.

Factors for transdisciplinary collaboration in healthcare

1	External regulations
2	Society recognition
3	Organisational purpose & support
4	Collaboration between stakeholders
5	Build a community
6	Right actors
7	Project resources
8	Collaborative process
9	Space to communicate, share, & learn
10	Deliver outcomes
11	Personal committment
12	Agreements between actors

Table 4.5. Factors to build effective transdisciplinary collaborations in health open innovation initiatives

These factors integrate the barriers and enablers presented by Choi and Pak for collaboration. Choi and Pak's study suggest maturity concerning the knowledge base of the actors (2007); however, this study does not consider the level of maturity knowledge but the openness to learn.

Limitations and future research

For both studies, I followed the same initial steps identifying stakeholders, detecting conditions to operate and operational steps, and identifying barriers and enablers. However, in the Netherlands, I explored eight initiatives at a higher level as only one to three actors per initiative were interviewed.

In Mexico, I studied more in-depth one case, so besides exploring the organisational levels, I collected relevant insights at the project level. Hence, in the Netherlands, I missed more insights to have a similar amount of information from both studies. Due to COVID-19, realising observation was not possible, so the information at the actors level is limited.

The suggestion for future research is to realise field research to build on the existing insights at the actor level. Besides, to explore how does design can contribute to the implementation of these twelve factors in a health open innovation initiative in a structured way.

Summing-up

Both studies present similarities between the stakeholders involved; academic institutions and hospitals are key stakeholders. In Mexico, the possibility to receive funding is limited; therefore, UIDT could explore possibilities to create their monetary fund.

Some conditions that enable initiatives to operate are receiving funding, having a physical space, building a network and sharing

knowledge. Besides some operational steps for open innovation initiatives in health are, starting a project, developing a project and learning from transdisciplinarity.

This analysis presents differences between studies; in the Netherlands, commercial parties, government, citizens and academic institutions are already frequently connected to the initiatives. UIDT could work to increase collaboration with government, citizens, and commercial parties. Besides, defining success metrics in every project could contribute to achieving better outcomes.

The analysis of both studies demonstrates that physical spaces enable collaboration between disciplines, so a competitive advantage of UIDT is to have a shared space inside the hospital, making it easier to collaborate with care providers and patients. Hence, UIDT can explore how to make use of the space effectively; for instance, to have periodical meetings or working sessions that provide the opportunity to share knowledge and learn from others.

As a result of this analysis, I suggest twelve factors that contribute to building effective transdisciplinary collaborations in healthcare (see Table 4.5)..

TAKEAWAYS FOR UIDT

- UIDT could create a monetary fund for project development.
- UIDT can increase collaboration with patients, commercial parties and government at the beginning of each project.
- UIDT should take advantage of the physical space inside the hospital as a mechanism to increase collaboration among UIDT actors, care providers and patients.
- To build effective transdisciplinary collaborations among actors, UIDT should consider the presence of the twelve factors defined (see Table 4.5).

CHAPTER 5

Strategy to Build Effective Transdisciplinary Collaboration at UIDT

This chapter aims to present a plan to build effective transdisciplinary collaborations inside the unit. Hence, I created a future vision and a future-oriented strategy for the unit. The strategy is formed by three strategic lines that present different proposals to guide the actors towards the future vision. This chapter presents the research method to define intervention opportunities in the unit and the method to define the strategy. As a result, I present three opportunities of improvement and a future-oriented strategy.

Table 5.1. Research sub-questions for Chapter 5

a. Which are the possible directions to contribute at UIDT?
b. How to design an intervention to build effective transdisciplinary collaborations inside the unit?

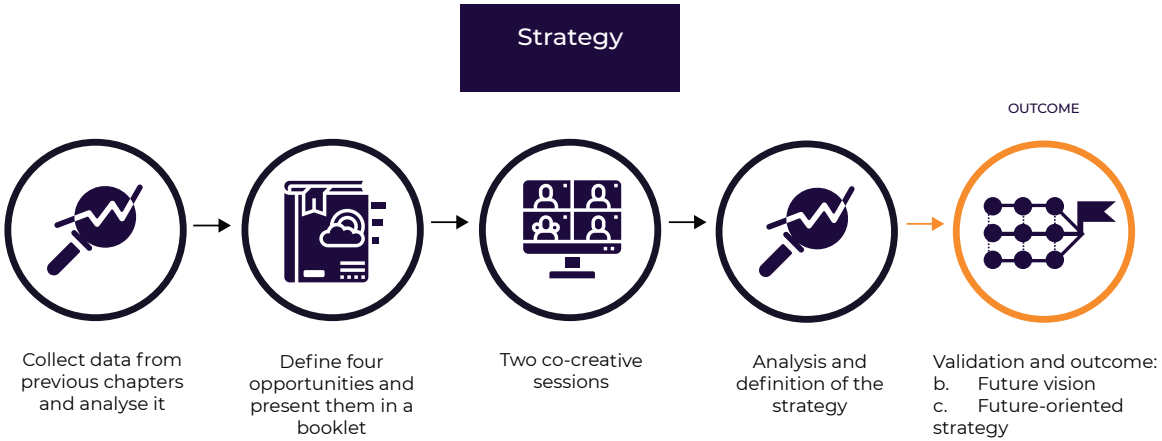


Figure 5.1 Process overview

5.1 Introduction

For this phase, the aim was to explore possible directions to build transdisciplinary collaborations inside the unit and then define a direction to intervene in the unit. For this section, I defined two research sub-question (see Table 5.1).

This chapter presents a future vision and a future-oriented strategy for the unit. The strategy presents a plan to build effective transdisciplinary collaborations in three different lines with implementations in the short-term, medium-term and long-term.

For this step, I took into consideration the results of the case study in Mexico and the results of the comparative analysis. I used the list of barriers and enablers from Chapter 3, and the twelve factors and the insights defined in Chapter 4. I analysed all these data and defined four opportunities for improvement. I presented those opportunities to the actors by creating a digital booklet.

Later, I realised two co-creative sessions where we discussed the booklets, we selected three of the four opportunities and brainstormed on how to tackle those opportunities. Then, I analysed the results of the co-creative sessions and defined a future vision and a future-oriented strategy for the unit.

Afterwards, I realised five sessions to validate the strategy, and I had a presentation with two of the hospital directors. Finally, I made adjustments to the strategy and the future vision (see Figure 5.1, Table 5.2).

11 actors involved

METHOD

7	Answers to sensitizing booklets
2	Co-creative workshops
5	Validation sessions
1	Meeting in person

Table 5.2 Overview of the methods implemented

5.2 Method

METHOD

a) Defining opportunities to build effective collaborations

For this step, I consulted the results of the seven validation sessions realised in the case study in Mexico. The aim was to define possible directions to build effective collaborations. For each session, I selected all the quotes related to barriers and enablers, and I printed them down. The quotes related to barriers include limitations, lack of collaboration, negative behaviours. For example:

> *'Some actors impose their opinion, and there is no room to negotiate, give an opinion or contribute.'*
>
> *- Full Researcher at ICAT*

For the enablers, I considered, opportunities to collaborate, goals achieved, and collaboration moments. An example of an enabler selected is:

> *'I considered 'establishing roles' helped. For instance, the resident physician was responsible for looking for patients and collecting their medical record.'*
>
> *- Master Student at ICAT*

Afterwards, those quotes were categorised based on the existing barriers and enablers shared in the survey. Some quotes related to more than one barrier or enabler, hence the relationships between barriers and enablers were also explored (see Figure 5.2).

As a result, fours opportunities were defined (see Figure 5.3): 1) Building a collaborative network between the actors, 2) Being updated about the status of the projects and the future of UIDT, 3) Share knowledge and learn from others for better outcomes, and 4) Support between actors to maintain their commitment to the unit. These opportunities represent possible directions to build effective transdisciplinary collaborations in the unit. Each opportunity was further developed by adding a description of the opportunity, a representative quote, the needs tackled and reasoning from existing literature.

METHOD

b) Designing a strategy to build effective transdisciplinary collaboration at UIDT

The purpose of this step was to co-design an approach to build effective transdisciplinary collaboration at the unit. Hence, I realised two-co-creative sessions with multiple actors from the unit. Before the session, the actors received a digital sensitising booklet. Eight actors answered the booklet, and six of those actors were present in one of the two co-creative sessions (see Table 5.3).

The purpose of the booklet was to prepare the actors for the session and address individual thoughts regarding the opportunities (Sanders & Stappers, 2018). Besides, during

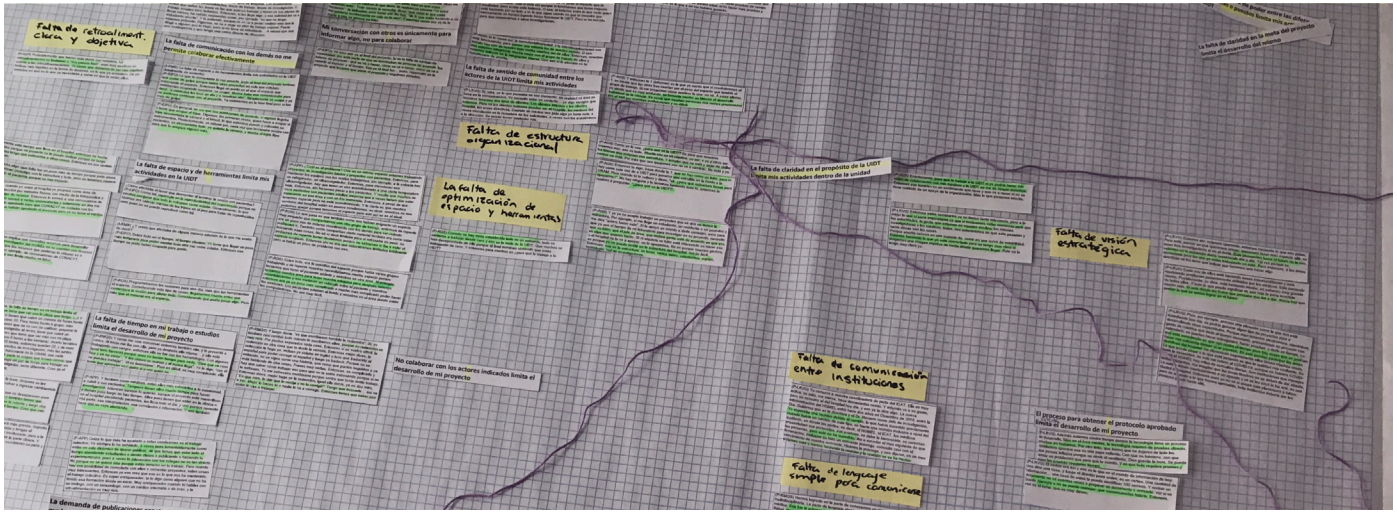


Figure 5.2 Map exploring the relationships between barriers and enablers

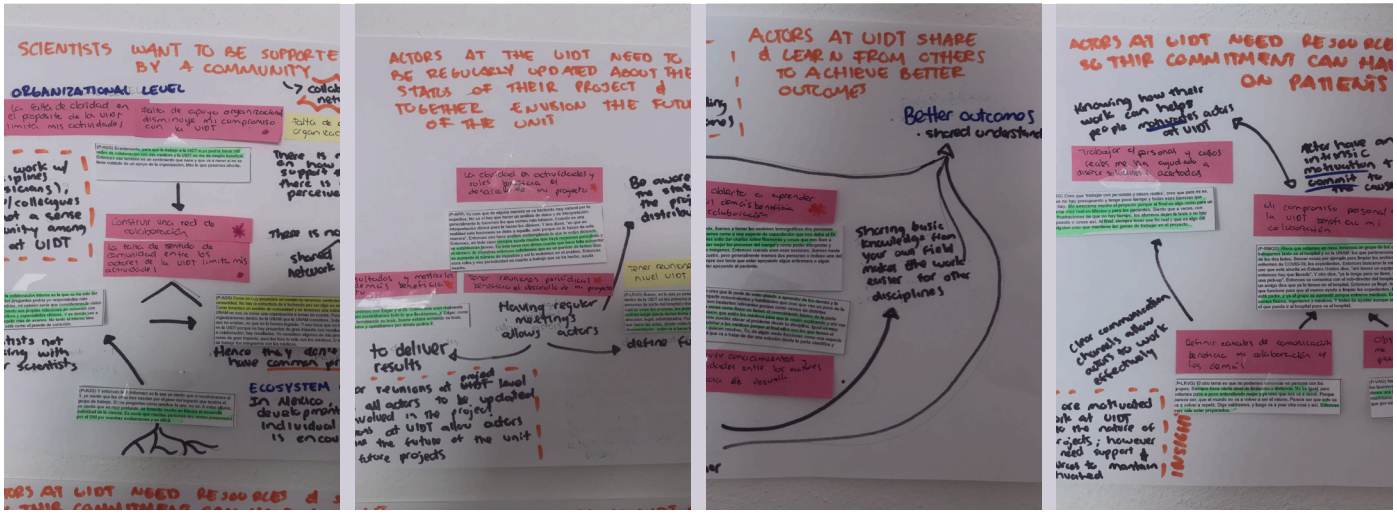


Figure 5.3 Preliminary infographics for each opportunity

Table 5.3 Actors who answered the booklet and were present in one co-creative session

	Type of initiative	Role	Professional brackground	Session
1	Master Student	ICAT	Medical Physical Science	1
2	Full Professor	ICAT	Organisation Management	-
3	PhD Researcher	ICAT	Astrophysics, Optics & Electronics	-
4	PhD Researcher	ICAT	Electric Engineering	2
5	Full Researcher	HGMEL	Medical Science	1
6	Full Professor	CIDI	Advanced Product Design	1
7	Bachelor Student	CIDI	Industrial DesignComputer	2
8	Full Researcher	ICAT	Atomic Physics	1

the session, the focus was only on collaborative activities rather than individual activities. The sensitising booklet first introduced the four opportunities as directions to build effective collaborations.

Then, each opportunity was described individually (see Figure 5.4), including a general description, a representative quote, the needs to tackle and some references from literature. I asked actors to share their opinion regarding each opportunity and some ideas on how to develop it. At the end of the booklet, they prioritised the four opportunities according to the impact and ability of implementation, by using the How-Now-Wow matrix (see Figure 5.5) (Ying Ng & Przybylek, 2019).

To prepare for the sessions, I collected all the answers from the sensitising booklets (see Appendix J to see some answers). During each session, the actors were connected via a video call and working together

Figure 5.4 Example of template in the booklet for Opportunity 1 (in Spanish)

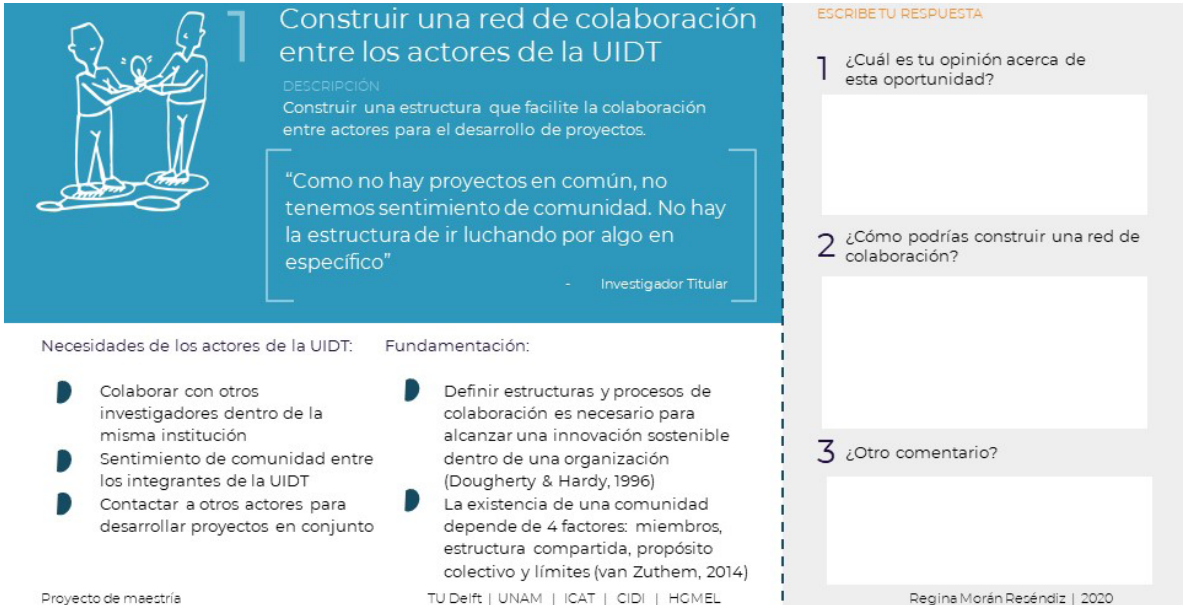
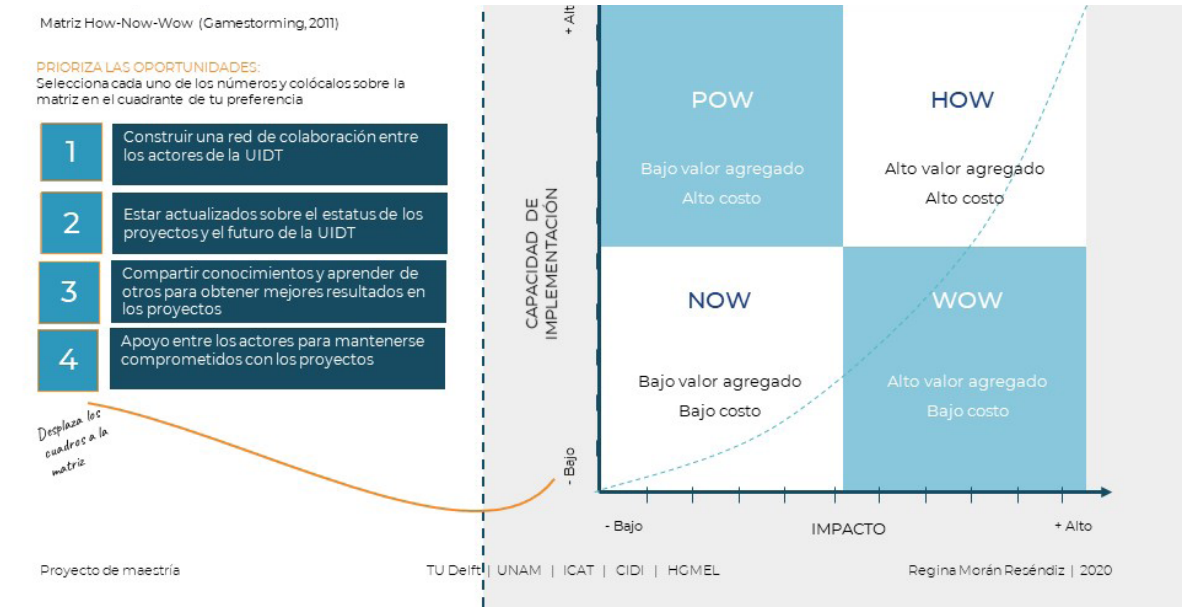


Figure 5.5 How-Now-Wow matrix on the booklet (in Spanish)



on a collaborative platform. The collaborative sessions lasted from 60 to 80 minutes; I recorded the audio and took some screenshots to document the process (see Figure 5.6).

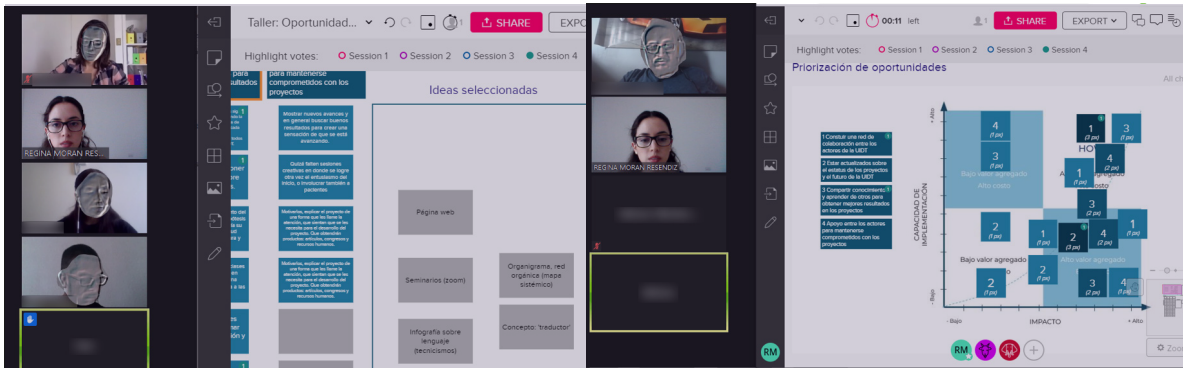


Figure 5.6 Co-creative sessions: 1 (left) Session 2 (right)

The structure of the sessions consisted of two main steps. First, sharing the results of the Now-How-Wow matrix and then a brainstorming session. During the first exercise, I presented the answers from the sensitising booklets in a matrix (see Figure 5.7).

Then, each participant voted for the two options they considered the most relevant. In the first session, actors selected two opportunities, and in the second session, the actors selected three opportunities to tackle according to the impact and ability of implementation. The opportunities were: 1) Building a collaborative network between the actors, 2) Being updated about the status of the projects and the future of UIDT, and 3) Share knowledge and learn from others for better outcomes. Later we had a discussion explaining the reason for selecting those opportunities and describing which quadrant they considered fits better for each opportunity selected.

Afterwards, a brainstorm session followed. The ideas shared by the participants through the booklets were placed in the workshop canvas (see Figure 5.8), as a way to trigger participants to share ideas. Participants had five minutes to come with as many ideas as possible for the opportunities selected. Then, a voting session followed, concluding with a discussion on which approaches they considered interested based on their own experience.

Subsequently, all the ideas collected from the booklet and the workshop were put together for the analysis. I clustered the ideas according to similarities between them. As a result, I defined three main clusters, being 'support for project development', 'promoting the unit', and 'building a knowledge community' (see Figure 5.9). Then, in each cluster, the ideas were divided according to the timeframe; ideas that could be implemented right away or ideas that could be implemented in the future.

Later, I placed together all the elements to create the first draft of a roadmap (see Figure 5.10) to visually plot the ideas in a timeline (Simonse, 2017). I created three horizons; the first horizon corresponded to the ideas that could be implemented right away. The ideas to be implemented in the future formed

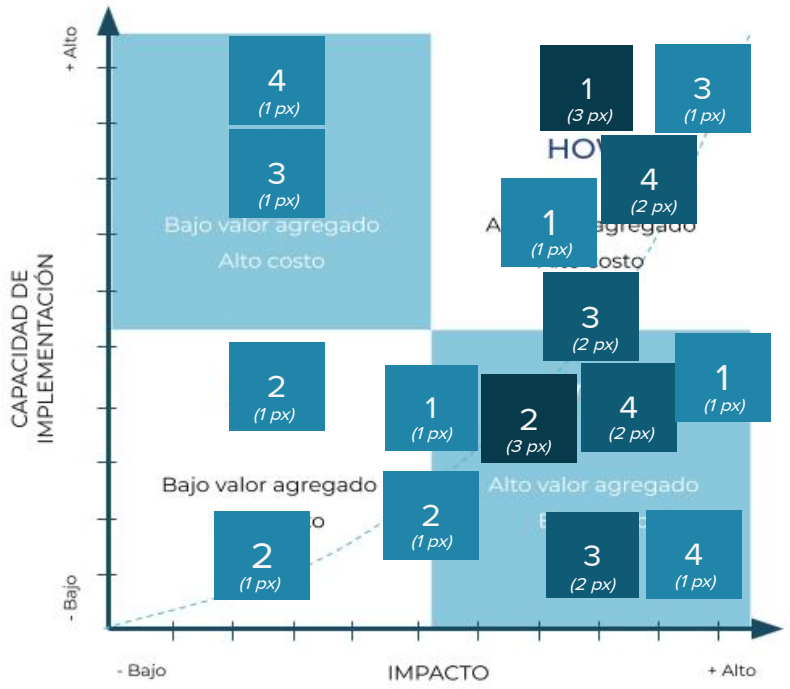


Figure 5.7 Matrix with all the answers provided by participants through the booklet (in Spanish)

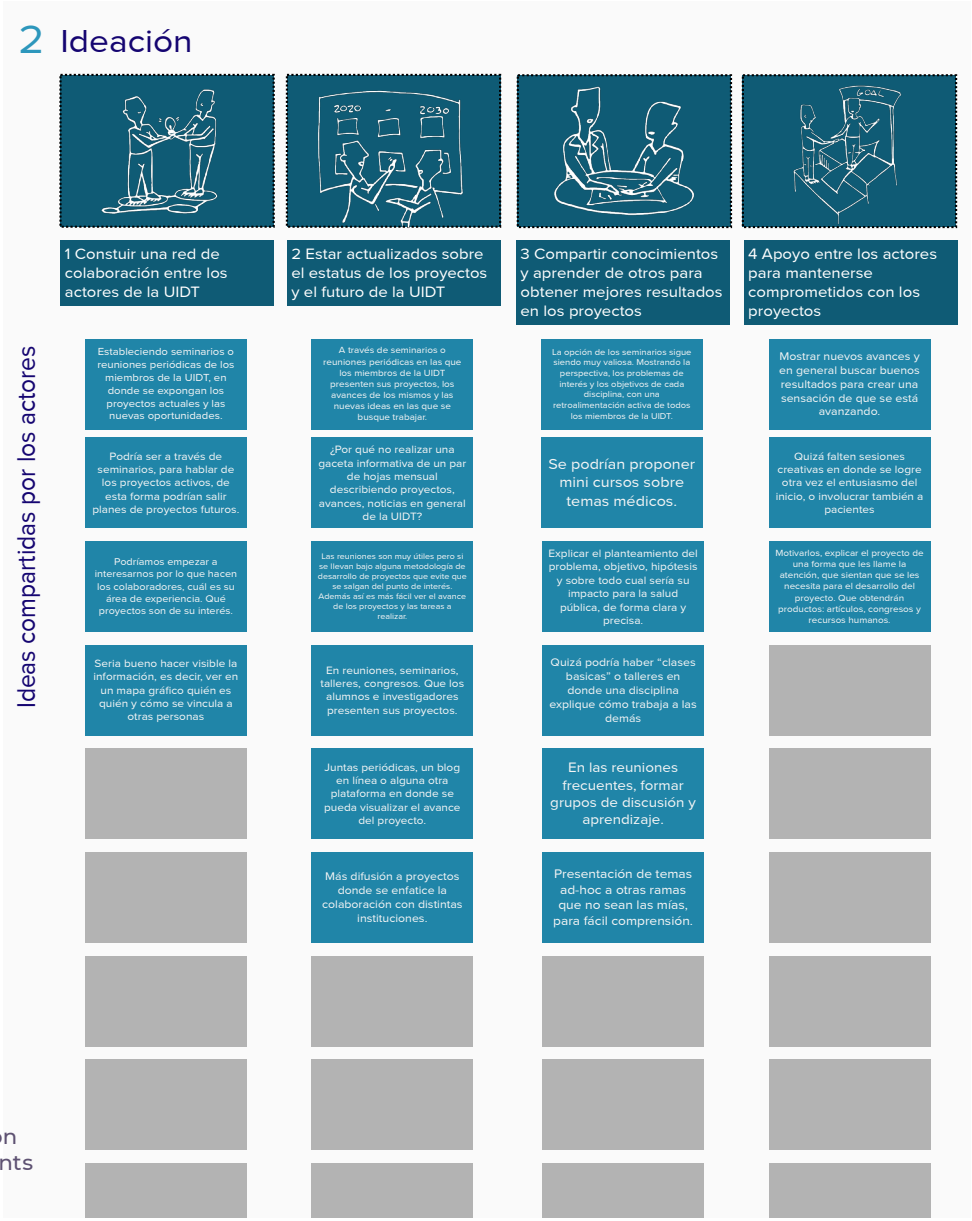


Figure 5.8 Template for ideation session filled in with ideas shared by participants through the booklet (in Spanish)

the third horizon, and I added a step in between the first and the third horizon, the second horizon. Besides, I added a space for the future vision after the three horizons. The future vision is an expression of the desired future that gives direction to the organisation (Simonse, 2017), in this case, to the unit.

After rearranging the initial ideas into the three horizons and the future vision, I realised a trend analysis to scan the environment and explore possibilities in the future (Simonse, 2017).

The trend research contributes to support the initial information and add additional insights. Hence, this strategy is formed with the wishes and needs of the actors, the suggestions of the researcher, and signals collected from the global context. To collect signals in a structured way and grasp trends from six different angles, I selected the DESTEP taxonomy technique. I collected the information systematically considering demographics, economic, socio-cultural, technological, ecological, and political aspects (Simonse, 2017). To see the complete analysis refer to

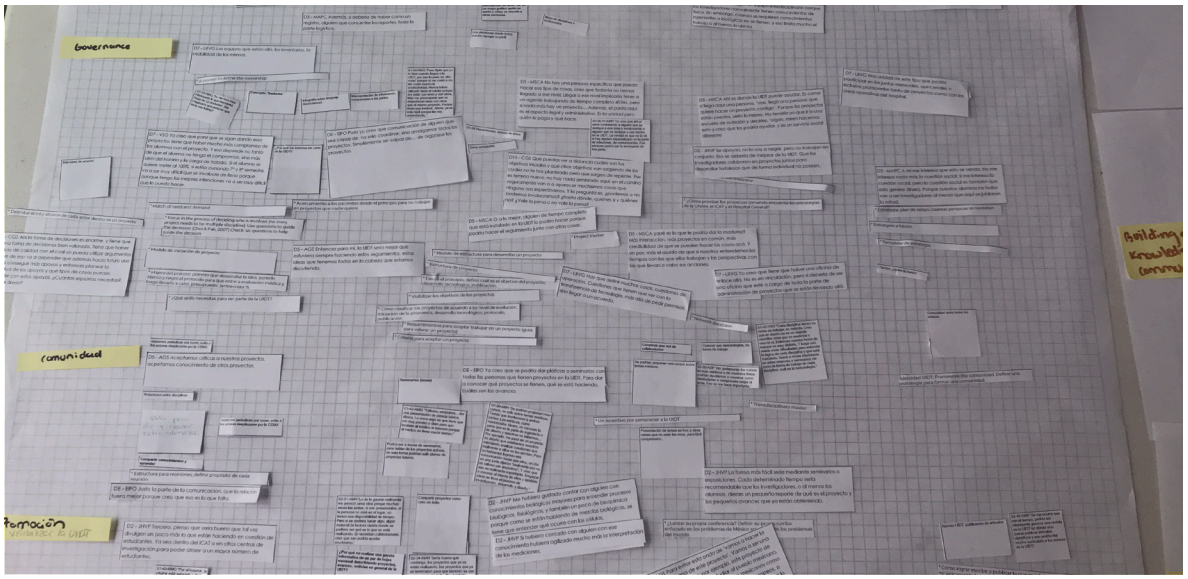


Figure 5.9 Analysis process from the workshop

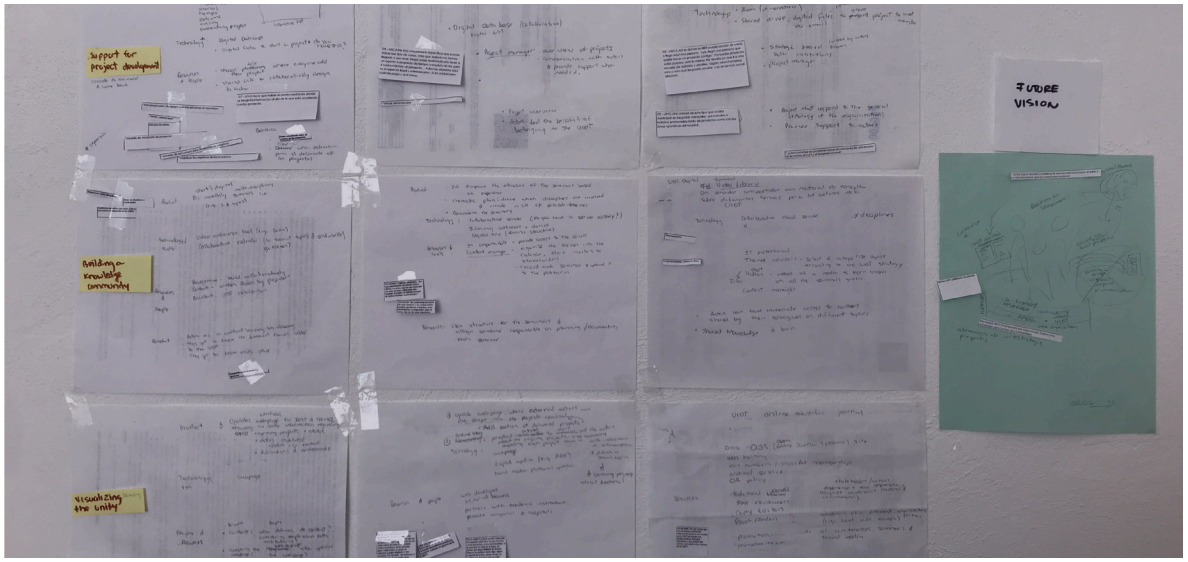


Figure 5.10 Draft of the strategy for UIDT

Appendix K.

Finally, all that information was structured to define a future vision and a strategy for the unit. Afterwards, I created two roadmaps, a tactical one and a strategic one (see Figure 5.11 and 5.12). The roadmaps contain three strategic lines; support for project development, promoting the unit, and building a knowledge community. Besides, the tactical roadmap contains different elements per strategic line; benefits, proposal, technology and resources, and actors involved.

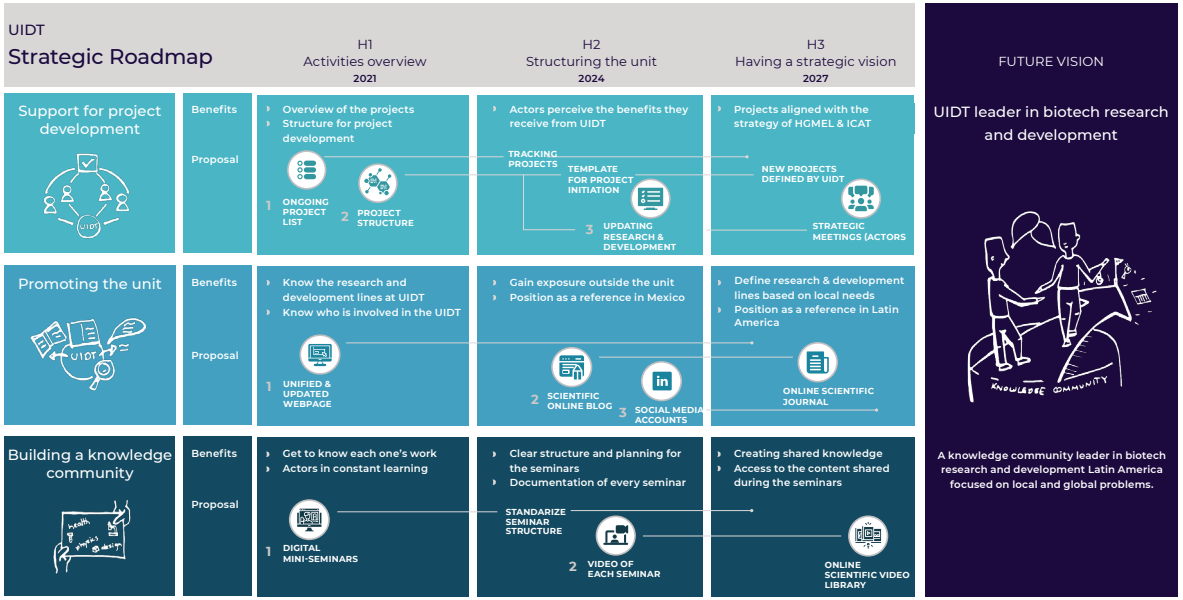


Figure 5.11 First version of the.strategic roadmap

METHOD

a) Validating the future-oriented strategy for UIDT

To validate the strategy, I created a digital prototype to present the strategic roadmap to the actors. The prototype is an interactive online file that introduces the roadmap. Each strategic line and the future vision contained a series of questions

to trigger actors to reflect on the proposals; for instance, 'how valuable is this step for you?', 'what is missing in the proposal?'. The prototype contained empty spaces for actors to respond and add their comments (see Figure 5.13).

After the strategic roadmap, some questions followed regarding the first strategic line (see Figure 5.14). The questions aimed to verify if similar solutions already existed at the unit. See the full prototype on Appendix L.

I realised five validation sessions via video call (four individual and one with two actors) to have in-depth discussions about the strategy proposed (see Table 5.4). The sessions lasted around 70 to 80 minutes. I recorded the audio for each session to be able to go back to the conversation during the analysis. Besides, I wrote down notes of the comments I considered relevant; for instance, a suggestion or a change in the strategy. Next to each note, I

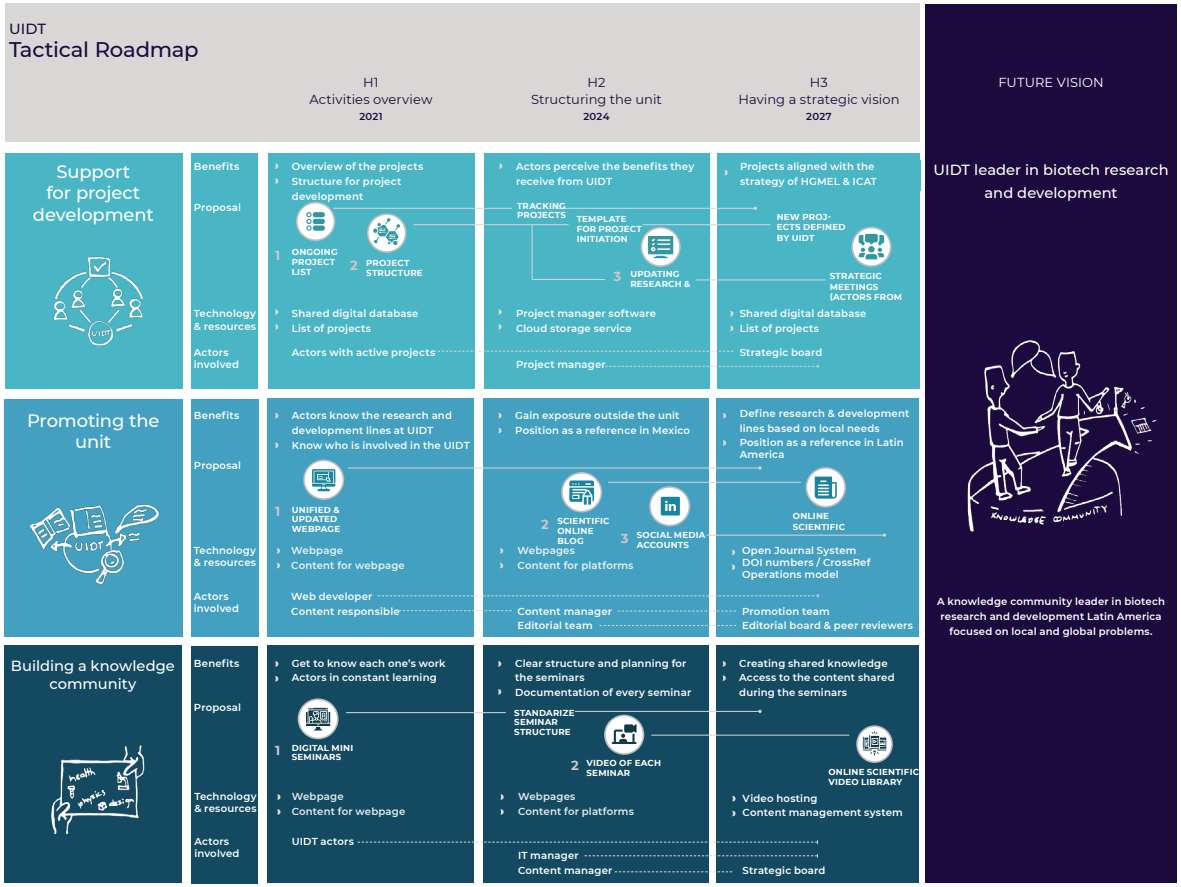


Figure 5.12 First version of the.tactical roadmap

wrote down the minute when the comment was shared. Hence, during the analysis, it was easier to listen back to those critical comments.

The actors received the prototype previous to the session to have time to answer it and get to know the topic to be explored in the session. However, only one actor answered the prototype. During the session, I first asked them to remember the goal of the unit. Most of them shared it with me during the first interview at the beginning of the study. Then, I asked them how did they envision the unit in ten years. It was an interesting exercise, as I perceived none of them had previously reflected on the future of the unit.

Afterwards, I shared the screen and presented the future vision I suggested as a result of study realised at the unit. Then, I realised some questions regarding their perception of the future vision suggested. Later, I presented each strategic line, followed by questions oriented to explore their opinion of the proposal.

Later, all the data from the sessions were collected. I also went back

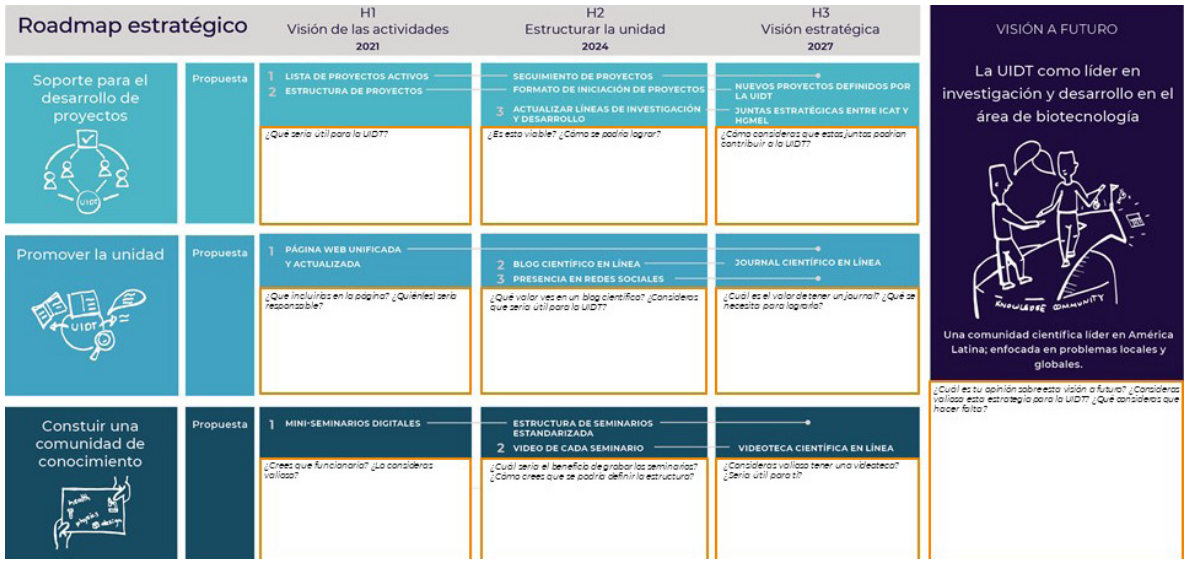


Figure 5.13 Strategic roadmap prototype

Figure 5.14 Questions related to 'support for project development.'

to the notes realised per session. When needed, I listened back to the recordings to have a better understanding of the idea. I transcribed all the comments that I highlighted during the interviews and created a list of insights. I then, printed down the roadmap presented to the actors and the insights (see Figure 5.15). I placed down the insights into the strategic line and the horizon I found more suitable. Later, I documented the adjustments and looked for the information missing.

Finally, I did a physical prototype of the roadmap (see Figure 5.16), and a visual presentation to show it to the Research Director and the Deputy General Director of the hospital. Due to sanitary measures implemented after COVID-19, the assistants to the meeting were just the directors and I (see Figure 5.17).

I designed the meeting as a discussion session. Like in the previous validation sessions, I introduced first the future vision and asked for feedback. Afterwards, we explored each strategic line. After the explanation, we discussed what could work better and what was

Table 5.4 Actors present during the validation sessions

	Type of initiative	Role	Professional brackground	Session
1	Full Researcher	ICAT	Optical Sicences	1
2	Full Researcher	HGMEL	Medical Sciences	2
3	Full Researcher	ICAT	Atomic Physics	3
4	Full Professor	CIFI	Advanced Product Design	4
5	Research Director	HGMEL	Neurosurgery	5
6	Deputy General Director	HGMEL	Cardiology	5

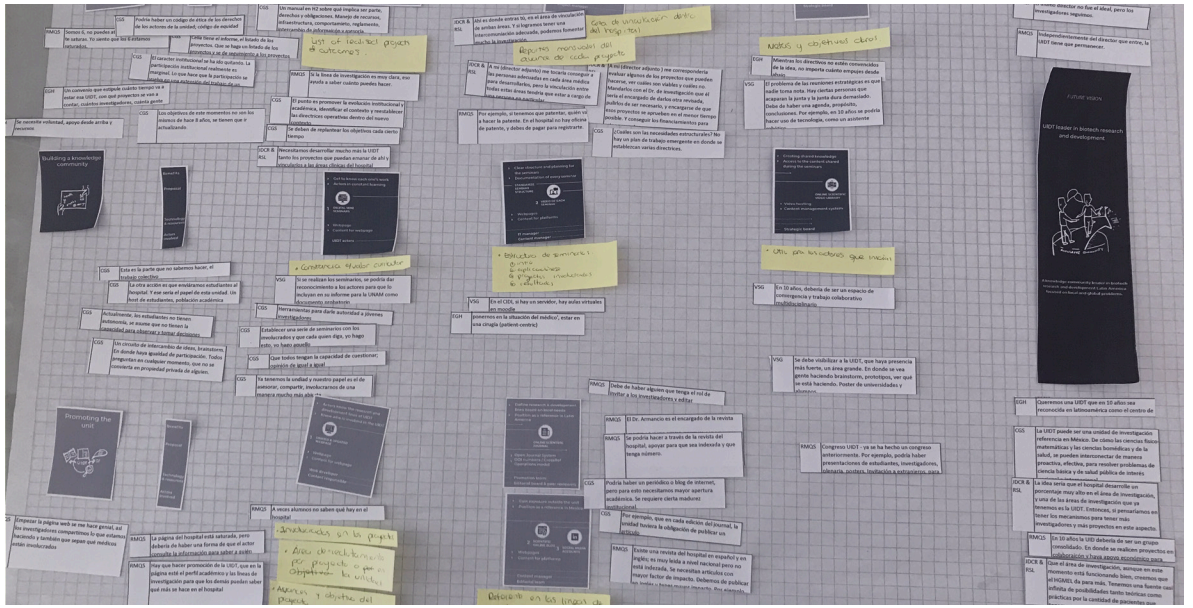


Figure 5.15 Iteration to the strategy for UIDT

missing. During the session, the support material were the slides (see slides in Appendix M), and I printed down each of the proposals in individual cards.

The session lasted one hour, and the audio was recorded. Due to the limited availability of the physicians, the prototype was saved for the analysis session. During the session, I took notes of relevant comments and wrote down the minute in the recording to consult it later.
For the analysis, I went back to the notes and listened again to the full recording. I wrote down the feedback directly on the roadmap (see Figure 5.18), all suggestions, changes and ideas.

Afterwards, I organised the information to verified which elements were missing and creating a coherent storyline. I completed the missing information with the information collected from the trend analysis and literature research. Besides, I considered the four takeaways of the previous chapter, 1) Create a monetary fund, 2) Increase collaboration with patients, commercial parties, and government, 3) Take advantage of

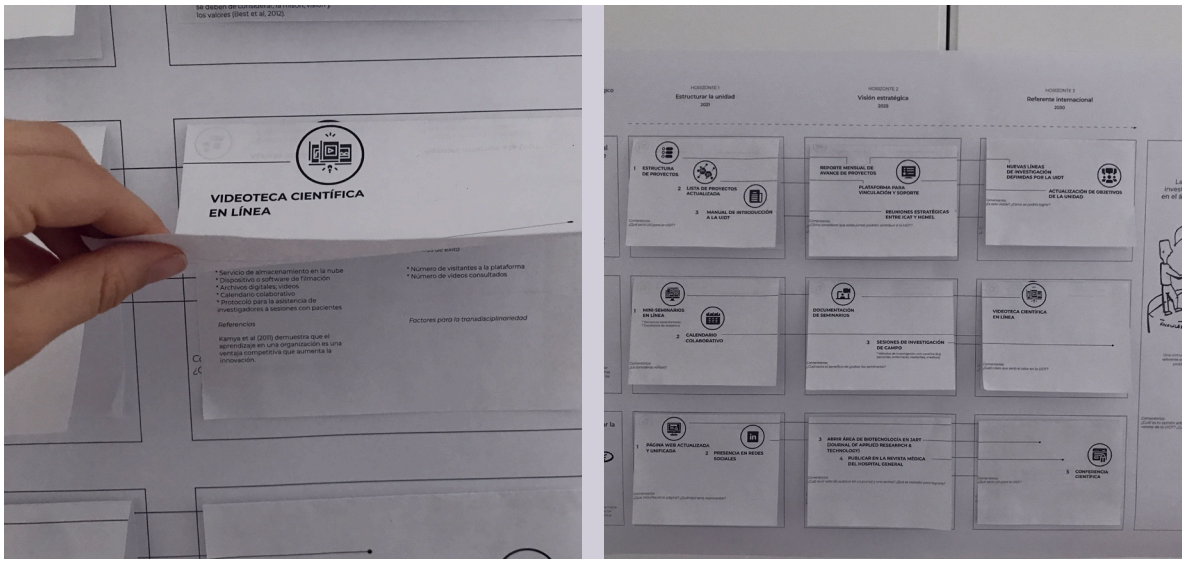


Figure 5.16 Physical roadmap

Figure 5.17 Outside the hospital before the meeting

the physical space in the hospital and 4) Implement the twelve factors defined for effective transdisciplinary collaborations. As a result, I created an updated version of the strategic and tactical roadmap.

5.3 Outcome

OUTCOME

a) Defining opportunities to build effective collaboration

To explore the possibilities of intervention at UIDT, I defined three opportunities as a result of the previous study. The opportunities represent possible directions to contribute to building effective collaborations in the UIDT (see Figure 5.19). Each opportunity contains a description, a representative quote expressed by one actor during the interviews, the needs to be tackled and some reasoning from literature. The opportunities are described in the following lines.

Building a collaborative network between the actors

This opportunity describes some of the needs expressed by the actors. They want to work with colleagues from their organisation, not only from other organisations. For instance, researchers from ICAT often collaborate with physicians from HGMEL; however, the collaboration between researchers inside ICAT does not happen often.

Hence, they would like to be able to reach their colleagues to collaborate. Additionally, the actors mentioned they would like to have a sense of community between the members of UIDT. However, the lack of collaborative projects does not encourage them to work together:

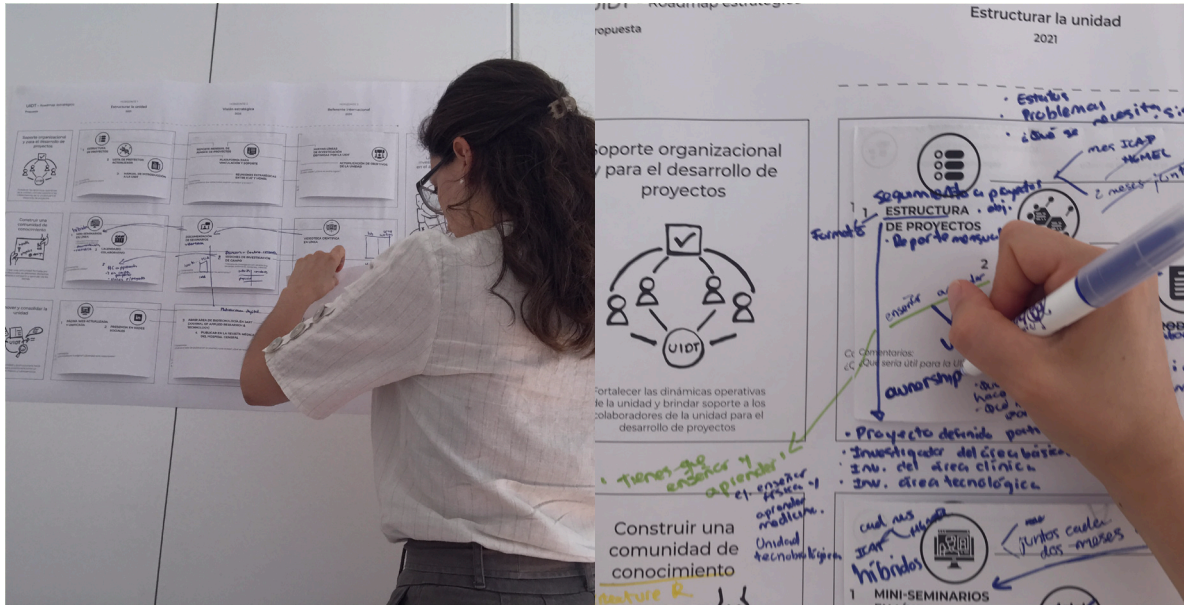


Figure 5.18 Making adjustments to the strategy

> *'Because we do not have shared projects, there is not a sense of community. There is not a structure that guides us in the same direction.'*
>
> *- Full Researcher at ICAT*

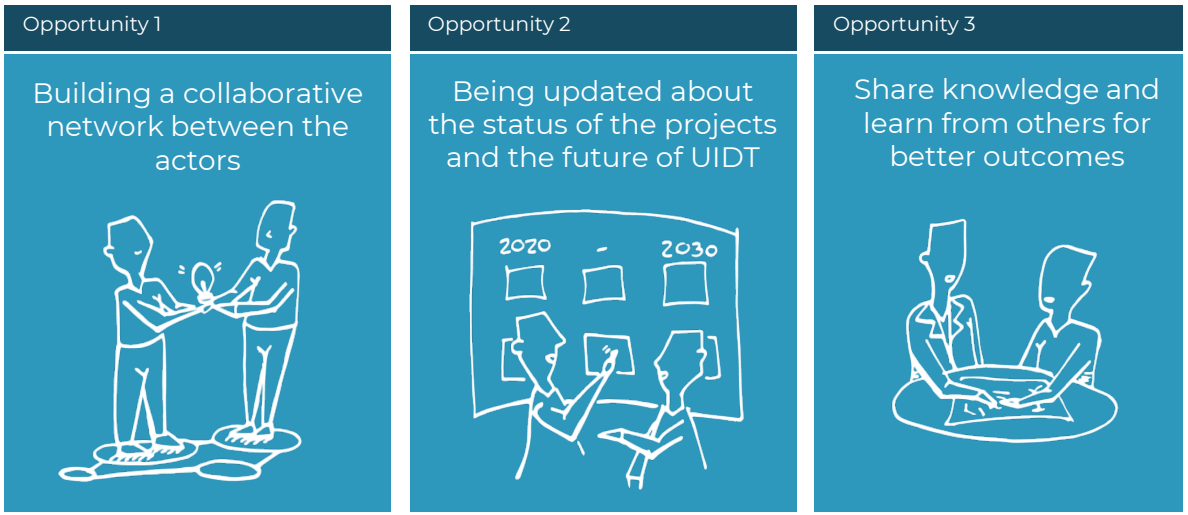


Figure 5.19 Making adjustments to the strategy

This opportunity aims to build a structure that enables collaboration among actors to develop projects jointly. Having defined structures and collaborative processes are necessary to reach sustainable innovation within an organisation (Dougherty & Hardy, 1996). Besides, to be able to build a community van Zuthem (2014) suggests the existence of a shared structure, members, a collective purpose, and boundaries.

Being updated about the status of the projects and the future of UIDT

During the development of a project, actors mentioned that it is essential to provide and receive feedback. In that way, it is easier to make decisions and realise the adjustments necessary. In some projects, the actors mentioned they already have frequent meetings to give and receive feedback; however, it is not a common practice in all projects.

Additionally, actors would like to know the future vision of the UIDT and be able to suggest new projects aligned to the unit's vision. On the past, those meetings happened once a month; however, those meetings are not happening anymore.

Thus, this opportunity aims to involve actors in the development of projects and let them have an overview of the activities happening at UIDT. Having

> *'There used to be a monthly meeting where the progress of projects, the research protocols and new ideas that could turn into projects were shared.'*
>
> *- Full Professor at ICAT*

a clear overview of the projects and managing the project at the unit will contribute to achieving the goals of the organisation (Nenni, Arnone, Boccardelli, & Napolitano, 2014). Besides, it is necessary to share with the actors the vision of the unit, so everyone works towards the same direction.

Share knowledge and learn from others for better outcomes

Due to the variety of disciplines present at the unit, actors face some difficulties to communicate with other disciplines. Hence, they would like to have a basic knowledge of the other disciplines they will work with to have a shared language and improve collaboration. Besides, they

would like to share their knowledge and also learn from other disciplines. Hence, this opportunity suggests shared knowledge between the actors to have a better understanding and enable collaboration. Besides, the

> *'Sometimes, as a physicist, you do not have the basic knowledge of the clinical part. Then, physicians need to explain to you that part. [...] And you are going to give a solution from the scientific and technological part.'*
>
> *- Master Student at ICAT*

knowledge shared among the actors will not benefit them only it will benefit the organisation in general (Coccia & Cadario, 2014). Stoimenova & De Lille (2017) suggest that sharing and integrating knowledge guarantees sustainable growth.

Support between actors to maintain themselves committed to the unit

Actors would like to work on projects they are interested in, specifically real cases where they can add value as professionals. To have an impact, they need to collaborate with other disciplines and support each other. Additionally, resources like money, time and space will allow them to achieve their objective.
Despite the challenges and limitations actors will face developing projects, the aim of this opportunity is that actors provide support among each other to achieve the expected

> *'I was very excited about the [previous] project because it is a solution to a real problem in Mexico and for patients. Although sometimes there are frustrations because there is no time, there is no budget or things like that.'*
>
> *- Full Professor at CIDI*

results and maintain themselves motivated during the project development. The value fo having multiple disciplines collaborating is that they can help each other to tackle a social problem from different perspectives (Lang et al., 2012). And it is through collaboration that theywill be able to design technological developments and innovations that result in social impact (Bergema, Valkenburg, Kleinsmann, & Bont, 2010)

OUTCOME

b) Designing a strategy to build effective transdisciplinary collaboration at UIDT

This strategy presents a future vision and three strategic lines; organisational and project development support, building a community, and promote and consolidate the unit (see Figure 5.20).

Each strategic line is formed by three main horizons, that describe proposals that will guide the actors and the unit towards the future vision. The aim is to start the implementation right away; hence, the first horizon suggests a proposal for 2020.

The second horizon is for 2024, a transition period in the unit. On 2024, the current actors that have directive roles will change. due to political period in Mexico Therefore, the challenge during this year will be that the new directors give continuity to the plans and project at the unit.

Finally, the third horizon is in 2030, to invite actors to think beyond a sexennial, which is the period mark by the government. As ICAT and HGMEL are public institutions, they are affected by political periods. In Mexico, it is common to have plans just for the six years the government will be in the power because most likely, the future government or administration will have new plans and start all over.

Hence, the suggestion is that the current administration leaves a structured unit with a portfolio of projects for the future, to make it easier to the future administration to give continuity to the plans and work towards the future vision.

In the following lines, I first introduce the future vision, then I explain each strategic line with the proposals for the three horizons.

Future vision: UIDT leader in Latin America

Currently, HGMEL is a national reference in healthcare for providing care solutions to complex challenges that people without social insurance face. The hospital has more than 85 specialities and more than 6,400 workers (Secretaria de Salud, 2020; Secretaría de Salud, 2015).

Generations of physicians, medical practitioners and nurses from Mexico and Latin America had been trained at HGMEL (Secretaria de Salud, 2020; Secretaría de Salud, 2015). Besides, UNAM, the university ICAT belongs to, is number 1 of the 200 Latin American universities evaluated by the uniRank webpage (UNAM, 2019). Hence, the collaboration of these two organisations has all the potential to achieve successful results in the future.

Thus, the future vision suggests that in 2030, UIDT is a leader in biotechnology and biomedicine research and development in Latin America (see Figure 5.21). In 2030, the UIDT has a consolidate group of researchers working together in biotechnology and biomedicine solutions with actors around the world. Those researchers tackle local and global problems, they belong to an international network of researchers, and the UIDT provides a physical and virtual space for open innovation.

This future vision represents a desired future; hence, the strategy that will be explained below is a guide to help the unit and the actors achieve this future vision. Thus, I suggest three strategic lines that will be described in the following lines: 1) Organisational and project development support, 2) Building

UIDT

Strategy for 2030

STRUCTURE THE UNIT
2020

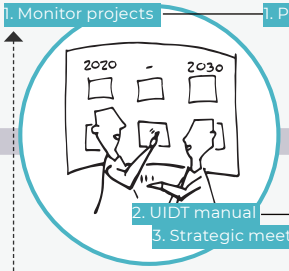
DEFINE A STRATEGIC VISION
2024

LEADER IN LATIN AMERICA
2028

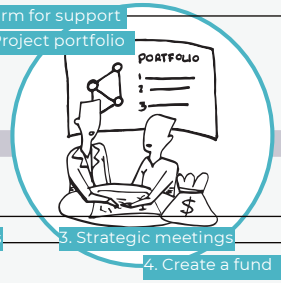
Organisational and project development support

Strengthen operational dynamics at the unit and provide support for project development to all the actors collaborating in the unit.

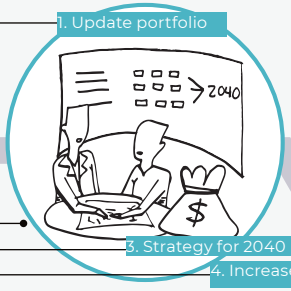
1. Monitor projects
2. UIDT manual
3. Strategic meetings



1. Platform for support
Project portfolio
3. Strategic meetings
4. Create a fund



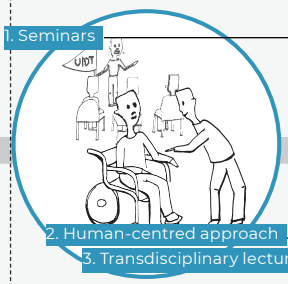
1. Update portfolio
3. Strategy for 2040
4. Increase fund



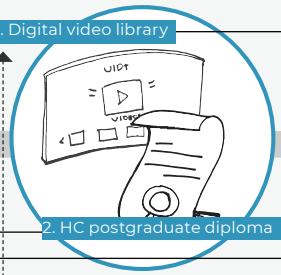
Building a kowledge community

Creating a learning space formed by professionals from different disciplines open to share knowledge and learn from others.

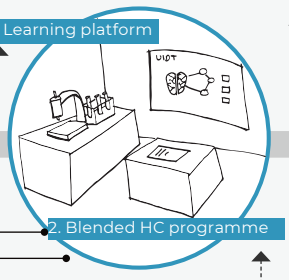
1. Seminars
2. Human-centred approach
3. Transdisciplinary lectures



1. Digital video library
2. HC postgraduate diploma



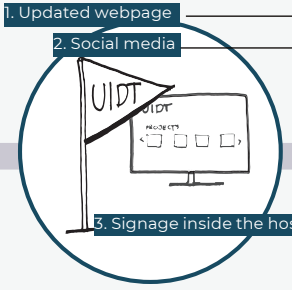
1. Learning platform
2. Blended HC programme



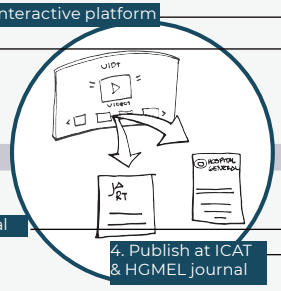
Promote and consolidate the unit

Make the unit visible for others outside ICAT and HGMEL. Promote and position the unit as a biotechnological biomedicine referent worldwide.

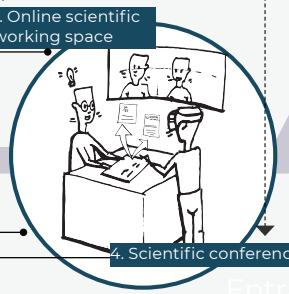
1. Updated webpage
2. Social media
3. Signage inside the hospital



1. Interactive platform
4. Publish at ICAT & HGMEL journal



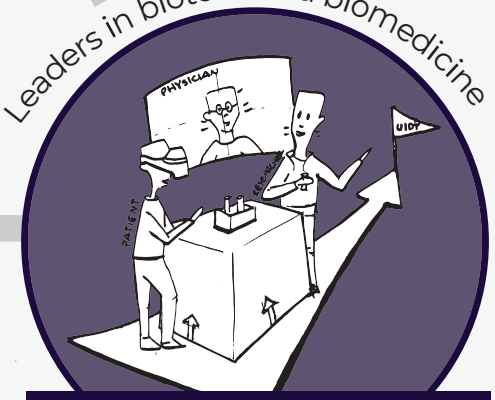
1. Online scientific working space
4. Scientific conference



FUTURE VISION FOR 2030

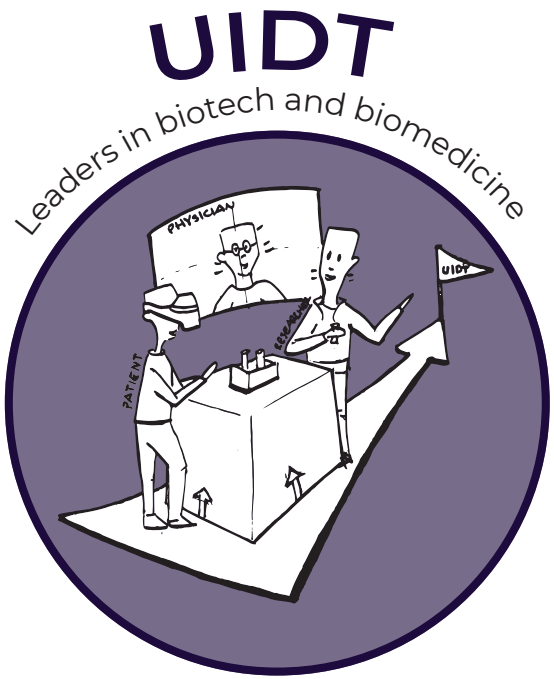
UIDT

Leaders in biotech and biomedicine



In 2030, the UIDT has a consolidate group of researchers working together in biotechnology and biomedicine solutions with actors around the world.

Entrance to the General Hospital of Mexico 'Eduardo Liceaga'



In 2030, the UIDT has a consolidate group of researchers working together in biotechnology and biomedicine solutions with actors around the world.

Those researchers tackle local and global problems. They belong to an international network of researchers, and the UIDT provides a physical and virtual space to work.

Figure 5.21 Future vision for UIDT

a community, and 3) Promote and consolidate the unit.

Organisational and project development support

This strategic line suggests to strengthen operational dynamics at the unit and provide support for project development to all the actors collaborating in the unit (see Figure 5.22).

UIDT has some limitations on resources (e.g. people and money). Thus, this strategy suggests small changes on the first horizon that do not require a significant investment. The proposal on the first horizon is to monitor projects, create a manual for the actors involved in the unit, and retake the strategic meetings (see Figure 5.23).

Monitoring projects will allow all actors to have an overview of what is happening in the unit. The suggestion is to have an initial project structure consisting of the elements needed to start a project. Then, to have a shared list of active and delivered projects where all the actors can have access. Additionally, implementing again the monthly reports were the actors can share the status of the projects, the limitations they have and the future steps.

The UIDT manual consists of having a document as a way of introducing the actors to the unit. It could have a description of what does UIDT mean, the purpose and the future vision of the unit. Then, a description of what the benefits for collaborating at the unit are. Also, describing what will be their responsibilities as UIDT members and the ethical behaviours among actors regarding ownership and intellectual property. Additionally, the requirements to develop projects in the unit.
The strategic meetings consist of periodical updates of directors from both institutions. In the short-term, those meetings could help to define

〈 Figure 5.20 Future-oriented strategy for UIDT

the content of the manual. Later, they can turn into meetings to redefine the unit, discuss the future and make collaborative decisions.

To implement these proposals, collaboration with different actors is necessary. First, directors from both institutions need to be involved (e.g. Deputy General Director at HGMEL, Research Director at HGMEL, Academic Secretary at ICAT, and Director at ICAT) and the UIDT coordinator.

The unit coordinator is aware of all the active projects, so her participation is relevant to monitor the projects; besides, the actors involved in the unit are responsible for sharing all the information of their projects with the coordinator. For extra support, a student doing their social service can help to collect all the information about the ongoing projects and also all the information to create the UIDT manuals.

In this horizon, the aim is to benefit actors by providing them with a clear structure to develop projects. Besides, they will be aware of what is happening in the unit and who is involved in every project. Also, they

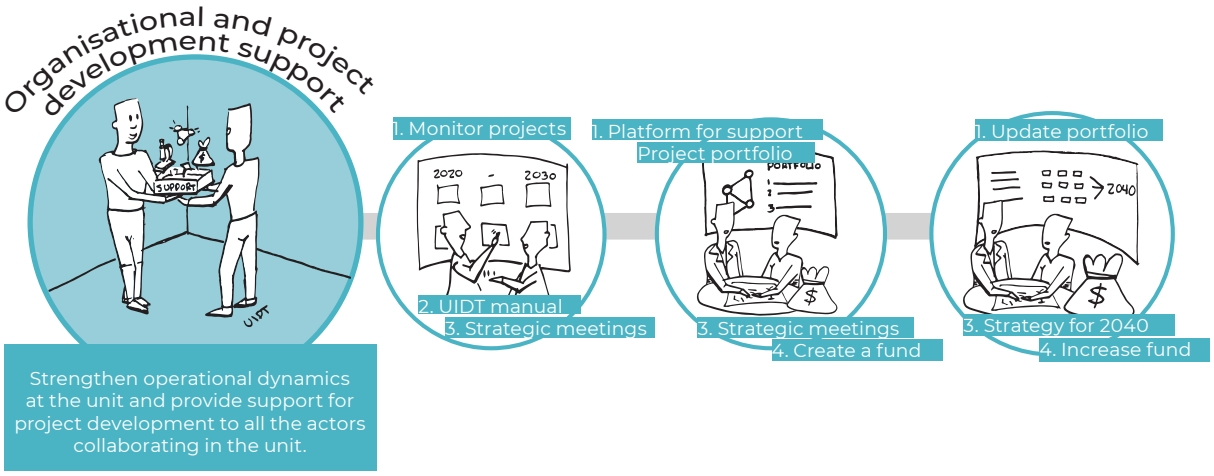


Figure 5.22 Strategic line: Organisational and project development support

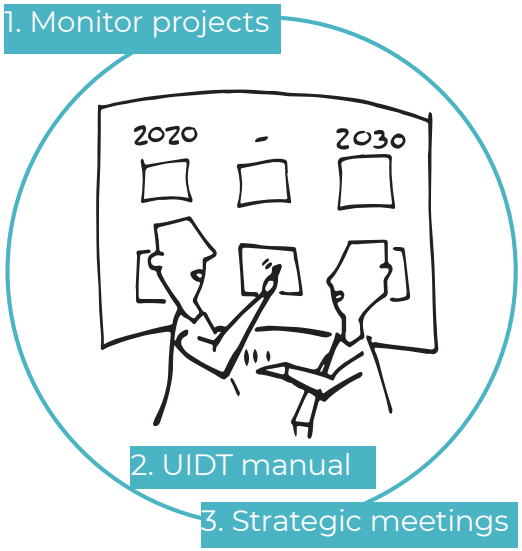


Figure 5.23 First horizon for 'organisational and project development support'

will be able to understand what are the benefits they receive by collaborating in the unit and what are the responsibilities they have as collaborators.

The suggestion is to create a database of the actors involved in the unit, to implement these proposals. Also, to use a shared platform and provide access to all the actors. If the unit does not have resources to print down the manuals, they can start with a digital version.

For this horizon, I suggest keeping track of two metrics, the number of actors involved in the projects and the number of ongoing projects; to have an overview of how many actors are present and how the unit is growing over time. Besides, the proposal in this horizon aims to increase the presence of two factors for transdisciplinary collaborations; first, organisational purpose and support by involving directors in the strategic meetings and monitoring the projects.

Second, to provide actors with a clear overview of what the unit is, and their benefit and responsibilities as collaborators, so they can consciously commit to collaborate at the unit.

Having a committed and structured team contribute to effectiveness in the team. Also, the effectiveness of a team highly depends on project management and the project organisation (Kleinsmann & Valkenburg, 2008).

In the second horizon, the proposal consists of three interventions that give continuity to the ones suggested in the first horizon, project portfolio for the coming years, a platform for linkage and support, and a committee for strategic meetings (see Figure 5.24). Besides, I suggest a fourth intervention which is creating a fund for project financing and development.

The first two interventions give continuity to monitoring projects. The quality of project documentation and the rigour of project planning are aspects that influence collaboration within a team (Bergema et al., 2011). For this horizon, the idea is to have a platform not only for monitoring projects but also for connecting actors to collaborate in the projects.

For example, a new project related to diabetes is about to start, through the platform, researchers and physicians interested in this topic

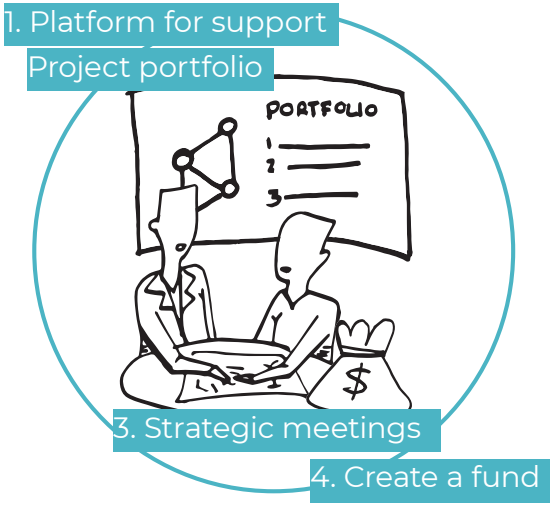


Figure 5.24 Second horizon for 'organisational and project development support'

can establish contact. Besides, actors have different needs to be able to start a project; hence, in the platform, they can find support if needed (e.g. how to apply for funding).

The second intervention consists of creating a portfolio of the projects for the coming years. The second horizon, 2024, is a transition period for the unit as the roles of directors (Deputy General Director at HGMEL, Research Director at HGMEL, Academic Secretary at ICAT, and Director at ICAT) will be taken by new actors. Therefore, the suggestion is that the current team leaves a portfolio of future projects so the coming actors can continue with the work done during the past years.

The third, to have a committee for the strategic meetings. During the first horizon, the suggestion is that directors of both institutions have strategic meetings with the UIDT coordinator. However, due to their busy agendas, the suggestion is that little by little, they can share the responsibility with others by creating a strategic committee. It can be formed by different actors that collaborate at the unit and have been involved for several years. In this way, when the directors leave their positions, the strategic committee can continue with the work done at the unit.

Additionally, the unit coordinator can be supported by a project coordinator. In this way, the unit coordinator can focus on high-level topics, while the project coordinator monitors the projects and provides support to the actors of the unit.

Afterwards, when the new members join the unit, it will be an excellent time to evaluate the current strategy and make adjustments so that all the actors (previous and new) are aligned.

Finally, the new proposal is to create a fund for project financing and development. The aim is that the unit does not depend only on the money provided for HGMEL and ICAT, which is usually not enough. Besides, from CONACYT it takes time to get money, so a suggestion is that the unit explore funding alternatives.

First, the strategic committee should estimate how much money they will need and for what. For this, the project portfolio will be useful, as it will provide them with an overview of what projects could be developed, and they can better estimate the money needed per project. Then, they can realise a list of potential donors and define a distribution and operations plan for the money. Although it will take time and it will demand much effort from the actors, in the future it can help to increase the number of projects realised in the unit.

These interventions need the collaboration of multiple actors; first, directors from both institutions (Deputy Director at HGMEL, Research Director at HGMEL, Academic Secretary at ICAT, and Director at

ICAT), the ones currently in charged and the ones who will take over on 2024. Then, the members that will form the strategic committee, the unit coordinator, the project coordinator, and active actors in the unit.

A social service student can provide support in different areas, like creating the platform or contacting donors. Besides, a financial responsible could help in structuring the fund for project financing and development. To get funding, the unit will also need to collaborate with other academic institutions, commercial parties and government.

The aim is that with this proposal, the actors have the certainty that their projects will continue, despite new directors will get involved. Besides, they will get support to connect to other actors and develop projects together. By creating a strategic committee with actors from the unit, all the actors will be represented and have a voice to receive organisational support.

Finally, by creating their funding for the unit, actors will benefit by receiving financial support to develop their projects.

For this horizon, it is necessary to keep the actors' database updated. Also, to acquire software for the projects management and a cloud storage service to save all the shared files. Ideally, the unit will have a conference room and a defined platform for video conference, when actors cannot meet in person. The unit also needs to have a shared calendar to schedule the meetings.

Besides, it is essential to document all the agreements in summary meetings and have them organised so everyone can consult them. The suggestion for this horizon is to track the improvements of the unit by counting the number of actors involved in projects, the number of active projects, the number of finished projects and number of donors.

This proposal attempts to implement certain factors for effective collaborations. For instance, counting the number of delivered projects contributes to having an overview of the delivered outcomes and how much is the unit contributing to biotechnology and biomedicine.

The fund will help by contributing with some resources to develop projects; besides, the collaboration with other stakeholders will be necessary. Finally, by creating a committee, the directors of both institutions can assure they define the right actors to guide the unit, and the strategic meetings will provide a space to communicate, share and learn with other actors.

Finally, in the last horizon, for 2030 (see Figure 5.25) the aim is to continue with the work that has been realised during the previous horizons. To update and increase the project portfolio, to define a strategy

for the coming years and to increase the monetary fund. It is possible to create a process from project to portfolio management and link it to the strategy to improve the general performance of the organisation (Nenni et al., 2014).

For this, the strategic committee needs to evaluate the success of

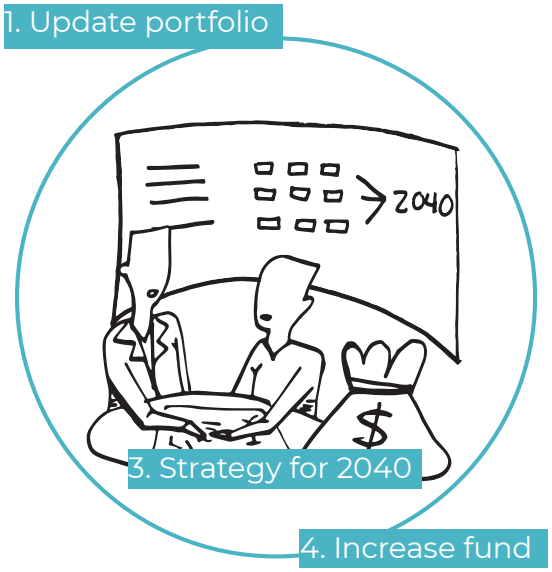


Figure 5.25 Horizon three for 'organisational and project development support'

past projects to verify if the project portfolio needs some adjustments. Then, they can define what elements does the unit already have to develop those projects (e.g. researchers and money).

Also, the committee is responsible for defining a strategy for the upcoming years. To reflect how do they envision the unit for 2040 and how to get there. Finally, to increase the monetary fund by acquiring new donors and exploring different models to get resources (e.g. crowdfunding).

For this horizon, the same roles as the previous horizon are needed. Ideally, the actors consolidate a structured team that keeps growing. Besides, the number of students realizing their social service at the unit can also increase. The students can provide support in the projects, in the coordination of the unit or the monetary fund. The unit could contribute by strengthening their relationships with other academic institutions, commercial parties and government institutions.

With these implementations, the actors will benefit by having the opportunity to explore new challenges for research and technological developments. Besides, they will also have more clarity in the projects to come, what to expect from the unit and more financial support for project development.

The metrics to track in this horizon are similar to the ones in horizon two; the number of actors involved in the projects, the number of active projects, number of finished projects, number of publications, number of technology transfers, and number of donors. In this horizon, the factors for effective collaborations are five; organisational purpose and support with the presence and intervention of the strategic committee. Besides collaboration with stakeholders to get money, project resources, spaces to communicate, share and learn,

and deliver outcomes.

Building a knowledge community

This strategic line aims to create a learning space formed by professionals from different disciplines open to share knowledge and learn from others (see Figure 5.26). On the first horizon, the proposal is to organise the seminars again, to implement a human-centred approach in the projects and to establish multidisciplinary lectures for each project (see Figure 5.27).

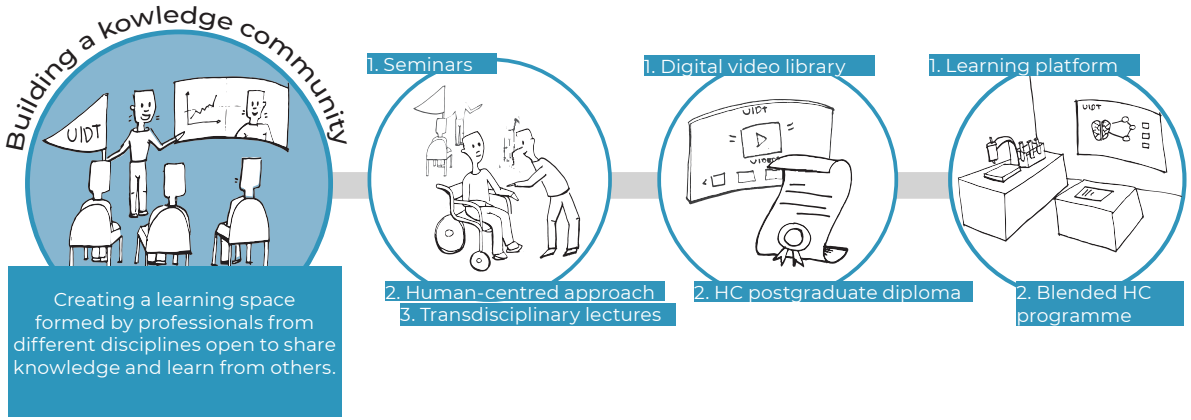


Figure 5.26 Strategic line: Building a knowledge community

The seminars can take place every quarter. Taking advantage of the changes in work dynamics caused by COVID-19, the seminars could be either digital or in person, as the traditional approaches to science are transforming into online symposia or virtual networking sessions (Kwon, 2020). The idea is to provide a flexible open space to learn from different disciplines. The seminars could have a defined structure, and they should be short to motivate actors to join. Besides, proof of participation could give extra motivation to participants to attend, as it would have a curricular value.

To begin, the unit needs a shared calendar to enable actors to plan the seminars and send invites. Besides, the seminars should be documented to create a bibliographic reserve.

Currently, some researchers have been to surgeries to understand the context of their research or the project they are developing. This practice should be encouraged throughout the unit by implementing a human-centred approach in each project. For instance, if a researcher is developing technology to help resident physicians to realise heart surgery; the researcher first needs to know how a heart surgery works to be able to design a solution.

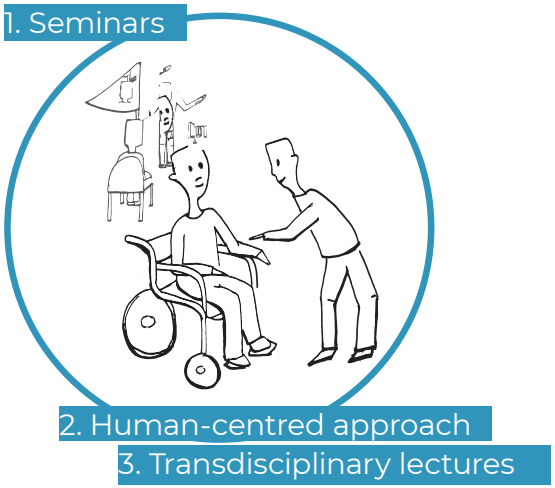


Figure 5.27 First horizon for 'building a knowledge community'

A human-centred approach actively involves actors in the process, switching their role from external actors to internal actors involved in the process (Junginger, 2008). In this way, actors could complement their lab research with field research. Besides, actors can use the physical space at the hospital to realise tests with patients, although they should have an assigned space for it and defined schedules as multiple projects are running at the same time.

A challenge of working with different disciplines is that actors sometimes do not understand each other, as they speak different jargon. To solved this, a group of actors have implemented short lectures between the project collaborators. For instance, the physician explains to researchers and designers the effect of diabetes in the human body. This practice could be implemented in all projects.

All the actors involved in a project can have a basic knowledge of the relevant topics in the project by implementing short lectures between different disciplines. This approach will facilitate communication and collaboration with others. Besides, it will enable integration between actors and allow the possibility to consider different perspectives for the project development. Diversity of thoughts at the beginning of project development often leads to innovations (Kleinsmann & Valkenburg, 2008).

For the implementation of the seminars, actors need to be proactive to present, and the rest curious and interested in acquiring new knowledge to attend the seminars. Besides, students doing their social service could contribute by preparing the programme for the seminars, coordinating the seminar, and documenting it.

This proposal will benefit actors by providing open spaces to share knowledge and to learn; creating new knowledge contributes to creating new solutions (Kleinsmann & Valkenburg, 2008). Also, the idea is to boost the development of young scientists in a learning environment and encourage them to present; and to enable a shared understanding among actors for project development.

To realise the online seminars, it is necessary to have a software for video calls; besides, a tool or software to record the seminars. Also, it is essential to define a physical space where the seminars will take place. Actors will need a shared calendar, a defined structure for the seminars and a programme for the upcoming seminars. Additionally, each actor presenting is responsible for preparing the content for their seminars.

To evaluate the success of this horizon, I suggest three metrics, number or realised seminars, the number of presenters, and number of assistants. In this horizon, the factors for transdisciplinary collaboration are 'personal commitment' for the seminars, and 'agreements between actors' to prepare the seminars and the programme; also, a collaborative process with the short lectures in each project. Finally, the aim is that these initiatives lead to building a community between actors.

In the second horizon, the idea is to improve the work realised in the first horizon (see Figure 5.28). The proposal is to use all the recordings of the previous seminars to create a digital video library that actors can access.

The second proposal is that after some years of experience of implementing a human-centred approach in the unit, the actors of the unit design a postgraduate diploma about implementing a human-centred approach to biotechnology and biomedicine. Human-centredness is an empathetic approach focused on understanding people's needs. For instance, realise observations to understand the needs of patients, physicians, nurses, and residents for every project. Actors from the unit could design and guide the programme. Also, a bigger space at the hospital could help students to work with researchers, patients and other actors.

For this horizon, the list of actors involved gets bigger. The suggestion is to have technical support for the online seminars and the digital video library. Besides, a coordinator responsible of all the logistics behind the seminars. The presence of UIDT is, of course, necessary, as they are

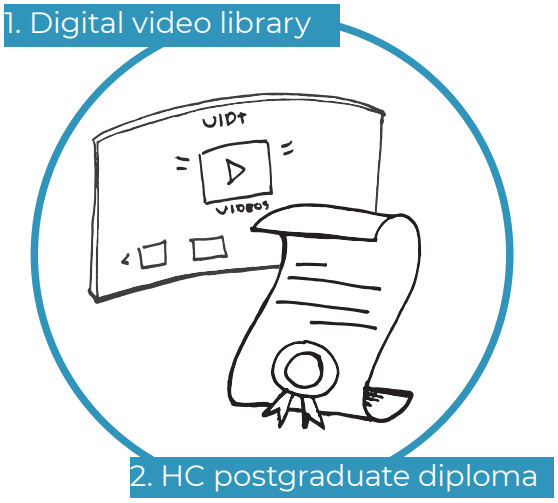


Figure 5.28 Horizon two for 'building a knowledge community'

the presenters and attendants to the seminars.

For the postgraduate diploma, it is necessary to have a team responsible for designing the programme and facilitating it, and a team of experts on defining research methods and techniques. Students will be present to attend the postgraduate diploma, plus students doing their social service can provide support for the digital library and the postgraduate diploma. Besides, in this horizon, the presence of the Quadruple Helix is necessary; for instance, citizens, academics, academic institutions, commercial parties, and government, to contribute to the implementation of the proposals.

The same technology and resources on the previous horizon are needed. Additionally, the unit will need the platform to create the digital library and working space for the postgraduates. Besides, the actors that belong to the diploma team will need to consider the regulations from the hospital to realise field research with patients, patients' family, resident physicians, physicians and other employees from the hospital.

The metrics for this horizon are, the number of seminars realised, the number of presenters, the number of attendees, and the number of students in the postgraduate diploma. Besides, the factors for effective collaborations present are 'collaboration with stakeholders' and 'build a community'.

Finally, the suggestion for the third horizon (see Figure 5.29) is to transform the digital library into an online learning platform where people can have access to the online seminars and the video library; additionally, access to the postgraduate diploma. In this horizon, the postgraduate diploma transforms into a blended programme. UIDT has bigger facilities in the hospital, where actors can work in multiple projects at the same time, and different areas (e.g. labs, working sessions with patients, working area for researchers and postgraduate students). Besides, it has a learning platform where actors can work with researchers around the world.

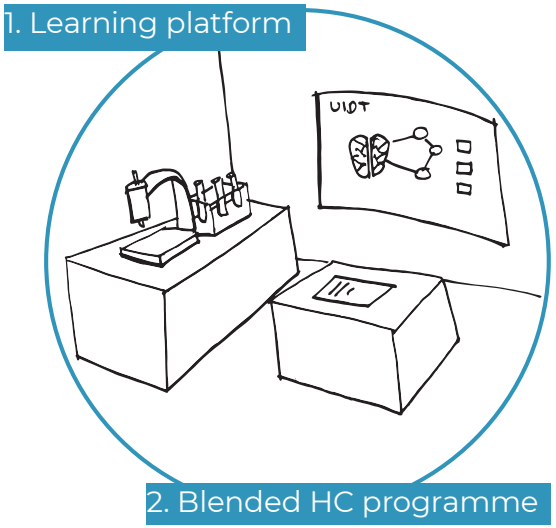


Figure 5.29 Third horizon for 'building a knowledge community'

For the development of these ideas, the same actors mentioned

in the previous horizon collaborate. However, the aim is to keep the team growing, formed by a transdisciplinary group of people. The only new actor could be a person responsible for the facilities; controlling the inventory and keeping order inside the unit. Besides, the collaboration with external parties continues (citizens, academics, other academic institutions, commercial parties, and government).

Actors at the unit will benefit from obtaining better facilities and tools to work and develop collaborative projects. Besides, having a shared space contributes to increase collaboration and will invite others to collaborate and innovate.

Different tools and technology contribute to making this proposal possible; some were described in the previous horizon. Additionally, a proper administration of the facilities and the learning platform will contribute to making efficient use of both spaces, online and

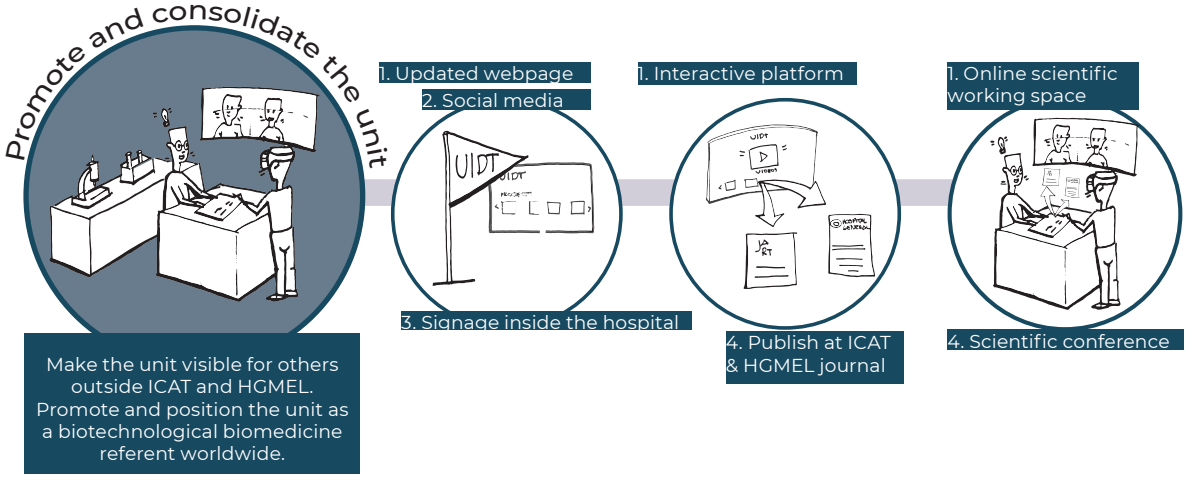


Figure 5.30 Strategic line: Promote and consolidate the unit

offline. For example, for the facilities, some initiatives could be related to manage an inventory and control who has access to the facilities.

The metrics mentioned in the previous horizons are still be relevant; however for this horizon. Additionally, I suggest two more, number of people present at the facilities per day and number of people visiting the online platform. This metrics will help to measure the success of both working spaces. This horizon integrates two factors for effective collaborations, collaboration with stakeholders and build a community. Building communities increase the commitment of the members, which allows them to work through obstacles (Padesky & Mooney, 2012).

Promote and consolidate the unit

This strategic line focus on making the unit visible for others outside

ICAT and HGMEL and promoting and position it as a biotechnological and biomedicine referent worldwide (see Figure 5.30). The interventions on the first horizon are simple (see Figure 5.31), and they could have a positive impact on the unit. The suggestion is to update the webpage of the unit, to have a presence in social media and to place UIDT signage in the hospital.

Currently, the information of UIDT is at ICAT webpage (see Figure 5.32), and at the hospital's webpage, there is no link or reference about the unit. Hence, the suggestion is to make sure ICAT webpage is updated with the active projects and the actors involved and creating a link from the hospital's webpage to the UIDT webpage. Other information to be added are the past projects, delivered outcomes, and collaboration. Then, to have more exposure outside the unit, social media could be useful; for instance, LinkedIn. Presence in social media facilitates communication with different actors and contributes to expanding the network (Van-Tien Dao, 2014).

Currently, only a few people inside the hospital know the unit, and not

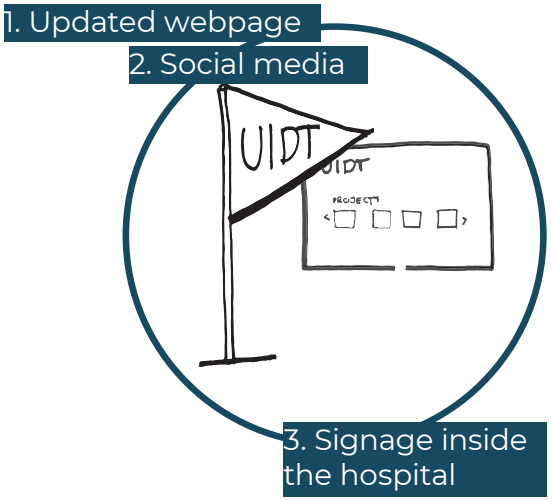


Figure 5.31 First horizon for 'promote and consolidate the unit'

Figure 5.32 UIDT webpage

all of them know what does 'UIDT' stands for. Hence, the suggestion is to add a bigger signage outside the unit (see current signage in Figure 5.33) and to add other visual communication elements around the hospital, so more actors get to know the unit.

The actors suggested for this proposal are the UIDT coordinator, who is the one sharing the information that goes in the webpage, the responsible of updating the webpage, a social service student helping with the design of the visual and printing

Figure 5.33 Current signage outside the unit

material, and the actors at the HGMEL that provide permission to change the existing communication element and add new ones.

The actors will benefit from this proposal because it will be easier to access to the information of the unit (e.g. current projects and actors involved). Besides, expanding the network could benefit them by having more opportunities to develop projects and building new collaborations with different stakeholders.

The technology and the resources needed are the webpages, the content for the webpage, social media account(s), also the content for social media, the design for the signage and the printed versions, and authorization from the hospital to place them around.

For this horizon, the metrics will be the number of visitors to the webpage, the number of new people contacting the unit and the number of people interested in collaboration opportunities. By having open and clear information, the aim is to facilitate the process to collaborate in the unit. Hence, the factor for effective collaborations is 'collaborative process'.

In this second horizon, the idea is to continue and improve the proposal on the first horizon and add two new interventions (see Figure 5.34).

Transform the webpage into an interactive platform with virtual tours inside the hospital, case studies via a scientific blog, news and events, and calls for collaboration. In addition, collaborate with the Journal of Applied Research and Technology (JART) that belongs to ICAT. Add an area in the journal related to biotechnology and biomedicine. Also, to publish periodically at the medical journal of the hospital, Revista Médica del Hospital General de México, and add the field for biotechnology and biomedicine. In this horizon, the unit will need to have a content coordinator and editorial team to follow and contribute to the publications.

Besides, the suggestion is to collaborate hand by hand with

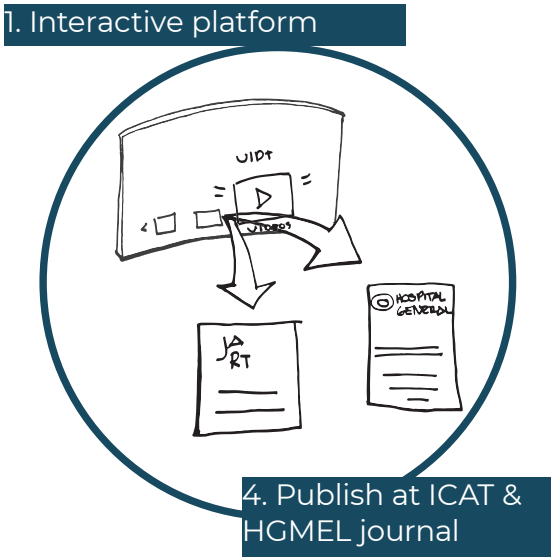


Figure 5.34 Second horizon for 'promote and consolidate the unit'

the responsible of JART and the responsible of Revista Médica del Hospital General de México. Besides, the collaboration will also be with external parties, like academic institutions and academics. The benefit for the unit will be that actors will have a presence outside HGMEL and ICAT, and they will receive support to publish in the institutions' journals. The aim is to collaborate with stakeholders like academic institutions and academics.

For the implementation, it is necessary to contribute with the webpage, to have the scientific articles that will be published, and access to JART and Revista Médica del Hospital General de México.

For this horizon, the metrics suggested are number of articles published at JART, number of articles published at Revista Médica del Hospital General de México, number of actors publishing at JART, and number of actors publishing at Revista Médica del Hospital General de México.

The factors of collaboration present in this horizon are the same mentioned in the first horizon.

This proposal aims to increase the number of researchers and publications. Currently, UNAM realises 33% of publications recognized by CONACYT (Elsevier Science & Akadémia Kiadó, 1995) and HGMEL also wants to increase the research department inside the hospital.

Finally, the third horizon (Figure 5.35) also aligns with the strategic line, 'building a knowledge community', by combining the existing webpage with the learning platform suggested. As a result, the idea is to create an online scientific working space with digital working rooms and a collaborative editorial platform. Besides, the use of technology like Augmented Reality (AR) and Virtual Reality (VR) could be useful for remote research and developing international projects online. In this proposal, it is crucial to have an international digital network of researchers. According to the Medical Futurist, building a global network will contribute to speed up the process of finding the solutions in health (2020).

The other idea is to create a blended scientific conference, online and offline, where international guests assist. For the offline sessions, the facilities from HGMEL and ICAT could be used for multiple purposes. For the implementation of these ideas, the collaboration will be with a content coordinator, editorial team, responsible for JART, responsible for Revista Médica del Hospital General de México, peer reviewers, proofreaders, promotion team, financial manager, and technical support.

Besides, the collaboration with citizens, academics, academic institutions, commercial parties, and the government is necessary. Science is transitioning to open information and public studies over secret research (Apuzzo & Kirkpatrick, 2020), so citizens will also become part of the scientific ecosystem (European Comission, 2015).

Actors will benefit from belonging to a consolidate group of leading researchers, and they will be able to collaborate with researchers worldwide. The resources and technology needed are a digital platform, facilities, economic resources, publicity, and sponsors.

Figure 5.35 Third horizon for 'promote and consolidate the unit'

The metrics in this horizon will continue from previous horizons; additionally, I suggest, number of active online projects, number of people visiting the platform, number of attendees to the conference, number of projects presented at the conference. The factors for effective collaborations in this horizon are a collaborative process, collaboration with stakeholders, projects resources, and building community. Communities form when knowledge is created (Adler, Kwon, & Heckscher, 2008); hence, this proposal considers knowledge creation and knowledge sharing.

To summarise, this strategy presents a future vision for 2030 and three strategic lines; organisational and project development support, building a knowledge community and promote and consolidate the unit.

Each strategic lines presents a plan considering three horizons; 2020, 2024 considered as the transition period when the actors in the directive roles change, and 2030. Each horizon contains a proposal, including actors involved, stakeholders collaborating, benefits for the actors of the unit, technology and resources needed, success metrics, factors to building effective transdisciplinary collaborations and literature references. All these information previously described has been put together in a tactical roadmap to have a complete overview of the strategy (see 5.36).

5.4 Discussion

In this section, I considered the results of the previous studies, the case study at UIDT, and the insights and factors defined as a result of the comparative analysis to design a strategy for UIDT. The purpose of the strategy is building effective transdisciplinary collaborations inside the unit. This section responds to two sub-question questions, which are the possible directions to contribute to UIDT? And how to design an intervention to build effective transdisciplinary collaborations inside the unit?

Sub-question question a. Which are the possible directions to contribute at UIDT?

According to the information collected from the case study and in collaboration with the actors, we defined three opportunities for improvement at UIDT. Those opportunities present directions to intervene and improve the collaboration between actors. The opportunities are; 1) Building a collaborative network between actors, 2) Being updated about the status of the projects and the future of UIDT, and 3) Share knowledge and learn from others to achieve better

UIDT

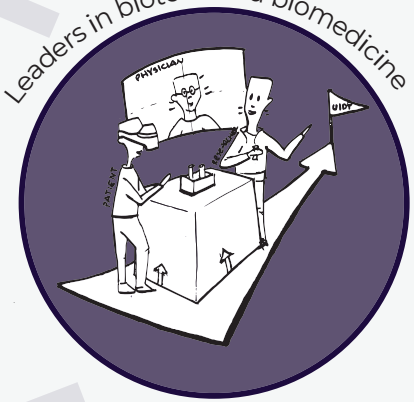
Tactical roadmap

	STRUCTURE THE UNIT 2020	DEFINE A STRATEGIC VISION 2024	LEADER IN LATIN AMERICA 2028
Organisational and project development support			
PROPOSAL	1. Monitor projects 2. UIDT manual 3. Strategic meetings	1. Platform for support Project portfolio 3. Strategic meetings 4. Create a fund	1. Update portfolio 3. Strategy for 2040 4. Increase fund
ACTORS	Directors from both institutions, unit coordinator, active actors, social service student.	Strategic committee, project coordinator, financial responsible	Financial manger
STAKEHOLDERS		Government, Academia, Companies	
TECH & RESOURCES	o Actors' database o Shared platform o Digital manual	o Cloud storage o Software for video call o Meeting room o Meeting agenda o Summary meetings	o Software for project management
SUCCESS METRICS	Number of actors involved in projects Number of ongoing projects	Number of finished projects Number of donors	Number of publications Number of technological tramsfers
COLLABORATIVE FACTORS	Organisational purpose & support Personal committment	Right actors Financial resources	Deliver outcomes Spaces to communicate Collaboration with stakeholders
Building a kowledge community			
PROPOSAL	1. Seminars 2. Human-centred approach 3. Transdisciplinary lectures	1. Digital video library 2. HC postgraduate diploma	1. Learning platform 2. Blended HC programme
ACTORS	UIDT actors, social service student	Technical support, seminars' coordinator, HCD team, students	Facilities responsible
STAKEHOLDERS			Society
TECH & RESOURCES	o Software for video call & recording o Physical space o Shared calendar o Seminars' structure & programme o Content for seminars	o Regulations from hospital o Facilities for postgraduates	o Inventory o Bigger facilities with specific zones (e.g. clinical trials, lab research)
SUCCESS METRICS	Number of realised seminars Number of presenters Number of attendees	Number of posgraduates	Number of people at the facilities per day Number of people visiting the platform
COLLABORATIVE FACTORS	Collaborative process Personal committment	Build a community Agreements between actors	Collaboration with stakeholders
Promote and consolidate the unit			
PROPOSAL	1. Updated webpage 2. Social media 3. Signage inside the hospital	1. Interactive platform 4. Publish at ICAT & HGMEL journal	1. Online scientific working space 4. Scientific conference
ACTORS	UIDT coordinator, webpage responsible, HGMEL administrator, social service student	Content coordinator, editorial team, responsibles for ICAT & HGMEL journals	Peer reviewers, proofreaders, promotion team, financial manager, technical support
STAKEHOLDERS			
TECH & RESOURCES	o Webpage o Webpage content o Social media account(s) o Content for social media o Design for signage o Printed signage o Authorization from HGMEL	o Scientific articles o JART o Revista Médica del Hospital General de México	o Digital platform o Facilities o Economical resources o Publicity o Sponsors
SUCCESS METRICS	Number of visitors at the webpage Number of people interested in collaborating Number of new contacts	Number of articles published at JART Number of articles published at Revista Médica Number of actors publishing	Number of attendees to the conference Number of projects presented at the conference
COLLABORATIVE FACTORS	Collaborative process	Build a community	

FUTURE VISION 2030

UIDT

Leaders in biotech and biomedicine



Unidad [illegible] to the General Hospital of [illegible] Eduardo Liceaga'

outcomes.

These directions formed the basis to define the future-oriented strategy for the unit.

Sub-question question b. How to design an intervention to build effective transdisciplinary collaborations inside the unit?

For this step, I considered the three opportunities identified in the previous step. Besides, from the comparative analysis, I defined twelve factors for effective transdisciplinary collaborations in healthcare. Hence, I used all this information to design a future-oriented strategy for the unit.
First of all, the future vision presented is crucial, because it represents the desired future of the actors, aligning them towards the same aim. Besides, I considered the strategy a suitable approach because it goes beyond an intervention; it is a plan that describes a series of proposals to tackle the barriers detected, enhance the enablers and improve the collaboration inside the unit.

Also, this strategy considers multiple directions. I took into consideration three directions, and I presented them as strategic lines to guide the actors towards the future vision. This strategy aims to build a structure that will allow actors to operate and as a result, collaborations among actors will increase and will strengthen.

Building effective transdisciplinary collaborations is not an easy task, it needs time and effort, but it also needs an organisational structure and a community. Hence, in this strategy, the first strategic line tackles the structural aspects and the second strategic line focus on building a sense of community. Besides, the third strategic line aims to consolidate the scientific community.

Finally, the way to present the strategy was by creating two roadmaps to visually plot all the proposals into a timeline. The roadmaps provide an overview of the plan to the actors. The aim of this roadmaps is first, as a reminder of what the future of the unit looks like, a plan that helps them implement the strategy in simple steps, and a living document they can continuously modify and adapt based on their needs.

Limitations and future research

Due to the remote working condition caused by COVID-19, it was challenging to organise a validation session with multiple actors; for this reason, I realised four individual sessions and one double session. However, the final presentation with the directors, Deputy General Director and Research Director at HGMEL, was quite useful to discuss relevant aspects of the strategy. Despite the limited time they had (one-hour), the discussion was fruitful, and we defined clear

‹ Figure 5.36 Tactical roadmap for UIDT

agreements for adjustments and future steps.

In the meeting with the directors, we agreed that the aim is that this strategy gets implemented. Hence, the next step is to share the final deliverable with them that includes all the deliverables in this report in Spanish. Additionally, realise a meeting to discuss the implementation of the proposals suggested in the first horizon.

We also discussed the possibility to have a UIDT coordinator at HGMEL; currently, the UIDT coordinator is at ICAT. Hence, having a counterpart at HGMEL will help to have representative figures from both institutions. The proposal for future research is to work in the implementation of the strategy and verify how the three strategic lines complement each other and what other aspects are missing to build effective transdisciplinary collaborations inside the unit.

Summing-up

There is not just one path to build effective transdisciplinary collaborations; hence, in this section, I present a future-oriented strategy to build transdisciplinary collaborations over time. The strategy is formed by a future vision and three strategic lines. The future vision presents a desired future for the actors; hence, it contributes to aligning all the actors in the same direction. Besides, each strategic line presents different interventions to build better conditions that will help actors to collaborate.

Some ideal conditions are needed to increase collaboration; for instance, organisational support, to develop projects collaboratively. Therefore, the first strategic line is ‘organisational and project development support’. Another strategic line is ‘building a knowledge community’ to create a space for sharing knowledge and learn from others. Finally, the third strategic line is to ‘promote and consolidate the unit’, as a way to demonstrate the achievements of the actors, their results and their contribution to the health sector. Besides, it is a way to encourage the actors to give their best to turn into leaders in biotechnology and biomedicine.

TAKEAWAYS FOR UIDT

- Defining a future vision contributes to aligning actors in the same direction, so they can later work together towards the same aim.
- To build effective transdisciplinary collaboration in the unit efforts in different lines are necessary. The suggestion is to start by providing organisational and project development support, focus on building a knowledge community and promoting and consolidating the unit.

CHAPTER 6

General Discussion

The purpose of this chapter is to discuss relevant aspects address in this graduation project. This chapter starts with a brief literature discussion on effective collaborations. Then, I directly address the research question, followed by a critical reflection on the design process used for this project. Then, I mention the limitations and steps for future research. I close this chapter with a final reflection.

6.1 Discussion

The Quadruple Aim could be implemented to achieve a transition towards sustainable healthcare, by focusing on improving the health of the population, improving the work-life of care providers, enhancing patients experience and reducing health cost (Pannunzio et al., 2019). However, implementing these four aims is challenging. It requires the effort and collaboration of multiple disciplines. Hence, innovation and transdisciplinary collaboration could contribute to the implementation of the Quadruple Aim.

Open innovation initiatives are spaces where transdisciplinary collaboration and innovation occurs. Therefore, I consider these initiatives could contribute to the transition to a sustainable healthcare system. For this reason, this study focused on building effective collaborations in open innovation initiatives. By building effective transdisciplinary collaborations, open innovation initiatives can operate efficiently and contribute to build sustainable healthcare systems.

To build effective collaborations, I first needed to understand the barriers to collaborate and enablers for team success present in the initiatives. At the beginning of the project, I considered the barriers and enablers defined by Choi & Pak (2006).

As a result of this study, I defined twelve factors to build effective collaborations. The list of factor considers the information collected during the project and the list of Choi & Pak. However, not all barriers and enablers are considered. For instance, Choi and Pak's study suggest maturity concerning the knowledge base of the actors (2007), and for this study, I do not consider the level of maturity knowledge but the openness to learn from each actor.

According to Kleinsmann (2006), to understand the context of the collaboration, the barriers and enablers should be located in three organisational levels; the organisation, the project and the actor level. In this study, I integrated a fourth level, ecosystem. In healthcare, the ecosystem is relevant because it regulates the technological developments and innovations in healthcare. For example, the Kazakh Research Insititute of Biological Safety Problems created a new vaccine for COVID-19; however, to be able to reach the market, it needs to be approved by the World Health Organization (WHO) (Yergaliyeva, 2020).

Effective collaboration refers to a group of people that not only focus on individual benefits but works together towards collective success (Head, 2003). To achieve effective collaborations in the unit, I propose a future vision to align all the actors and a strategy formed by three strategic lines; organisational

project and development support, building a knowledge community, and promoting and consolidating the unit.

Answers to the research question. How to build effective transdisciplinary collaborations in healthcare?

This graduation project is formed by two studies, an interview study in the Netherlands and a case study in Mexico. For both studies, I explored which stakeholders are involved, how do the initiatives operate, and I detected the barriers and enablers present. With this information, I was able to realise a comparative analysis between both studies. I identified some similarities and differences from the studies, and I then defined twelve factors needed to build effective transdisciplinary collaborations in healthcare (see Figure 4.5).

With all this information collected, I explored four opportunities in the units. After some sessions with the actors, we selected three opportunities and defined ideas to tackle those opportunities. Out of those directions and ideas, I defined a strategy for the unit. This strategy suggests three strategic lines that could contribute to building effective transdisciplinary collaborations among actors at UIDT.

During the process, I realised there is no one way to build transdisciplinary collaborations. First, to build effective transdisciplinary collaborations, there needs to be a reason to collaborate. Therefore, I focused on defining a vision. I defined a vision that actors could easily relate with, 'in 2030, UIDT will be a leader in biotechnology and biomedicine'. All the actors agreed with it; they all want to succeed, and if the unit goes well, things will go well for them also. Hence, future vision is the first step to align actors in the same direction.

Besides, to achieve effective transdisciplinary collaborations, the organisation needs to provide certain conditions; organisational structure and support for project development. These two factors will help the actors perceive they have support to realise their work. Also, actors need to have a sense of belonging, to feel they belong to a group of people. In this unit, knowledge is a feasible way in which actors can get to know each other; by sharing knowledge and learning from others. Hence, 'knowledge' could be the vehicle that can help actors to build a community where they can support each other; a knowledge community.

Finally, actors need to deliver results and receive some feedback for their work, as a way of validating the effort was worth it. Hence, the suggestion is to promote the unit outside UIDT and HGMEL, so other stakeholders can get to know the achievements of the actors at the unit. Besides, publications and conferences organised by the unit will contribute that more people get

to know their work. This initiative will result in a consolidate group of researchers leaders in biotechnology and biomedicine.

To summarize, actors need a reason to collaborate; hence, a future vision could contribute by aligning the actors in the same direction. Besides, building effective transdisciplinary collaborations take time; therefore, a strategy was a suitable way to present a plan in a defined timeframe. The strategy presented tackles different directions; three strategic lines related to organisational and project development support, building a knowledge community, and promoting and consolidating the unit. In addition, I identified twelve factors that contribute to building effective collaborations; therefore, those factors were integrated into the strategy.

6.2 Critical reflection on the design process

This graduation project presents the complete design process, since the creation of the brief to the deliverable of a final outcome. For me, the most valuable aspect of design is the process. I like exploring new methods for each project and learning new ways of doing things. I believe the implementation of a good process contributes to better outcomes.

It was challenging to define the design brief, the unit has different needs, but ICAT and HGMEL did not have a concrete demand. They wanted to have a general 'scan' of how the unit works. Hence, it was difficult to define the best way to deliver the results. During the brief, I suggested realising a collaboration strategy and tools and methods for improvement. However, during the process, I decided it was better to focus only on defining and detailing a clear strategy. The strategy suggest building a structure for the unit, and the tools and methods could follow afterwards. As part of the strategy, I propose tools and method for each horizon, so the next step will be to define how those proposals will look like.

This project had a long period of research and shorter design phase. The general process consisted of research, analysis, ideation, design and validation. Having an extensive amount of data make it easy to define a strategy.

I considered I had plenty of information to back up each proposal with data. I also liked that during the validations sessions of the roadmap, the actors identify their ideas shared on previous sessions, and I considered that contributes to creating ownership with actors. In the end, they do not see it as my strategy but their strategy, because they are the actors that form the unit.

This is a benefit of implementing a co-creative process. Besides, I consider this aspect is necessary to make the actors own the solution to increase adoption.

Although the actors involved in the unit are not entirely familiar with the design processes, I was surprised that they were always open to collaborating. For example, some actors did not fully understand the use of the booklet, so they did not fill it in, but they answered the questions out loud. I was aware that this was the first time most of the actors were involved in a design process; hence, I was flexible during the process, not pushing them to answer every time. In total, twenty-five actors collaborated throughout the process.

During the process, I was able to identify the actors that were more open and willing to share. As the process moved on, I considered the most active actors as the main participants for the different activities I planned.

I consider that a good ending for this graduation project was the collaboration with the Deputy General Director and the Research Director of the hospital. During the process, I collected plenty of information regarding the actors' point of view, so I had proposals on how to make changes from a bottom-up perspective. However, the collaboration with both directors helped me integrate a top-down approach to verify the support the unit and the actors have from the organisation. Furthermore, I was glad to listen that they are willing to contribute and implement the strategy.

From the design process, I selected three learnings to consider for future projects. First, consider data triangulation in every phase. Although I realised about it a bit late, now I am aware that when doing individual research data

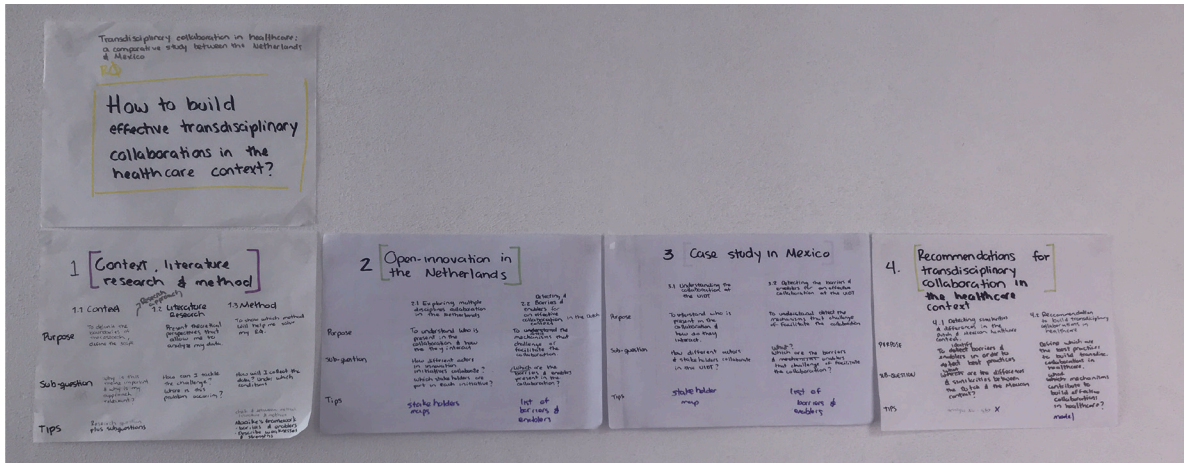


Figure 6.1 Physical map with the research question and sub-questions

triangulation is also necessary and possible. By integrating the data collected from the participants, literature research and my point of view as an expert. The problem was that I was not doing it in a structured way, I was adding some literature research but without considering as a formal process in each step. Data triangulation helps to compare and validate the information shared by the actors.

Second, halfway during the project, I realised I was losing the scope, so I wrote down my research question and the different phases of the project. For each phase, I defined the research sub-question and purpose. So every time I was making a decision, I looked back to my wall (see Figure 6.1) to verify if I was answering in line with the purpose and the research question. During the process, some aspects were adjusted and updated.

Finally, my third learning is to reflect. This learning is in line with the previous paragraph. I tend to focus on the deadlines, and I work towards the deliverable despite the barriers and challenges. After each phase, I need to take a step back to reflect. This helps me to have an overview of what I am doing and double-check if I am responding to the purpose of the project. So every time I am taking a new step and a new decision I need to ask myself, why am I doing this?

6.3 Limitations and future research

Due to COVID-19, the research was not in field, so I considered I missed some information at the actor level. However, I focused more on the project and the organisational level, where I collected fruitful information. Almost all the conversations, sessions and exercise were online. This digital way of doing research might have reduced the amount of data collected and the frequency of the interaction with stakeholders. It was not possible to get in contact with all the actors; physicians' role has been crucial during this pandemic, so their time available was scarce.

The collaboration with physicians and other actors from HGMEL was limited in comparison with actors from ICAT and CIDI. Besides, I was not able to coordinate a validation session with actors from both institutions, so I collected the information independently and put it together.

For future research, it will be useful to organise a session to present the outcome to actors from both institutions and define roles for the implementation of the strategy. The next phase will be to explore how design can contribute to implementing the strategy, considering the three strategic lines and the proposals on the first horizon for each strategic line.

6.4
Final reflection

This project leads me to the reflection that the projects realised at the unit are relevant for the biotechnology field, and in some cases, they result in benefits for patients, physicians and physician residents. I consider this case is an excellent example of how things could change and contribute towards a sustainable transformation in healthcare, by enabling trandisciplinary collaborations that contribute to improvements in healthcare.

Despite the lack of resources, the fragmentation of the system, and the difficulties to collaborate, UIDT actors are still delivering relevant results and contributing to science. Although existing barriers limit the full potential of the unit, I am confident that some improvements as the ones suggested in this strategy could contribute to building a better and effective unit. I know most of the actors are committed to their work; they just need some support to be able to do their work.

An organization's effectiveness partly depends on the success of its projects (Nenni et al., 2014). If the unit commits to implement this strategy, I am positive it will contribute to improve the unit in the future. This case is an example of how having a clear future vision and a strategy could contribute to improve the collaboration among actors for the benefit of the organisation.

The current pandemic, COVID-19, has shown us how valuable s that multiple disciplines work together. For instance, designers and engineers helped 3D-printing ventilators and masks when the hospitals ran out of them.

This pandemic has shown us the existing fractures in the health system, so now, we cannot allow things to continue as they were. We need to work towards a sustainable healthcare system considering to improve the experience of health providers and patients, to improve the health of the population and to reduce the cost of care (Quadruple Aim) (Pannunzio et al., 2019).

FINAL TAKEAWAYS

- A clear future vision and a future-oriented startegy can contribute to improve the operations and collaborations among actors at an open innovation initiative in healthcare.
- Transdisicplinary collaborations can provide an innovative approach to transition towards sustainable healthcare systems. For instance, by suggesting novel approaches to implement the Quadruple Aim effectively.

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Icons made by Flaticon.

Drawings and pictures by Regina Morán Reséndiz.

APPENDIX

Collaboration in healthcare:

Building effective transdisciplinary collaborations in open innovation initiatives

Master thesis
Regina Morán Reséndiz
July, 2020

Note: continue with the Appendix document

low investment

high investment

DT - Roadmap estratégico

uesta

HORIZONTE 1
Estructurar la unidad
2021

HORIZONTE 2
Visión estratégica
2024

HORIZONTE 3
Referente internacional
2030

Visión a futuro
2030

porte organizacional para el desarrollo de proyectos

UIDT

rtalecer las dinámicas operativas la unidad y brindar soporte a los laboradores de la unidad para el desarrollo de proyectos

1 ESTRUCTURA DE PROYECTOS

2 LISTA DE PROYECTOS ACTUALIZADA

3 MANUAL DE INTRODUCCIÓN A LA UIDT

REPORTE MENSUAL DE AVANCE DE PROYECTOS

PLATAFORMA PARA VINCULACIÓN Y SOPORTE

• REUNIONES ESTRATÉGICAS ENTRE ICAT Y HGMEL

4 Crear un fideicomiso

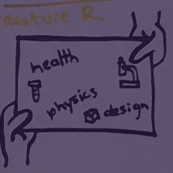
NUEVAS LÍNEAS DE INVESTIGACIÓN DEFINIDAS POR LA UIDT

ACTUALIZACIÓN DE OBJETIVOS DE LA UNIDAD

Comentarios:
¿Es esto viable? ¿Cómo se podría lograr?

La UIDT es líder en investigación y desarrollo en el área de biotecnología

Construir una comunidad de conocimiento



rear una comunidad formada por ofesionales de diferentes disciplinas lerta a compartir y aprender de los demás.

1 MINI-SEMINARIOS EN LÍNEA

2 CALENDARIO COLABORATIVO

DOCUMENTACIÓN DE SEMINARIOS

2 SESIONES DE INVESTIGACIÓN DE CAMPO

* Métodos de investigación con usuarios (e.g. pacientes, enfermeras, residentes, médicos)

VIDEOTECA CIENTÍFICA EN LÍNEA

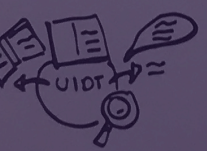
Residencias

Comentarios:
¿Cuál crees que sería el valor en la UIDT?

Crecer la comunidad y formarla como
Una comunidad científica consolidada y referente en América Latina; enfocada en problemas locales y globales.

Con espacio físico y virtual para colaboraciones internacionales.

mover y ~~consolidar~~ la unidad



Visualizarla

rtalecer la unidad y promocionarla hacia el exterior para posicionarla como un referente en México y Latinoamérica

1 PÁGINA WEB ACTUALIZADA Y UNIFICADA

2 PRESENCIA EN REDES SOCIALES

3 ABRIR ÁREA DE BIOTECNOLOGÍA EN JART (JOURNAL OF APPLIED RESEARCH & TECHNOLOGY)

4 PUBLICAR EN LA REVISTA MÉDICA DEL HOSPITAL GENERAL

5 CONFERENCIA CIENTÍFICA

Comentarios:
¿Cuál es tu opinión sobre esta visión a futuro? ¿Cuáles son los valores de la UIDT? ¿Cuál es la misión?

Menos tiempo

-Interacción del área y de todos los compañeros

Collaboration in healthcare:

Building effective transdisciplinary collaborations in open innovation initiatives

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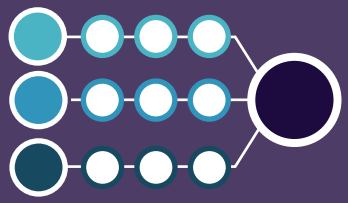
July, 2020



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