



**InnoRenew CoE**

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# Renewable Materials for Healthy Built Environments

## PREPARATION OF DOCTORAL DISPOSITION

**Dr. Oihana Gordobil**

Research Associate

Wood Modification group

E: [oihana.gordobil@innorenew.eu](mailto:oihana.gordobil@innorenew.eu)

Zoom, 18.11.2020

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# Outline

## ➤ Steps of the Research Process

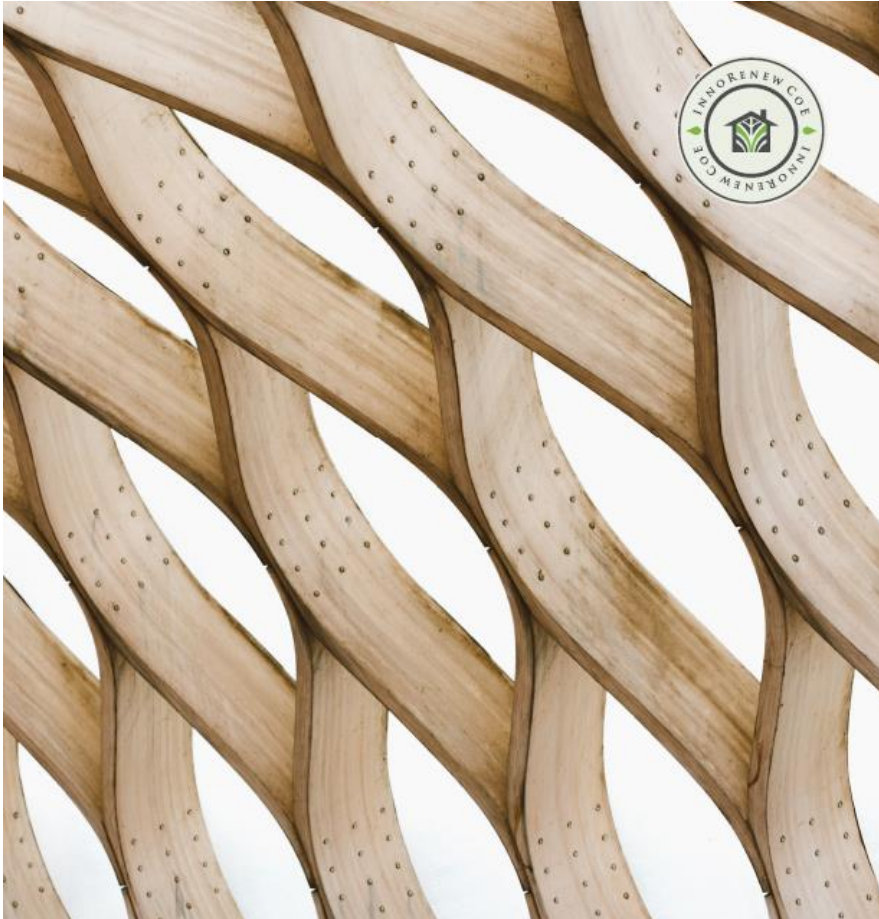
- Research problem: definition and elements
- Research design
- Importance of the literature review, sources of literature, websites of interest
- Content of the doctoral disposition

## ➤ Example of research project development

- MSCA action
- Green synthesis of sustainable BIO-sourced multi-functional ingredient for skin CARE applications



# Who I am?



Oihana Gordobil

Researcher

E: [oihana.gordobil@innorenew.eu](mailto:oihana.gordobil@innorenew.eu)

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Dr Oihana Gordobil is a researcher in the Wood Modification group at InnoRenew CoE.

She completed a bachelor's degree in industrial chemical engineering and a master's degree in renewable materials engineering at the Faculty of Engineering of Gipuzkoa, University of the Basque Country. In 2018, she earned her PhD in renewable materials engineering from the University of the Basque Country.

In her research work, she focuses on lignin valorization, biorefinery processes, development and characterization of bio-based materials, bulk and surface wood treatments and exploration of new analytic techniques.



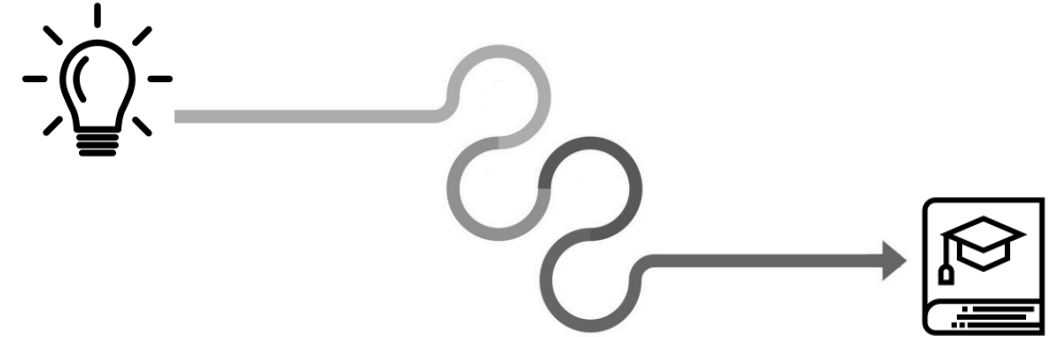


# From the background...

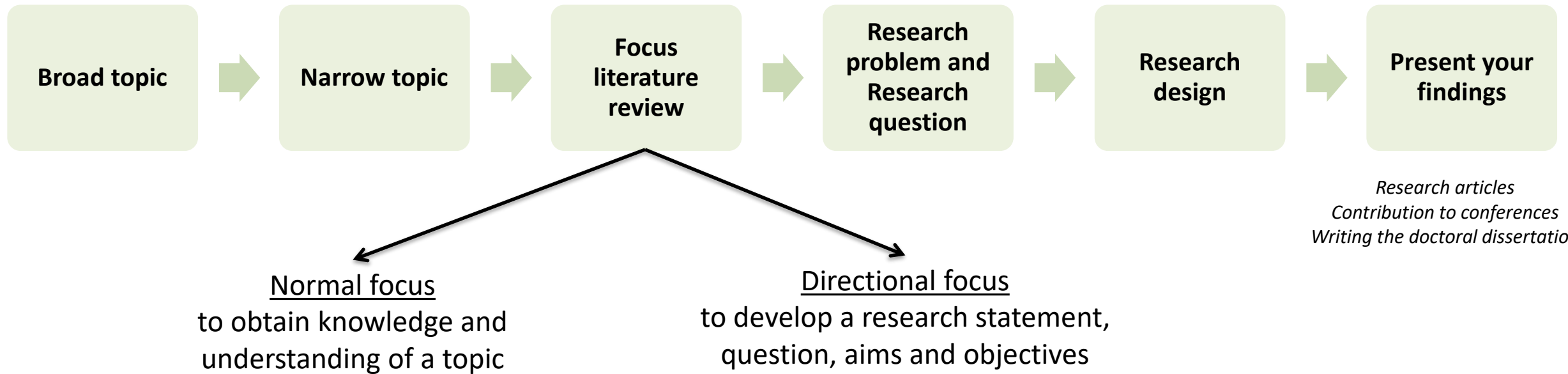
Research process

A photograph of a wooden surface with horizontal planks. In the center, the word 'Challenge' is spelled out using ten light-colored wooden blocks, each with a black letter on top.

C h a l l e n g e



# Steps of the Research process



# How to define a research problem?

## Research problem

The first step of the research (thesis, papers, proposals) → It is the **heart of the study**.  
Specific issue, concern, or gap in knowledge to be studied in the research.  
Define the quality and relevance of the research.

### 1. Identify a broad problem area

- Practical problems aimed at contributing to change
- Theoretical problems focuses on expanding knowledge

### 2. Learn more about the problem

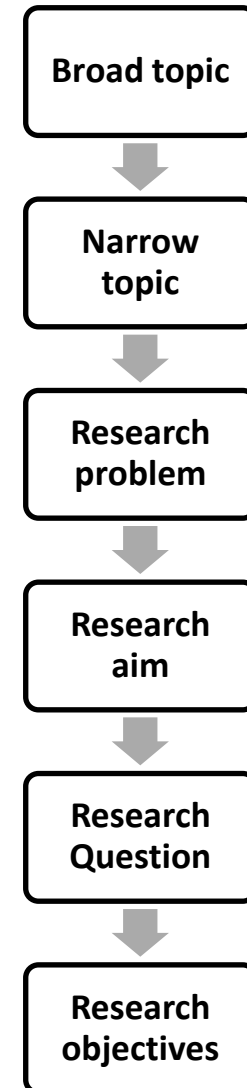
Make directional literature review to develop a research statement, questions, aims and objectives

### 3. Write problem statement (concise and concrete)

Put the problem in **context** (what do we already know?)

Describe the **precise issue** that the research will address (what do we need to know?)

Show the **relevance** of the problem (why do we need to know it?)





# Research aim, questions and objectives

## Research aim

Expresses the general intention of the research

Summarize in a single sentence what you hope to achieve at the end of a research project

## Research question

*What do you want to answer or address in the study? (What/How)*

Most important component of the research → everything is focused on answering the RQ

RQ determine objectives and research design

Good research questions: narrow, specific, clear, relevant and original

## Research objectives

Specific steps that you will take to achieve your research aim.

Your objectives should be clear and **SMART**:

**S**- Specific  
**M**-Measurable  
**A**- Achievable  
**R**-Realistic  
**T**-Time-bound

# Research design

**Definition:** the overall strategy that you choose to address the research problem and questions integrating the different components of the study in a coherent and logical way

## 1. Determine the type of data you need

- Primary vs. Secondary
- Qualitative vs. Quantitative

## 2. Decide how you will collect the data

Determine your **research methods**

- specific tools, procedures, materials and techniques you will use

## 3. Decide how you will analyze the data

**Qualitative analysis:** used to understand words, ideas, and experiences

**Quantitative analysis:** uses numbers and statistics to understand correlations and cause-and-effect relationships

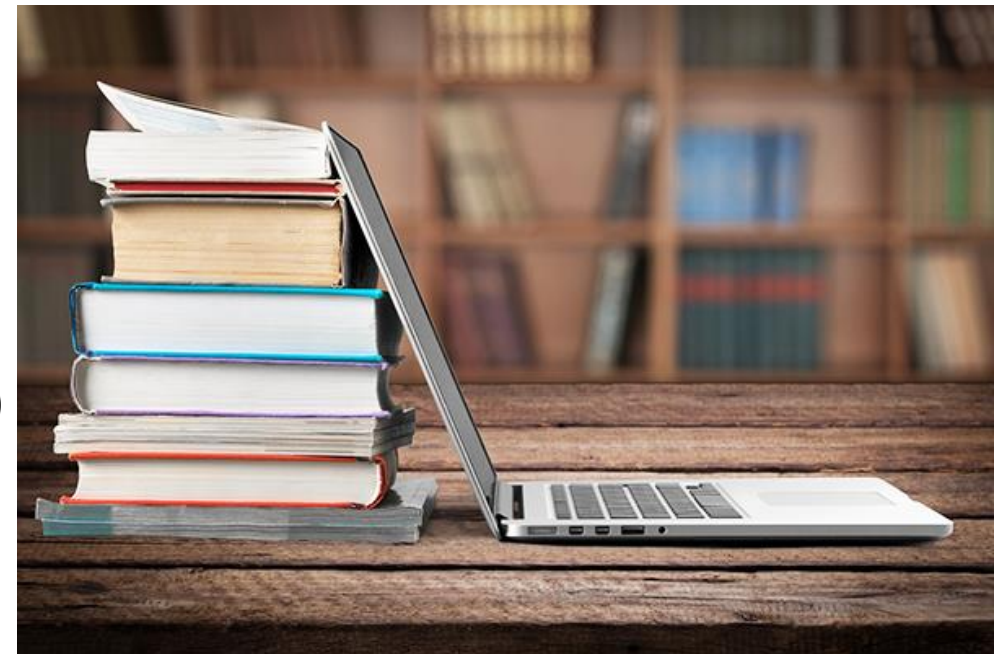
Research methods	Primary or secondary?	Qualitative or quantitative?
Surveys	Primary	Quantitative
Interviews/Focus Groups	Primary	Qualitative
Experiments	Primary	Quantitative
Observation	Primary	Either
Literature review	Secondary	Either



# WHY literature review is important?

What is already done?  
What is still missing?

- To gain a thorough understanding of the **academic work that already exists** on your topic
- To put your **work in perspective**
- To **justify the relevance and coherence** of your research
- To **identify research gaps**
- To **generate new original ideas**
- To **collect sources** (e.g. books, journal articles, list of experts in your topic)
- To **develop the research methodology**
- To provide evidence that may be used to **support your own findings**
- To **avoid duplicating results** of other researchers in your area



# Literature sources



## PRIMARY LITERATURE

- Provide first-hand information
- Include analysis of data collected in the research
- Contain detailed methodology, in-depth descriptions and discussions

➤ Peer-reviewed journal articles, dissertations, technical reports, conference proceedings, patents, letters, autobiographies, interviews, official reports, photographs, and drawings



## SECONDARY LITERATURE

- Provide second-hand information
- Summarize and synthesizes primary literature (usually broader)
- Contain extensive bibliographies, useful source for finding more information on the topic, references, etc.

➤ Literature review articles, books, articles in magazines and newspapers, databases, dictionaries, encyclopedias



<https://scholar.google.com>



<https://www.scopus.com>



<http://www.sciencedirect.com>



<https://www.researchgate.net/>



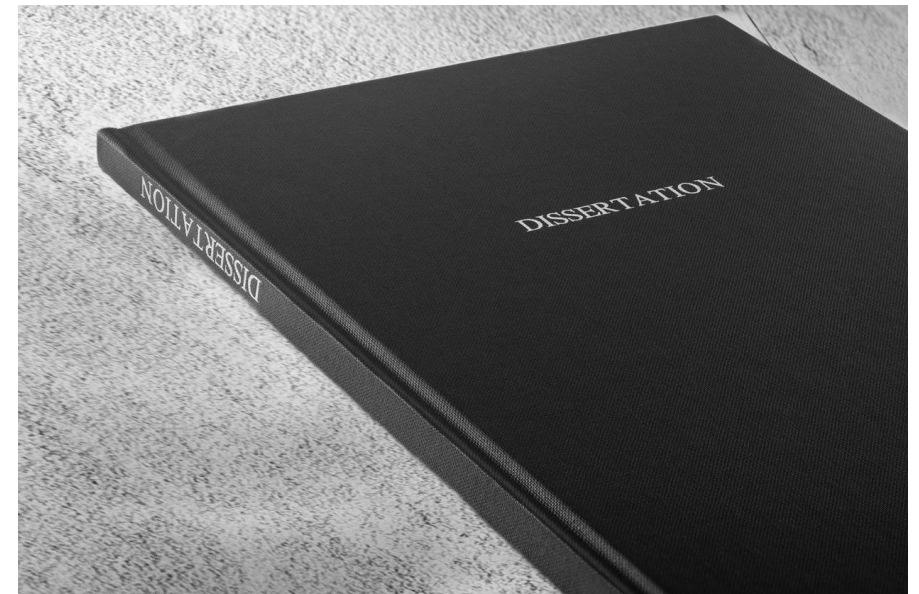
# Time to start writing...

Dissertation structure



# Writing and structuring your dissertation

- **Your dissertation will be probably the longest piece of writing you've ever done!!! (100-250 pages)**
- Think and plan carefully before writing
- Writing is not a linear process → Link your chapters
- Not underestimate the time to write (3-6 months)
- The structure is divided into at least 4-5 chapters
- Common dissertation structure includes the following sections:



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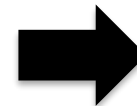
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➤ Common dissertation structure includes the following sections:



1. Title page
2. Acknowledgements
3. Abstract
4. Table of Contents
5. List of Figures and Tables
6. List of Abbreviations
7. Introduction
8. Literature review
9. Methodology
10. Results and discussion
11. Conclusions
12. Reference list
13. Appendices
14. List of publications





# Introductory part

## ➤ Title page

- The very **first page** of your document and should include:

*Dissertation's title, your name, department, institution, degree program, your supervisor's name and submission date.*

## ➤ Acknowledgements

- Usually **optional**
- Statements of appreciation or recognition of special assistance (supervisors, participants, friends and family who supported you)

## ➤ Abstract

- Short summary (300-400 words)
- Abstract should be written last.
- It **should be able to stand alone.**
- In the abstract, make sure to:

- ✓ State the main topic and aims of your research
- ✓ Describe the methods you used
- ✓ Summarize the main results
- ✓ State your conclusions



# Body of the text

## ➤ Introduction (Chapter 1)

- Explain the research topic, purpose and relevance giving necessary background
- Define the focus, scope and motivation of your research
- Clearly state the research questions and objectives
- Give an overview of your dissertation's structure (provide a brief summary of each chapter)
- **Clear and attractive!**

## ➤ Literature review (Chapter 2)

- To situate your research within existing knowledge on your topic (concepts, methodology, gaps)

## ➤ Methodology (Chapter 3)

- Describe how the research is conducted.
- The methodology chapter includes:

- ✓ The overall approach and type of research (e.g. qualitative, quantitative)
- ✓ Methods of collecting data (e.g. experiments, interviews, surveys, archives)
- ✓ Methods of analyzing data (e.g. statistical analysis)
- ✓ Tools and materials used (e.g. computer programs, lab equipment)
- ✓ An evaluation or justification of used methods

## ➤ Results (Chapter 4)

- Only report results that are relevant to your objectives and research questions
- Sometimes combined with the discussion, sometimes separated... (qualitative/quantitative research)
- Include tables and figures
- Include relevant statistics (e.g. means, standard deviations, test statistics, etc.)
- The results should be written in the past tense.

## ➤ Discussion (Chapter 5)

- Interpret and analyze your results in detail.
  - Discuss what they mean, especially in relation to your research question and aims
- ✓ what do the results mean?*  
*✓ why do the results matter?*  
*✓ what can't the results tell us?*  
*✓ what scientific studies should follow?*

## ➤ Conclusions (Chapter 6)

The conclusion is the very last part of your dissertation or thesis.

You must:

- ✓ Clearly state the answer to the main research question
- ✓ Summarise and reflect on the research
- ✓ Make recommendations for future work on the topic
- ✓ Show what new knowledge you have contributed

Use **reference management software**



<https://www.mendeley.com>

**zotero** <https://www.zotero.org/>

# Websites of interest...



<https://www.researchgate.net/>

**Academic social networking site designed to facilitate access to academic research and collaboration between researchers**

## How it works?



Share your publications, access millions more, and publish your data.



Connect and collaborate with colleagues, co-authors, and specialists.



Get stats and check who is reading and citing your work.



Ask questions, get answers, and solve research problems.



Share updates about your current project, and keep up with the latest research.



Find the right job.



InnoRenew CoE

# Of interest...



<https://www.researchgate.net/>

Academic social networking site designed to facilitate access to academic research and collaboration between researchers

Navigation: Home, Questions, Jobs

Search: Search for researchers, publications, and more

Profile: Oihana Gordobil, 25.99 · PhD · Edit

Buttons: Add new research

Tabs: Overview, Research, Experience (New), Stats, Scores, Following

About me: Introduction (Lignin valorization), Languages (Basque, English, Spanish), Disciplines (Chemical Engineering), Skills and expertise (10): Material Characterization, Antioxidant Activity, Composites, Biomass Conversion, Lignocellulosic Conversion, Lignin, Lignocellulose Degradation, Wood Chemistry, Bioactive Compounds, Biorefinery

Current affiliation: InnoRenew CoE, Location: Izola, Slovenia, Department: Wood Modification, Position: Research Associate

Stats overview: Total Research Interest (448.7), Citations (521), Recommendations (46), Reads (8,326)

Following (105): Kizkitza González, Alona Oberemko, Amaia Morales





# Websites of interest...



Connecting Research and Researchers

<https://orcid.org/>

- *ORCID provides a persistent digital identifier (ORCID iD)*
- *Get your unique ORCID iD → free and fast*
- *Connect your iD with other systems and platforms*
- *Use your iD to ensure you get recognition for all your contributions*
- *Save your time and reduce the risk of errors (grant applications)*

**ORCID**  
Connecting Research and Researchers

**FOR RESEARCHERS** FOR ORGANIZATIONS ABOUT HELP

**OIHANA GORDOBIL**

**ORCID ID**  
<https://orcid.org/0000-0002-2246-8291>

Print view

**Country**  
Spain

**Other IDs**  
Scopus Author ID: 56007901700

**Employment (1)**

InnoRenew CoE: Izola, Slovenia, SI  
2020-09 to present | Research Associate (Wood Modification)  
Employment  
Source: OIHANA GORDOBIL ★ Preferred source

**Education and qualifications (3)**

University of the Basque Country: San Sebastián, Basque Country, ES  
2014 to 2018 | PhD in Renewable Materials Engineering, (Chemical and Environmentl Department)  
Education  
Source: OIHANA GORDOBIL ★ Preferred source

University of the Basque Country: San Sebastián, Basque Country, ES  
2011 to 2012 | MSc, Renewable Materials Engineering (Chemical and Environmentl Department)  
Education  
Source: OIHANA GORDOBIL ★ Preferred source

University of the Basque Country: San Sebastián, Basque Country, ES  
2007 to 2011 | Industrial Engineering, Chemical Engineering (Chemical and Environmentl Department)  
Education  
Source: OIHANA GORDOBIL ★ Preferred source

**Works (24 of 24)**

Fast methods for the identification of suitable chemo-enzymatic treatments of Kraft lignin to obtain aromatic compounds  
Biofuels, Bioproducts and Biorefining  
2020-05-04 | journal-article  
DOI: 10.1002/bbb.2093  
Source: Crossref ★ Preferred source (of 2)

Direct lignin depolymerization process from sulfur-free black liquors  
Fuel Processing Technology  
2020 | journal-article  
DOI: 10.1016/j.fuproc.2019.106201  
EID: 2-s2.0-85071567673  
Source: OIHANA GORDOBIL via Scopus - Elsevier ★ Preferred source



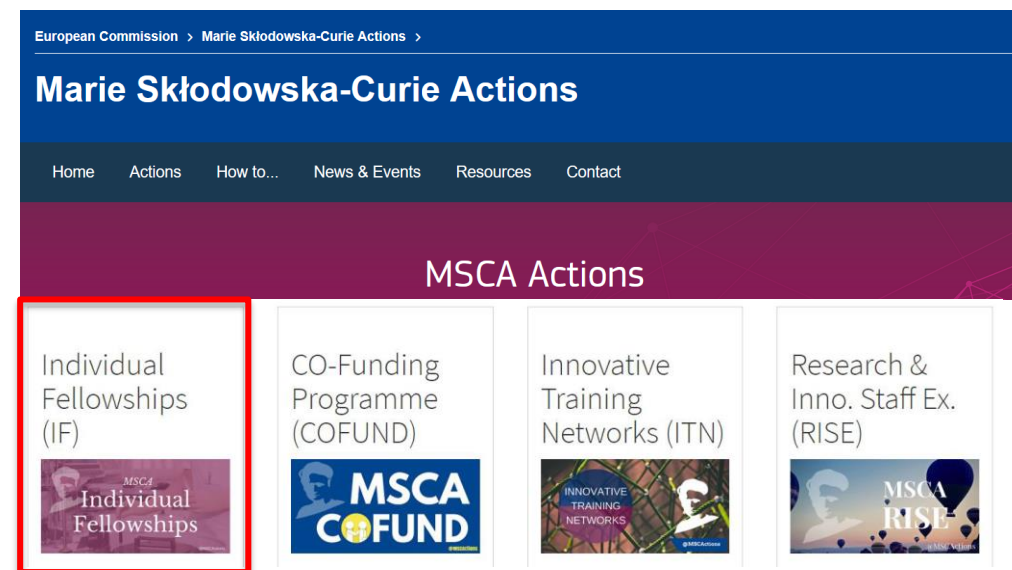
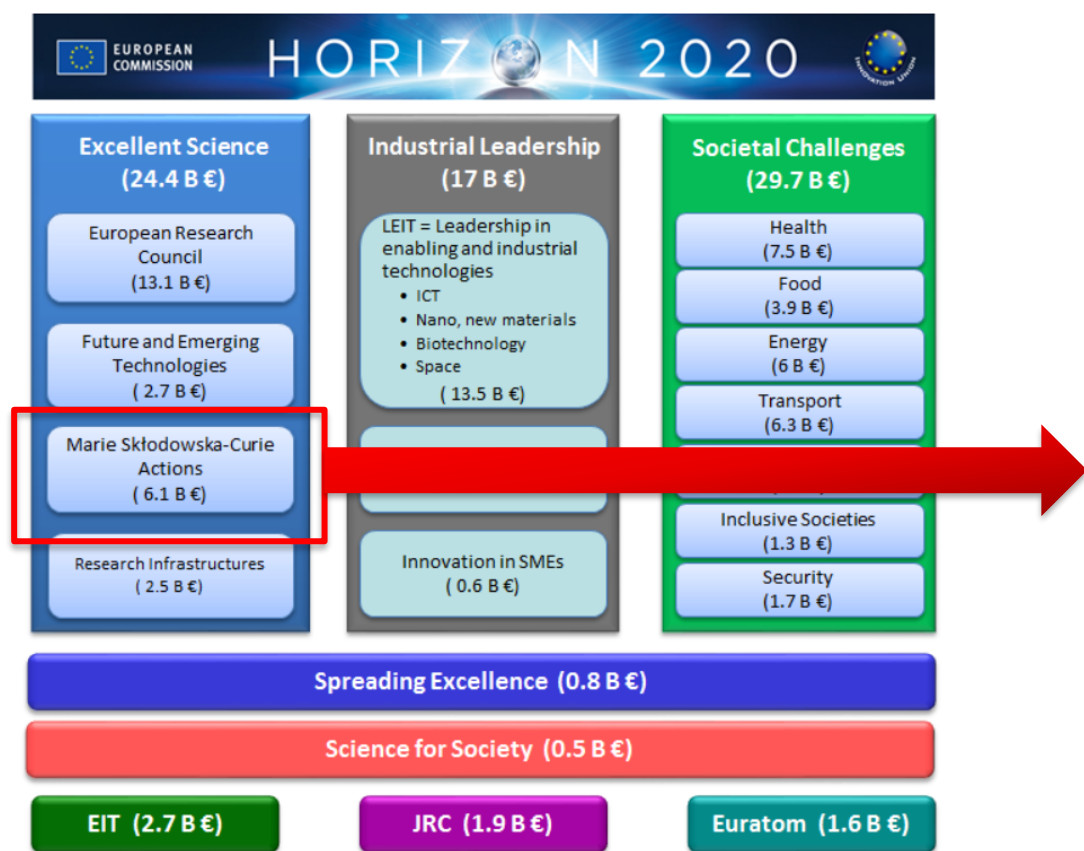
# Example of postdoctoral project proposal preparation

**MSCA Individual Fellowship (IF)**

**BIO4CARE project**

# Marie Skłodowska-Curie Actions Individual Fellowships (IF)

## Overview



2021-2027



[https://ec.europa.eu/info/horizon-europe\\_en](https://ec.europa.eu/info/horizon-europe_en)

# Marie Skłodowska-Curie Actions Individual Fellowships (IF)

## Overview

### Individual Fellowships (IF)



*Objective: The goal of the Individual Fellowships is to enhance the creative and innovative potential of experienced researchers, wishing to diversify their individual competence in terms of skill acquisition through advanced training, international and intersectoral mobility.*

- Personal postdoctoral fellowship
- Annual Call for Proposals
- Full-funded for 1 to 2 years
- Open to all nationalities
- Open to all academic disciplines
- **Career development tool**

Horizon 2020  
Work Programme 2018-2020





Based on the

# Research topic

## **Bioeconomy and sustainability: Optimal use of Renewable Materials**

Development of bio-based products/materials from renewable sources

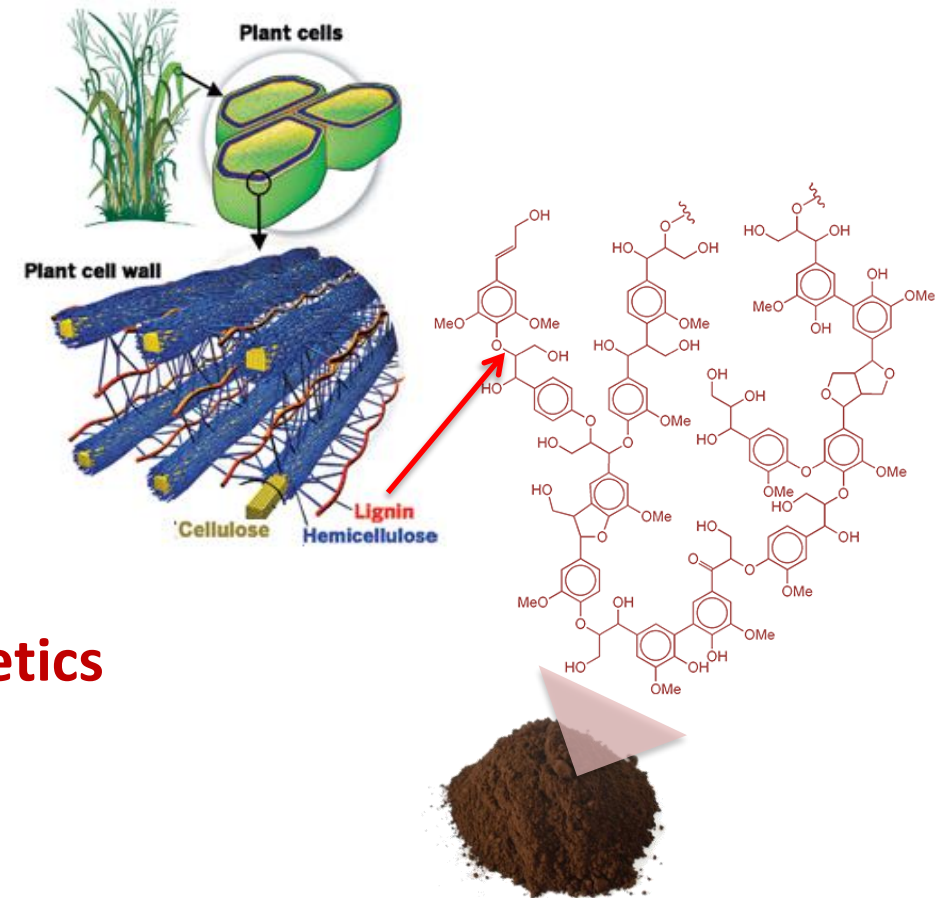
## **Lignin valorization**

Lignin conversion into a high value-added products/materials with potential to replace some of the synthetic compounds used in the cosmetic industry



## What is lignin and Why is interesting for skin care applications?

- The most abundant polyphenolic compound present in nature
- Present in lignocellulosic biomass (10-35%)
- Industrially available (**KRAFT LIGNIN**)
- Complex amorphous polymer with high chemical variability
- Aromatic polymer → UV absorbing functional groups (chromophores)
- **BROAD-SPECTRUM SUNBLOCKER**
- Antioxidant capacity → able to reduce the formation of free radicals
- Biological activity (antimicrobial, antitumoral, etc.)
- At nanoscale acts as a surfactant (emulsifier)



## Limitations of lignin for high-value application in cosmetics

1. Very complex chemical structure
2. Challenging the understanding of structure-properties relationships
3. Dark color (aesthetical disadvantage)
4. Low solubility in water
5. Low sunscreen performance (low *Sun Protection Factor*)

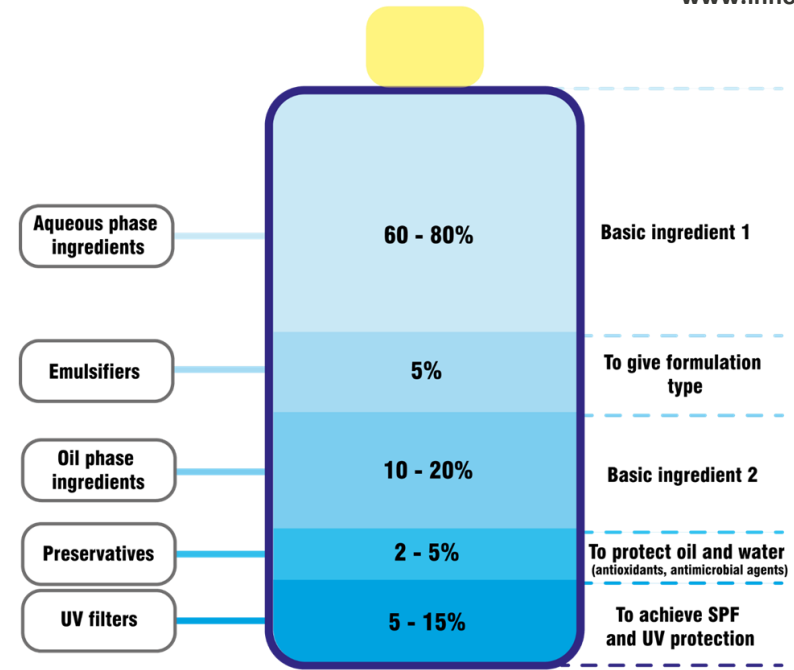
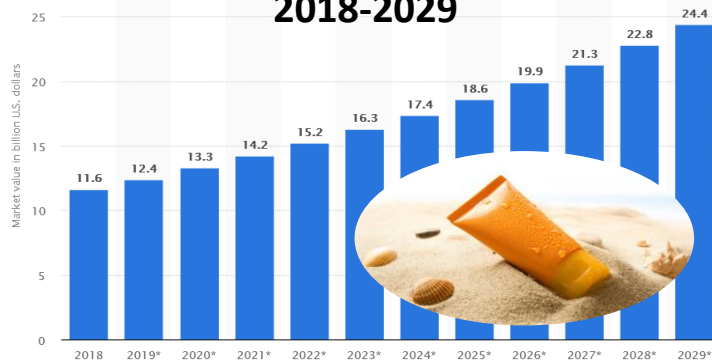
# Research Problem

## Introduction

### Cosmetics and personal care products

- Essential commodities of our life
- The personal care market is largely driven by skin care products
  - To combat age signals
  - To protect the skin against UV radiation

**Forecasted market value of sun care worldwide 2018-2029**



### Skin care products (sunscreens)

- Based on water and oil
- Chemical functional ingredients
  - Surfactants
  - Preservatives
  - Antioxidants
  - UV filters

# Research problem

## Environmental impact

### Presence in aquatic ecosystem

- **Directly** → *recreational activities*
- **Indirectly** → *wastewater treatment plants (WWTPs)*



Drinking water



Waste water



Rivers/Lakes/Sea

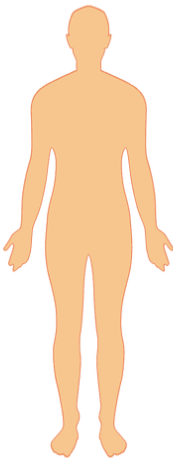


## Risks to human health

- **Percutaneous absorption**  
*Penetrate in the skin causing dermatological side-effects (allergies)*
- **Oral exposure**  
*Contaminated food and water consumption*

### Bioaccumulation/Biomagnification

- Environment (sediments)
- Living organisms
  - Aquatic biota
  - Human



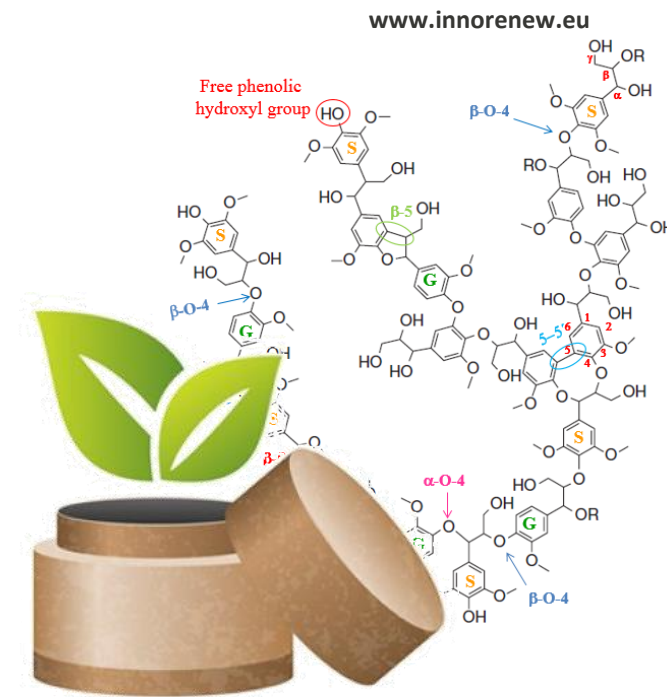
- **Bioaccumulation in fluids and tissues**  
Urine, semen, bloodstream and breast milk
- **Hormonal activity**  
Adverse effects on fecundity and reproduction in several organisms
- **Maternal transfer**  
Humans, dolphins, and birds

# Research challenge

➤ **Key challenge is to increase the sustainability of skin care formulations with innovative and safe bio-sourced alternatives.**



**Safe  
Natural  
Petrochemical-free**



# Research aim

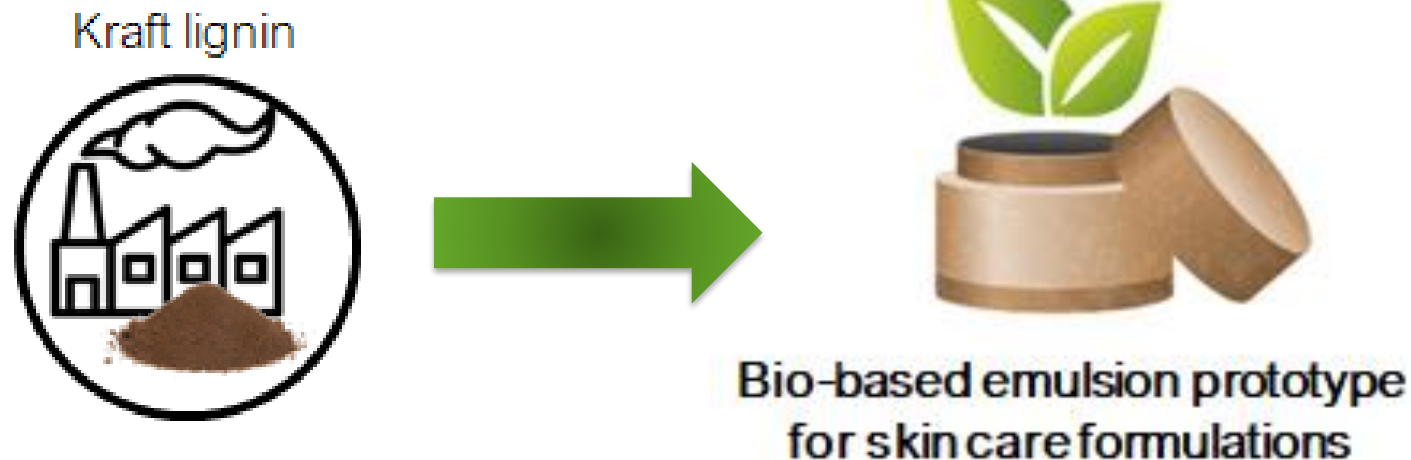
**Increase lignin performance through an efficient conversion process and evaluation as a cosmetic ingredient**

# Research questions

What is the most effective strategy to increase lignin performance?  
How effective is lignin as a multi-functional ingredient in skin care products?

# Research objective

- To develop **an innovative and efficient lignin-based multi-functional ingredient for cosmetics and health care products** able to work as a surfactant, UV filter, antioxidant and preservative by utilising the valorization of an undervalued kraft-pulping by-product.





# Research design: Methodology

## 1. Development of sustainable and high-yield LNP production process

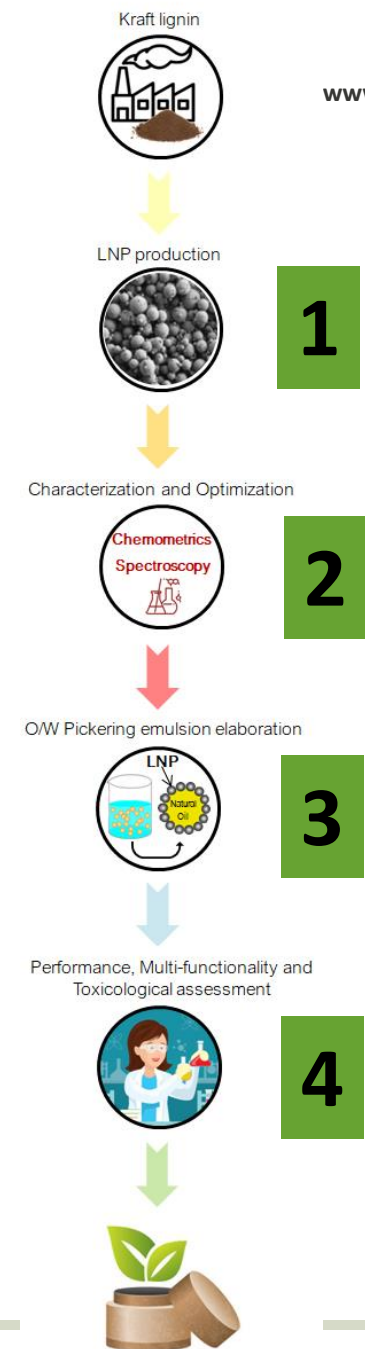
- Physical/chemical pre-treatments
- Process conditions  
(solvent type, initial concentration, solvent/antisolvent ratio, and speed of antisolvent addition).
- Intensification method: ultrasound technique

Regular morphology and size

## 2. Understanding of nanostructure-properties correlations using powerful analytical tools (infrared spectroscopy and chemometrics)

Assessment of functional properties of LNP:

- Antioxidant capacity
- Color
- UV absorbance capacity
- Photostability of elaborated LNP



# Research design: Methodology

## 3. Use of LNP for the manufacture of natural oil-in-water (O/W) Pickering emulsions

Emulsification process parameters will be studied:

- Oil type (standar and natural oils UV abs capacity)
- Bio-based oil/water ratio
- LNP conentration

***How effective are LNP for the elaboration of high-quality emulsions?***

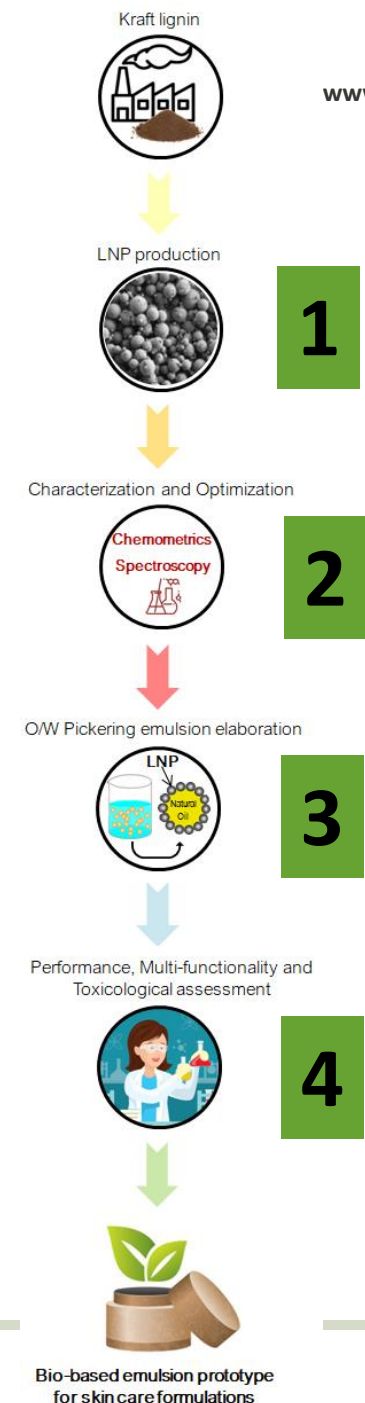
## 4. Performance, multi-functionality and toxicological assessment of LNP

*In vitro* Sun Protection Factor (SPF)

*In vitro* antimicrobial tests (antifungal and antibacterial capacity)

The synergic effect between LNP and vegetable oils

*In vitro* toxicological analysis of LNP (cytotoxicity and photo-induced toxicity)





# Data collection and analysis ongoing...



# Some tips...

- **Read, read, read**
- Organize your literature with a **systematic approach**
- **Organize** your work and workspace
- Build effective **networks**
  - Attend ing conferences, workshops, seminars...
  - Collaborate with other experts and group members
  - Apply for small research grants, even if it's "only" travel costs
- Present your research (publish research articles)
- Maintain a healthy work–life balance
- **Take care of yourself!**





InnoRenew CoE

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# Thank you for your time.