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**Robust Internal Thermal Insulation of Historic Buildings**

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**Project Acronym:** RIBuild

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**Abstract:**

This deliverable contains a draft version of the communication and exploitation plan for RIBuild. The Exploitation Plan is based on the outcome of the Exploitation Strategy Seminar held in Leuven 17 November 2017.

**Keyword list:** Communication plan, exploitation plan

# Table of Contents

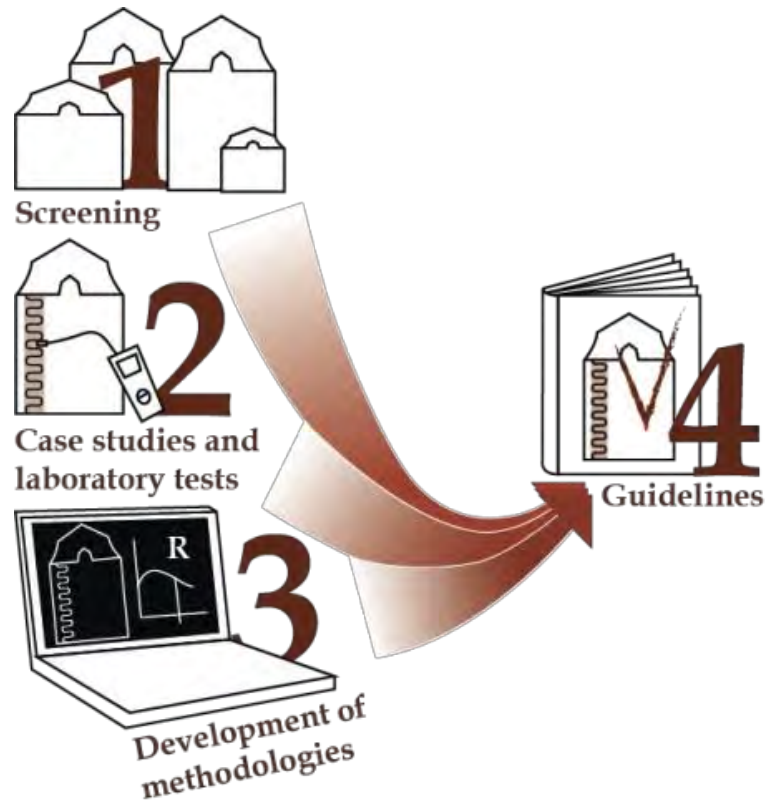
<b>ABBREVIATIONS</b> .....	<b>3</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>4</b>
<b>1 INTRODUCTION</b> .....	<b>5</b>
<b>2 COMMUNICATION PLAN – DRAFT</b> .....	<b>6</b>
2.1 BACKGROUND AND OBJECTIVES.....	6
2.2 PARTICIPANTS AND PROJECT IDENTITY .....	6
2.3 MESSAGES .....	7
2.4 TARGET AUDIENCE AND CHANNELS .....	7
2.5 ACTIVITIES.....	9
2.6 SCHEDULE FOR DELIVERABLES .....	13
2.7 RESOURCES.....	14
2.8 BUDGET .....	14
<b>3 EXPLOITATION PLAN – DRAFT</b> .....	<b>15</b>
3.1 BACKGROUND AND OBJECTIVES.....	15
3.2 KERS DISCUSSED BEFORE ESS.....	15
3.3 KER ASSESSED UNDER ESS.....	20
3.4 CHARACTERIZATION OF THE WEB TOOL .....	20
3.5 HOW TO EXPLOIT THE WEB TOOL .....	24
3.6 THE PARTNERS’ CONTRIBUTION (GROUND IDENTIFICATION).....	26
3.7 RISK ASSESSMENT .....	28
<b>4 FURTHER DEVELOPMENTS OF PLANS</b> .....	<b>31</b>

## Abbreviations

AAU	Aalborg University, Denmark
CIB	International Council for Research and Innovation in Building and Construction
D	Deliverable
DBMC	International Conference on Durability of Building Materials and Components
DTU	Technical University of Denmark
EEHB	International Conference on Energy Efficiency of Historic Buildings
EMA	Erik Møller Architects, Denmark
HES-SO	Haute Ecole Spécialisée de Suisse Occidentale (University of Applied Sciences Western Switzerland), Switzerland
IFLEX	INTRO FLEX ApS, Denmark
KER	Key Exploitable Result
LCA	Life Cycle Assessment
LCC	Life Cycle Cost
NSB	Nordic Symposium on Building Physics
PM	Person Months
RIBuild	Robust Internal Thermal Insulation of Historic Buildings
TUD	Dresden University of Technology
W	CIB Working Commission
WP	Work Package

## Executive Summary

The general objective of RIBuild is to develop effective, comprehensive decision guidelines to optimize the design and implementation of internal thermal insulation in historic buildings across the EU. RIBuild focuses on heavy external walls made of stone, brick and timber framing, as most historic buildings are made of these materials.



*Figure 1. The research activities in RIBuild*

The communication plan describes how RIBuild intend to communicate those results of the project that are relevant to public authorities, building owners, consulting engineers and other professional practitioners within the construction industry in the Member States, secondly how RIBuild intend to spread the results among international academics. The ultimate goal is to improve knowledge among practitioners about when internal insulation is an adequate measure in historic buildings and by which methods. A secondary goal of the project could be to point out new areas of research. Also it is desirable if some of the research results can be used in industrial innovation of new products and methods.

The exploitation plan identifies the most relevant key exploitable project results and describes how the key exploitable project results will be exploited, and what the intentions of each partner are with regard to the dissemination and use of the KERs. Furthermore, the exploitation plan contains a risk assessment that addresses conflicts of interest and weaknesses in the exploitation plan. The exploitation plan is developed based on an Exploitation Strategy Seminar held in Leuven 17 November 2017. It was decided to focus the exploitation plan on one KER: The web tool as this will be the most relevant KER for the practitioners. The practitioners are seen as the main target group for the outcome of the RIBuild project.

# 1 Introduction

This document describes RIBuild deliverable 7.11 ‘Communication and Exploitation plan – draft’. It is a draft version of the communication and exploitation plan for RIBuild. Final versions of the plans will be produced at the end of the RIBuild project.

Dissemination and communication is an ongoing activity in the RIBuild project. Therefore the communication plan will address this process. The exploitation plan will address how and for what purpose the key exploitable results of the project will be used by the target group of the RIBuild project.

## 2 Communication plan – draft

### 2.1 Background and objectives

RIBuild will develop guidelines for securing the robustness of internal thermal insulation of historic buildings through a pre-renovation assessment of the existing structures. Significant energy savings are expected depending on selected building practice.

It is vital to reduce the energy consumption of the European building stock as approximately 40 % of the energy consumption in Europe is attributable to housing, offices, shops and other buildings across the public and private sectors.

In many European countries, the implementation of the Directive on the Energy Performance of Buildings (EPBD) has reduced the energy consumption of new buildings within the last 10 years. However, new buildings increase the building stock by only around 1-1.5% every year, while the renovation rate is about 1.2-2 % per year<sup>1,2</sup> and considering the current rates of construction, demolition, and renovation across Europe, around 80 % of the 2030 building stock and 70 % of the 2050 building stock is already built. Today 30 % of existing buildings are historic buildings<sup>3</sup> and as they are less energy-efficient than new buildings they account for more than 30 % of the energy consumption in buildings.

RIBuild is funded by the European Union under the Work Programme EE3-2014: Energy strategies and solutions for deep renovation of historic buildings.

The objectives of WP 7, *Communication and dissemination*, is first of all to communicate those results of the project that are relevant to public authorities, building owners, consulting engineers and other professional practitioners within the construction industry in the Member States, secondly to spread the results among international academics. The ultimate goal is to improve knowledge among practitioners about when internal insulation is an adequate measure in historic buildings and by which methods. A secondary goal of the project could be to point out new areas of research. Also it is desirable if some of the research results can be used in industrial innovation of new products and methods.

### 2.2 Participants and project identity

Eight universities and two firms from seven different countries in Europe participate in RIBuild:

- Aalborg University, Denmark
- Riga Technical University, Latvia
- Katholieke Universiteit Leuven, Belgium
- Technische Universität Dresden, Germany
- Università Politecnica delle Marche, Italy
- Technical University of Denmark
- SP Technical Research Institute of Sweden
- Haute Ecole Spécialisée de Suisse Occidentale, Switzerland
- INTRO FLEX ApS, Denmark

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<sup>1</sup> Energy-efficient Buildings PPP. Multi-annual Roadmap and Longer Term Strategy. European Commission, 2010. p.9. [http://www.ecto.org/cws/params/ecto/download\\_files/36d1191v1\\_eeb\\_roadmap.pdf](http://www.ecto.org/cws/params/ecto/download_files/36d1191v1_eeb_roadmap.pdf)

<sup>2</sup> Renovate Europe Day - 11 October 2012. Stimulating growth and jobs in Europe. Report of the Conference Held at the Thon EU Hotel, Brussels, [http://www.renovate-europe.eu/uploads/RenovateEuropeDay2012\\_Report.pdf](http://www.renovate-europe.eu/uploads/RenovateEuropeDay2012_Report.pdf)

<sup>3</sup> Energy-efficient Buildings PPP. Multi-annual Roadmap and Longer Term Strategy. European Commission, 2010, p.18.

- Erik Møller Arkitekter, Denmark

WP 7 designed a logo for RIBuild. Figure 2 shows the RIBuild logo. The project name “RIBuild” is a central part of the logo, and the logo reflects, that the project concerns internal insulation of historic buildings. The logo is used together with the EU logo in all RIBuild materials.



*Figure 2. The RIBuild logo*

Moreover WP7 launched a website in April 2015 which contains the RIBuild logo, the participant logos and the EU logo. The participants' logos links to information about the participants and their contribution to the project. The participants have the possibility of leaving their mark on some parts of the website, see 2.5 *Activities*.

## **2.3 Messages**

The central message of RIBuild will reflect the European effort to save energy by renovating and energy updating historic buildings. Moreover the central messages will reflect the scientific results that are relevant to the target audience. At this point we don't know the final outcome of the scientific process, but WP7 evaluates research results as they appear in terms of relevance to practice and ensures that the central messages will be disseminated and repeated in all relevant communication channels.

## **2.4 Target audience and channels**

The primary target audience is public authorities, building owners, consulting engineers, architects and other professional practitioners within the construction industry in the Member States. The secondary target audience is international academics. A third target audience is the RIBuild participants. WP7 has established a project website to both ensure communication between the participants and inform external users about RIBuild. The communication between participants will take place at the SharePoint site: <https://sharepoint.ribuild.eu/> while the external users can find information about RIBuild on the website: [www.ribuild.eu](http://www.ribuild.eu).

The primary target audience need information about the scientific results that are relevant to their work. Preferably this information should be in their national language. Therefore this information will both be distributed in English on the website and through network partners in the seven countries that participates in RIBuild. The network partners could be national organizations, trade media and public authorities. It is important to select those network partners that the primary audience already use, when they search for information about building renovation and energy upgrading.

The network partners will receive information through the website, newsletters and at least one seminar in the beginning of the project and one seminar at the end of the project. The local RIBuild participants will help establishing and maintaining contact with networking partners in their country, see section 2.5.2, *D7.2: Map of Member States' relevant professional networks* and 2.5.3, *D7.3: Formation of network partnerships*.

The secondary target audience (the international academics) will need information of scientific value. The project is expected to result in a large amount of new knowledge of interest to at least three different groups of the international academic community:

- those who do research on building physics (heat, moisture, air tightness and thermal insulation),
- those who do research on energy efficiency of buildings,
- those who do research on refurbishment and maintenance of buildings worth of preservation.

Results of the project will be spread among all three groups by publishing in scientific journals, such as 'Journal of Building Physics', 'Energy and Buildings' and 'Journal of Architecture'. Moreover, results of the project will be presented at international scientific conferences and committees, such as 'Nordic Symposium of Building Physics' (NSB), 'Durability of Building Materials and Components' (DBMC), 'Energy Efficiency of Historic Buildings' (EEHB) and CIB W086 Building Pathology.

Table 1 shows overview of the primary and secondary audience, their interest in building renovation, energy upgrading and scientific results of RIBuild and their need for information.



**Table 1. Overview of the primary and secondary audience, their interest in building renovation, energy upgrading and scientific results of RIBuild and their need for information**

Target audience	Priority	Interest
Public authorities	1	Results that will potentially alter the national building regulations. Results that make it possible to reduce energy consumption in historic buildings without altering their original appearance.
Building owners	1	Results that make it cost efficient to reduce energy consumption in historic buildings without altering their original appearance.
Consulting engineers	1	New technical methods. Building regulations.
Architects	1	Renovating building without altering their original appearance. Building regulations.
Other professional practitioners within the construction industry	1	New practical solutions are easy to implement. Building regulations.
Researchers on building physics	2	Scientific results about building physics (heat, moisture, air tightness and thermal insulation).
Researchers on energy efficiency of buildings	2	Scientific result about energy efficiency of buildings.
Researchers on refurbishment and maintenance of buildings	2	Scientific results about refurbishment and maintenance of buildings.
Participants in RIBuild	3	Internal project communication and dissemination of the scientific results.

## 2.5 Activities

WP7 holds track of and coordinates the overall communication of the *RIBuild* project. Project communication activities will be monitored at the RIBuild SharePoint site, see <https://sharepoint.ribuild.eu/>. Furthermore, WP7 will hold track of the dissemination activities of RIBuild at the SharePoint site.

AAU is leading WP7. All the participants of *RIBuild* are involved to ensure a thorough communication of the findings of the project through their existing networks of professional practitioners and academics. The activities are divided into three main tasks and eleven deliverables (D) with a lead partner as shown in Table 2.

**Table 2. Activities and involvement of other participants**

<b>Deliverable</b>	<b>Activity and lead partner</b>	<b>Involvement of other project partners</b>
<i>Communication with professional practitioners</i>		
D7.1	Procedure for evaluating research results in terms of relevance to practice (AAU)	Project partners has received information about the procedures and has commented on the procedures
D7.2	Map of Member States' relevant professional networks (AAU)	Project partners in member states has pointed out the local network partners has ensured that they target the primary target audience.
D7.3	Formation of network partnerships (AAU)	Project partners in member states have contacted the network partners.
D7.4	Production and distribution of a number (>5) of information kits on basis of the project's results (AAU)	Project partners will ensure scientific correct information in the information kits
D7.5	A seminar at the beginning of the project (AAU)	Project partners in member states have motivated the local network partners to take part in the seminars.
D7.6	A conference at the end of the project (AAU)	Project partners in member states must motivate the local network partners and fellow researchers to take part in the conference.
<i>Spreading results among international academics</i>		
D7.7	A number (>20) of journal and conference papers (all)	Project partners must contribute with at least 20 articles that can be distributed in scientific journals and at international conferences.
<i>General project communication</i>		
D7.8	A project website with templates for reporting, project descriptions, press material etc. (AAU)	Project partners will fill in content on the part of the website that describes activities in their country
D7.9	A press release in the beginning of the project (AAU)	Project partners has ensured scientific correct information in the press releases
D7.10	A press release at the end of the project (AAU)	Project partners will ensure scientific correct information in the press releases
D7.11	A draft of a communication and exploitation plan (AAU)	Project partners will ensure the ongoing development and the execution of the plans
D7.12	A final communication and exploitation plan (AAU)	Project partners will ensure the development and execution of the plans

### **2.5.1 D7.1: Procedure for evaluating research results in terms of relevance to practice**

Some of the project's results will be relevant to public authorities, building owners, consulting engineers etc., and others will not. The procedure for evaluating research results describes how to select the results which should be given priority and how to communicate these effectively, as this vary considerably depending on the nature of the specific results. The lead of this subtask has set up procedures to ensure that all results are properly handled in this respect. The procedure is developed by internal communication professionals who are experienced in building research communication. The result of this work is documented in [D7.1 Procedure for evaluating research results](#).

### **2.5.2 D7.2: Map of Member States' relevant professional networks**

It is expected that the most effective method to communicate the project's research results goes through networks that the target audience are already used to use when searching for new knowledge on energy upgrading and building renovation. These networks are constituted by national organizations, trade media and public authorities. The mapping of these networks is documented in [D7.2 Mapping of networks](#).

### **2.5.3 D7.3: Formation of network partnerships**

Local participants have helped to establish partnerships with institutions with well-established relations to the different groups of professional practitioners, see *2.4 Target audience and channels*.

Another measure is to offer the partners relevant lectures at their seminars and conferences. Rather than developing and promoting new media and events dedicated for the project, the project connects with existing media and events arranged by local partners. The result of this work is documented in [D7.3 Formation of network partnerships](#). However, the formation of the network is an ongoing process.

### **2.5.4 D7.4: Production and distribution of a number (>5) of information kits on basis of the project's results**

The project will deliver knowledge to these networks of communication partners, who – on their side – will benefit from communicating useful results to their audiences. One of the measures for this is the production and distribution of information kits including text, illustrations, fact sheets and instructive videos. The videos could be about how to use the results from RIBuild including the web tool, see the exploitation plan, section 3.4, *Characterization of the web tool*. The information kit will be planned during summer 2018 and will be produced in the last year of the project (2019), when the results are known.

### **2.5.5 D7.5: A workshop/seminar at the beginning of the project**

A seminar was held after the first year of the project. At the seminar the project was presented and the expected implications were discussed. After the seminar a survey was conducted in order to gain knowledge about the practitioner's experiences with internal thermal insulation. The conference and the survey are documented in [D7.5 Report on first open seminar](#) and [Survey among practitioners](#).

The survey shows a need for knowledge about thermal internal insulation and how to handle the biggest challenge which concerns vapour barriers and humidity. The results of the survey will be used as input in the development of new guidelines on how to install internal thermal insulation in historic buildings while maintaining their architectural and cultural heritage.

### **2.5.6 D7.6: A conference at the end of the project**

A conference will be arranged at the end of the project. At the conference the conclusive results will be presented and discussed. Statements from possible future users of the RIBuild web tool see the exploitation plan, section 3.4, *Characterization of the web tool*, could be presented in a short video as a supplement to the statements from the researchers. The conference will preferably be held in connection to an existing, international conference with a target group that includes international academics interested in isolation of historic buildings. The target group for the RIBuild conference will be the communication partners and the international academics interested in the RIBuild subject. The planning of this conference will start summer 2018.

### **2.5.7 D7.7: A number (>20) of journal and conference papers (all)**

The project is expected to result in a large amount of new knowledge of interest to at least four different groups of the international academic community:

- Researchers interested in building physics
- Researchers interested in architecture of historic buildings
- Researchers interested in planning and energy consumption
- Researcher interested in sustainability.

Results of the project will be spread among all four groups by publishing in scientific journals, see *2.4 Target audience and channels*. RIBuild keeps track of the journals and conference papers in the RIBuild SharePoint site, WP7, see <https://sharepoint.ribuild.eu/>

### **2.5.8 D7.8: A project website with templates for reporting, project descriptions, press material etc.**

For the purpose of external as well as internal communication of the progression of the total project, RIBuild has established a project website, continuously updated with actual status of the ongoing research projects and their communication. The external website is visible to the public and is used for communication with the network of communication partners. The internal website is only visible to the project partners and is a SharePoint site for internal communication among the researchers of the project. The SharePoint site contains templates for reporting etc., project descriptions, press material etc. The SharePoint site supports the cooperation between the project partners. It is possible to work together on reports and papers in a workspace based on Microsoft SharePoint. See [D7.8 Project website](#).

### **2.5.9 D7.9 - D7.10: At least two press releases on the project**

As part of the general project communication at least two press releases will be issued: One about the start of the research project and another about the conclusive results. The press releases will be

possible to adjust for national distribution. See the first press release in [D7.9 First press release of the project](#).

### **2.5.10 D7.11: A draft of a communication and exploitation plan**

Dissemination and communication is an ongoing activity in the RIBuild project. Therefore the communication plan will address this process. The exploitation plan will address how and for what purpose the key exploitable results of the project will be used by the target group of the RIBuild project.

This is a draft version of the communication and exploitation plan for RIBuild. A final version will be produced at the end of the RIBuild project.

### **2.5.11 D7.12: A final communication and exploitation plan**

The final communication plan will address the distribution and use of the information kit developed in WP7, and the exploitation plan will address how and for what purpose the key exploitable results of the project is expected to be used by the target groups of the RIBuild project.

## **2.6 Schedule for deliverables**

**Table 3. Schedule for deliverables in WP7**

<b>Deliverable</b>	<b>Activity and lead partner</b>	<b>Time [Month: M]<sup>4</sup></b>
D7.1	Procedure for evaluating research results in terms of relevance to practice (AAU)	M6
D7.2	Map of Member States' relevant professional networks (AAU)	M6
D7.3	Formation of network partnerships (AAU)	M6
D7.4	Production and distribution of a number (>5) of information kits on basis of the project's results (AAU)	M60
D7.5	At least one workshop/seminar at the beginning and one conference at the end of the project (AAU)	M12, M60
D7.6	A number (>20) of journal and conference papers (all)	M60
D7.7	A project website with templates for reporting, project descriptions, press material etc. (AAU)	M3
D7.9	A press release in the beginning of the project (AAU)	M6
D7.10	A press release at the end of the project (AAU)	M60
D7.11	A draft of a communication and exploitation plan (AAU)	M36
D7.12	A final communication and exploitation plan (AAU)	M60

<sup>4</sup> M1 = January 2015

## 2.7 Resources

Person months (WP7, AAU): 19

Website, seminars etc., external costs: EUR 40.000

The other partners each have 3 person months for WP7 activities. These months are not included in the budget in section 2.8.

Further, the RIBuild budget includes external costs for publishing: EUR 30.000, distributed on RIBuild scientific partners from EU member states (excluding HES-SO, IFLEX and EMA).

## 2.8 Budget

**Table 4. Budget for WP7, AAU**

<b>Deliverable</b>	<b>Activity</b>	<b>Person months (AAU)</b>	<b>External cost [EUR]</b>
D7.1	Procedure for evaluating research results in terms of relevance to practice (AAU)	2	
D7.2	Map of Member States' relevant professional networks (AAU)	2	
D7.3	Formation of network partnerships (AAU)	2	
D7.4	Production and distribution of a number (>5) of information kits on basis of the project's results (AAU)	3	
D7.5	A workshop/seminar at the beginning and one conference at the end of the project (AAU)	1,5	10.000
D7.6	A conference at the end of the project (AAU)	1,5	10.000
D7.7	A number (>20) of journal and conference papers (all RIBuild partners)	1,5	30.000
D7.7	A project website with templates for reporting, project descriptions, press material etc. (AAU)	3	20.000
D7.8	At least two press releases on the project (AAU)	0,5	
D7.11	A draft of a communication and exploitation plan (AAU)	1	
D7.12	A final communication and exploitation plan (AAU)	1	

### 3 Exploitation plan – draft

#### 3.1 Background and objectives

An Exploitation Strategy Seminar (ESS) was held in Leuven 17 November 2017. All project partners except EMA were present. The ESS was a brainstorming exercise to characterize the Key Exploitable results (KERs), discuss key features and the risks and obstacles for using them. The event was organized by Sara Giordani from TTP Lab. She was appointed as ESS expert by EU. The project partners and the expert worked together and identified:

- How to characterize the key exploitable project results
- How to exploit the key exploitable project results
- Each partner’s intention with regard to the exploitation of the KERs after the RIBuild project has finished.
- A risk assessment that addresses conflicts of interest and weaknesses in the exploitation path/plan.

After the ESS, the Expert prepares a report summarizing the results of the seminar for the project partners and the European Commission and provides recommendations for the future.

#### 3.2 KERs discussed before ESS

Before the ESS several KERs were discussed within RIBuild. Table 5 shows the KERs discussed. Further description of the KER’s according to the templates delivered by the expert prior to the ESS can be found in the following subsections. It was not possible to fill in all the fields characterizing each KER beforehand, i.e. how the specific KER’s are characterized in the following will differ from KER to KER.

**Table 5. KERs discussed within RIBuild prior to the ESS**

<b>KERs discussed prior to the ESS</b>	
Producer of KER: WP2	Material characterization procedure / Needed lab measurements as input for DELPHIN
Producer of KER: WP3 and WP6	Geometry of insulated walls included in RIBuild web tool
Producer of KER: WP4	Probabilistic hygrothermal modelling methodology
Producer of KER: WP5	Probabilistic methodology for LCA and LCC of internal insulation solutions
Producer of KER: WP6	Web tool for the practitioners to estimate the thickness of internal insulation
Producer of KER: WP7	Network - database

### **3.2.1 Material characterization procedure / Needed lab measurements as input for DELPHIN (WP2)**

A description of the most decisive material properties in hygrothermal simulations with the DELPHIN simulation tool for calculation of coupled heat, air, and moisture transport in building components. Including a list of the laboratory measurements needed to determine the material properties. For each of the measurements, the KER contain a description of the measurement method, the equipment, the test conditions etc.

#### **Problem addressed by KER**

Lab measurements are being performed for a number of reasons, mainly to document that the product can be marketed e.g. in the European Union. However, for material characterization making it possible to perform advanced hygrothermal simulation a more comprehensive set of data is needed. Some of the methods are described in standards but some of these are either not described precisely enough or the method is not precise enough. A more practical approach is therefore necessary. Without these descriptions material properties may be determined in different ways, leading to different simulation results if used in DELPHIN or other simulation programs.

#### **Unique selling point**

DELPHIN is one of a number of simulation tools designed for calculation of coupled heat, air and moisture transport. However, DELPHIN is able to calculate in 1-3D, calculate moisture transport both liquid and vapour transport, Boundary conditions include temperature and RH indoor and outdoor as well as solar radiation on vertical surface and wind-driven rain density. The program needs specific material properties to be able to create material functions e.g. moisture storage function, water vapour permeability and liquid water conductivity

This KER will describe the needed measurements to be performed to become part of the DELPHIN material database, including how to prepare material samples.

#### **Market size**

The descriptions can be used for historic materials as well as new materials. Building owners (planners) could use the descriptions to ask labs for testing of specific materials. Producers will know what it takes get a full description to characterize their materials to be ready to be used in DELPHIN.

In this way, commercial laboratories, as well as universities, can benefit from the descriptions, as it will make it easier to estimate a price for testing materials.

Building owners will benefit from simulations that are more precise or from more targeting testing of material properties e.g. only choosing the most decisive tests.

#### **Public acceptance**

Hygrothermal simulations are not commonly used today, but as more user-friendly programs become more available and less time consuming due to faster computers, simulations will become more used in the future. More building owners will ask for simulations.

#### **Early adopters**

Some of the descriptions are based on routine test methods used at TU Dresden. Some RIBuild partners have upgraded their laboratory to perform the needed lab measurements for material characterization. With the precise description, it would also be possible to do round robin tests to determine how robust the methods are when using different equipment.



**Cost of implementation**

None, as the description of needed lab measurements is part of RIBuild activities.

**Time to market**

This KER consisting of lab measurements will be part of a deliverable from the RIBuild project, i.e. it is expected to be ready for the market at the end of the project.

**Product/service price**

The descriptions are free but can be used by producers and labs to estimate the price for testing materials in order to get their materials characterized, including being taken up in the DELPHIN database.

**3.2.2 Geometry of insulated walls included in RIBuild web tool (WP3 and WP6)**

A list/catalogue of the compositions of external walls, including the thickness of the different material layers within the wall, choice of insulation solutions etc. that are included in the RIBuild web tool. The list is based on knowledge of typical compositions of existing non-insulated external walls gathered in the project and a list of insulation systems available on the European market (not an exhaustive list, but covering a different kind of solutions) suited for external walls in historical buildings

**Problem addressed by the KER**

Today customers are required to get an overview of possible solutions by contacting producers of insulation systems, either by doing it himself or by hiring a consulting engineer

**Unique selling point**

This KER brings together knowledge on typical composition and properties of external walls in European historical buildings and material properties of insulation systems suited for internal insulation.

**Time to market**

After completing the list/catalogue it is ready for the market, although it needs to be updated depending on the development of new insulation systems

**External Experts to be involved**

External Experts should comment the list/catalogue before using it as basis for pre-calculations performed in RIBuild making use of the methodology developed in WP4 (see separate KER)

**3.2.3 Probabilistic hygrothermal modelling methodology (WP4)**

The result is an efficient methodology for the probabilistic assessment of hygrothermal performances of building components via numerical simulation.

**Problem addressed by the KER**

The state-of-the-art in relation to hygrothermal performance assessment is a deterministic approach, wherein fixed values for material properties, weather exposure, wall geometry etc. are assumed. Such approach does not consider the strong variability present in the real world, and hence a

probabilistic approach is to be preferred. This, however, requires a specific methodology, which is the main result aimed for.

#### **Unique selling point**

This KER allows accounting for parameter variability, while at the same time reducing the required calculation time.

#### **Market size**

The market size is limited to specialized engineering consultants and scientific researchers.

#### **Early adopters**

The early adopters of the KER will be specialized engineering consultants and scientific researchers.

#### **External Experts to be involved**

Although internal tests of the KER are made during the project, it needs to be tested by external experts during and after the project.

### **3.2.4 Probabilistic methodology for LCA and LCC of internal insulation solutions**

WP5 develops a probabilistic assessment methodology based on LCIA, LCC and CO analysis, able to take into account all the uncertainties related to the prediction of the variable involved. In particular, the impact of uncertainty on the performance, as the probabilities of benefits (reduced heat loss and energy consumption) and damages (deterioration due to mould growth, moisture damage ...) of insulating solutions calculated in previous WPs, will serve as input to the LCIA, LCC and CO analysis.

#### **Problems addressed by the KER**

They are performing calculations based on a deterministic approach, i.e. using fixed values, not taking into account uncertainties on LCA and LCC parameters

#### **Unique Selling Point**

A probabilistic approach takes into account uncertainties related to LCA and LCC parameters.

#### **Time to market**

After completing the prototype of the methodology it has to be tested in a number of cases before being ready for the market

#### **External Experts to be involved**

External Experts could test the methodology prototype making further recommendations for improvement.

### **3.2.5 Web tool for the practitioners to estimate possible internal insulation solutions (WP6)**

A web tool which can give an estimation of how many millimetres of thermal insulation the user can apply at the internal face of a chosen historic wall type with a specified risk. The web tool consists of pre-calculated cases of internally insulated solid walls in the Delphin simulation tool, using combinations of wall thicknesses and materials and insulation systems developed for internal

insulation. The solutions cover common types of external walls in historic buildings and insulation systems present in the partner countries. The system makes use of Sobol quasi-random low-discrepancy sequences. By giving some information about the direction of the wall, thickness, materials etc. to the system, the user will get a choice among different insulation systems with an estimation of the safe thickness of the thermal insulation material.

### **Problem addressed by the KER**

Today customers are reluctant using internal insulation because of the related risks (increased risk of moisture-related damage) and lack of best-practice examples. Simulation tools are too time-consuming to be relevant when to decide whether or not to apply internal insulation. The web tool will give a quick estimate on if it is possible and if yes how many millimetres insulation can you apply.

### **Unique selling point**

This KER brings together knowledge on material properties and a huge amount of weather data from all over Europe, with advanced methodologies for simulating hygrothermal performance and LCA/LCC of the chosen solution.

It will be the only system of the sort. E.g. Delphin and WUFI are two simulation tools which can do the same but with much more effort and cost.

### **Market size**

To use the database/simulation system will be free. The income to update the web tool will come from establishing a business model where manufacturers pay for becoming part of the web tool database, and by tracking users of the web tool.

### **Public acceptance**

The society wants to reduce heat loss and CO<sub>2</sub> emission. To reduce heat loss and CO<sub>2</sub> emission, when external insulation is not possible, interior insulation is often the only solution.

### **Early adopters**

Building consultants will be the early adopters. The building owner/consultant need as part of the decision making the process a quick estimate of the possibilities.

The web tool can deliver an estimate. A disclosure has to be made since systems like this cannot be legally responsible.

### **Cost of implementation**

Cost of implementation will cover testing the system, quality control and contacts with the manufacturers.

### **Time to market**

After completing the prototype of the methodology it has to be tested in a number of cases before being ready for the market.

### **Product/service prize**

The use of the system should be free of charge. The manufacturers of insulation materials can be charged a fee for having their material in the web tool database. This will be implemented after an introduction period.

### 3.2.6 Network – database (WP7)

Database consisting of the different RIBuild network partners, cf. Section 2.5.2-2.5.3; a database that e.g. could help other projects in their work with communicating research results to a target group working with or interested in historical buildings and/or renovation of existing buildings. This was not described further at this stage.

### 3.3 KER assessed under ESS

During the first part of the ESS it was decided to focus on one KER at the seminar: The web tool developed in WP6, introduced in section 0, *Web tool for the practitioners to estimate possible internal insulation solutions (WP6)*. The reason for this decision was that the partners assess the web tool as the most relevant result for the practitioners.

The web tool has the broadest target audience, and therefore the web tool will probably be one of the main topics in the information kit produced in WP7. See Section 2.5.4, D7.4: *Production and distribution of a number (>5) of information kits on a basis of the project's results*.

The other KERs are relevant to specialized engineering consultants and fellow researchers. All journal articles can be seen as KERs for fellow researchers.

Moreover the production of the web tool involves all partners in RIBuild. The web tool is based on the outcome of WP1 - WP5.

### 3.4 Characterization of the web tool

The web tool will help practitioners choose the best solution for their internal insulation project. Figure 3 describes the development of the web tool.

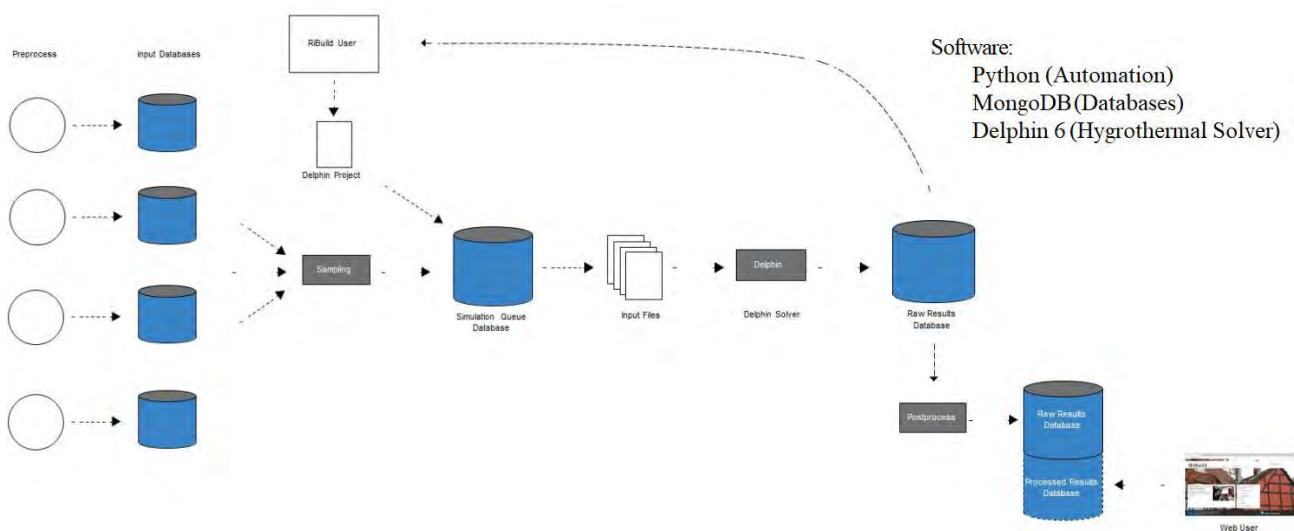


Figure 3. The development of the web tool

Table 6 describes the web tool as a KER, based on the outcome of the ESS. This description therefore is more detailed than what is found in Section 3.2.5.

**Table 6. Characterization of the web tool as a KER**

<b>Characterization of the RIBuild web tool as a KER</b>	
<b>Description of the KER</b>	<p>The web tool is expected to give an estimation of how many millimetres of thermal insulation the user can apply at the internal face of a certain historic wall type with a specified risk.</p> <p>The tool consists of pre-calculated cases of internally insulated solid walls, made in the Delphin simulation tool, using combinations of wall thicknesses, historic building materials and insulation systems developed for internal insulation. The solutions cover common types of external walls in historic buildings and insulation systems present in the partner countries.</p> <p>Based on information from the user about the orientation and thickness of the wall, type of building materials etc., the web tool will present the user for a number of applicable insulation solutions with an estimation of the safe thickness of the thermal insulation material.</p> <p>The web tool can support decision-making by evaluating the risk of internal insulation in the specific case. Further, the environmental impact of the solution, expressed by a Life Cycle Assessment of the solution, will be given.</p>
<b>Problems you are addressing and how your customers solve them so far</b>	<p>Today customers are reluctant to use internal insulation because of the related risks (increased risk of moisture related damage) and lack of best-practice examples.</p> <p>Simulation tools are too time-consuming to be relevant when deciding whether or not to apply internal insulation. The web tool will give a quick estimation of how many millimetres of thermal insulation can be applied with a certain risk.</p> <p>Implementation of internal insulation solutions is hindered by the lack of an overview of benefits and risks of such solutions. Also the perceived complexity of internal insulation solutions is a barrier: different fields of knowledge involved, a lot of time to collect and evaluate available information, not well disseminated best practices.</p> <p>The web tool provides a holistic approach to the issue, both for the practitioners and in the education of students.</p>

<b>Unique Selling Point</b>	This KER brings together knowledge on material properties and weather data from all over Europe, with advanced methodologies for simulating hygrothermal performance and LCA/LCC of the chosen solution.
<b>Product/Service Market Size</b>	Use of the web tool will be free. 3.000 users a year is expected (web hits using the web tool).  25 contributing users are expected.
<b>Market Trends/Public Acceptance</b>	The society wants to reduce heat loss and CO <sub>2</sub> emission. To achieve this internal insulation is often the only solution when external insulation is not possible.  There is a need for better understanding of benefits and risks of internal insulation.
<b>Product/Service Positioning</b>	The web tool is for specialists, consulting engineers and other professional practitioners at work. A simplified version of the tool for building owners could be considered.  The building owner/consultant needs, as part of the decision-making process, a quick estimate of the possibilities.
<b>Legal or normative or ethical requirements (need for authorisations, compliance to standards, norms, etc.)</b>	The web tool complies with relevant standards. The developers of the web tool are not legally responsible for decisions taken on the basis of the web tool outcomes; liability disclaimer in each country should be considered.  Regulations concerning the preservation of historic buildings in the different countries must be taken into account by the user.  In the future, incentives for renovation improving energy performance could be included in the web tool.
<b>Competitors/Incumbents</b>	Competitors could be those offering alternative solutions. "Blue ocean" approach as apparently there are no competitors, i.e. this KER will create the market.
<b>Early Adopters - First Customers</b>	Building consultants, architects and engineers, minor companies not having the budget for sophisticated and

	complex tools can be early adopters.
<b>Cost of implementation - bringing product/service to the “market” (before Exploitation)</b>	<p>Cost of implementation will cover testing the system, quality control and contacts with the manufacturers and users.</p> <p>The web tool should be freely available for the users, and the expenses should be covered by manufacturers of insulation systems suited for internal insulation delivering data to the web tool.</p>
<b>Time to market (from the end of the project)</b>	After completing the prototype of the methodology it has to be tested in a number of cases before being ready for the market. The tool will be ready for market one year after the RIBuild project has ended, given the level of acceptance of the targeted groups.
<b>Foreseen Product/Service Price</b>	It should be free to use the web tool. However, the manufacturers of internal insulation will have to pay a fee to keep the web tool running. The fee varies according to the number of contributing companies.
<b>Adequateness of Consortium Staff</b>	A few people with the right skills are sufficient. The Consortium Staff should be able to keep the web tool updated with new product data in order to function as described in this characterization scheme, to keep in contact with producers and users, and to manage the web tool. The consortium staff is not expected to improve the system because that will imply more research.
<b>External Experts/Partners to be involved</b>	External Experts/Partners could test the prototype making further recommendations for improvement.
<b>Status of IPR: Background (type and partner owner)</b>	The data from the manufacturers uploaded to the web tool should be protected.
<b>Status of IPR: Results/Foreground (type and partner owner)</b>	Based on the WP6 description as prepared for the H2020 application, DTU initiated the idea of a database and a web tool in January 2016, approved by all partners June 2016. No claims on the web tool.

<p><b>Status of IPR: use the results from the Exploitation Form</b></p>	<p>The set up depends on the business plan. The manufacturers of internal insulation have the rights to and responsibility for the test data uploaded to the web tool. After RIBuild is finished the rights will be given to a partner managing the web tool. It could be an external partner.</p>
<p><b>Partner/s involved expectations</b></p>	<p>The web tool could be used for professional and educational purposes. It could raise awareness of the problem and pave the road for more and definitely better renovation.</p>
<p><b>Sources of financing foreseen after the end of the project</b></p>	<p>The resources are expected to come from manufacturers of internal insulation solutions. They will have to pay a fee for having their products in the web tool database. The resources will cover managing, presenting and updating the web tool. If a manufacturer hasn't tested the hygrothermal properties of an insulation solution or if the solution has been improved, the manufacturer will have to pay for testing the insulation solution at a research institute.</p> <p>Eventually, further funding is needed for improving the web tool and the database that the tool is dependent on.</p> <p>With more research and a database with more simulations, more accurate described solutions for internal insulation of a building will be available for the users. If building owners agree to an investigation of the real hygrothermal performance of the installed solution in their building, the web tool can be improved and deliver more precise assessments. Or it could even be a requirement in national building regulations to monitor the building after renovation. Either as a stand-alone requirement or as a requirement to get public funding for the renovation.</p>

### 3.5 How to exploit the web tool

#### 3.5.1 Exploitation roadmap

The road to implementing the web tool is described in table 7.



**Table 7. Exploitation Roadmap**

<b>Exploitation Roadmap</b> (Actions to implement after the expiration of the EU grant)	
<b>Briefly describe actions planned 3-6 months after project end</b>	Find a business team to keep the web tool updated. AAU is considering the possibility of managing the web tool after the end of the RIBuild project. If AAU can't handle this responsibility, we will have to encourage a trade organization or another university to handle the task.
<b>Roles for partner involved</b>	AAU will work on a business model for getting the needed income for maintenance. The other partners is expected to contribute with ideas and comments.
<b>List milestones and monitoring parameters</b>	<p>Milestones and monitoring parameters:</p> <ul style="list-style-type: none"> <li>• Three months after completing RIBuild: A list of all needed actions and resources required for maintaining and updating the web tool.</li> <li>• One year after completing RIBuild: A fee paid by the manufactures of insulation material will be introduced. The fee will cover listing the material, marketing and web updates.</li> <li>• One year after completing RIBuild: The business plan will be re-evaluated.</li> </ul>
<b>What will be next? (what is planned after 12 months?)</b>	<p>AAU is managing the web tool or the RIBuild partners have found a responsible, external partner for managing the web tool. The users have free access to a full functioning web tool. A fee paid by the manufactures of insulation material will be introduced. The fee will cover listing the material, marketing and web updates.</p> <p>The business model will be re-evaluated.</p>
<b>What will be the impact in 3-year time? (jobs created, investments mobilized, turnover generated)</b>	9.000 hits using the tool

### 3.5.2 How to cover the cost of exploitation after the project has ended

The costs of the exploitation after the project has ended is listed in table 8.

**Table 8. Cost after the end of the project and how to cover them**

<b>Financials</b> (Cost after the end of the project and how to cover them)	
<b>Budget to implement planned activities (3 months, 6 months, 1 year)</b>	6 PM's per year
<b>Financial sources to cover budget</b>	Not yet found. The resources are expected to come from manufacturers of internal insulation solutions. They will have to pay a fee for having their products in the web tool database.
<b>Timeline for the funding</b>	1 year
<b>Projected revenues and eventual profits over the next 3-5 years?</b>	No profits

### 3.6 The partners' contribution (ground identification)

Table 9 describes the RIBuild partners' contribution to the development and exploitation of web tool, their willingness to claim rights and bring the web tool to the market after the end of the RIBuild project. Table 10 gives a status on the agreement to transfer the exploitation right to an external partner. Both table 9 and 10 is based on the table about 'ground identification' provided by Sara Giordani from TTP Lab who was appointed as ESS expert by EU.

In the original table, all project partners are supposed to be listed in a matrix in order to show the different contributions and commitment from the partners. We have simplified the table. Instead of listing all project partners in a matrix, we have mentioned the relevant project partners in the right column in table 9. This makes it possible to explain the nature of the partner's contribution and commitment. Also, we have mentioned the possibility of involving external partners in the future.

**Table 9. The partners' contribution**

<b>The partners' contribution (ground identification)</b>	
<b>Partners willing to go to the market</b> <i>Accept the share of investments &amp; risks</i>	None at the moment. However, AAU is considering the possibility of managing the web tool when RIBuild is finished. If this is not possible, the RIBuild partners will have to find an external partner that will and is capable to manage the web tool and. The external partner should be free of interests related to specific products on the market as the database included in the web tool covers many products from several manufacturers. Therefore the external partner can't be a producer of internal insulation. It could be a university or a trade organization.
<b>Porte-parole partner (not contributing)</b> <i>For coordination purpose only</i>	None. All RIBuild partners are contributing to the development of the web tool because it is developed in WP6 based on results from WP1-5.
<b>Partners providing background knowledge and their willingness to claim rights</b> <i>Only those not listed in 4</i>	All RIBuild partners are supplying background knowledge to the project and development of the web tool. TUD has the rights to the simulation tool (Delphin) used for simulating the hygrothermal performance of the internal insulation cases the web tool is based on. The partners claim rights to their research knowledge used within the RIBuild project.
<b>Partners providing results and their willingness to claim rights</b> <i>Only those not listed in 4</i>	All partners are contributing to the results that the web tool is based on. The partners claim rights to and are responsible for the research results. The partners do not claim rights to the web tool. This is transferred to the internal or external partner that will manage the web tool after the RIBuild project has ended.
<b>Nature of the partners' foreseen activities</b>	RIBuild research partners produce research that can be used for developing the web tool. They develop the web tool in collaboration with RIBuild partner EMA, an architectural company. Communication professionals at AAU disseminate the RIBuild results in collaboration with the researchers. Further, they will conduct a market research and revise the exploitation plan.
<b>Rights and obligations that are given to the internal or external partner that is willing to manage the web tool</b>	The web tool manager will be given the rights to the interface of the web tool, the database behind it and the opportunity to update the database using the Delphin simulation tool. Rights to the simulation tool as such, including further development of this stays at TUD. Further, the manager will have the obligation to keep the web tool running, to keep the database updated and to promote the web tool among relevant professional practitioners.

**Table 10. Status on agreement to transfer the exploitation right to external partners**

<b>Status on agreement to transfer the exploitation right to external partners</b>	
All RIBuild partners agree to transfer the exploitation rights to a business team	
There is still room to clarify the IP/IPR	X
At least one partner do not agree to transfer the rights (VETO)	

AAU is considering the possibility of managing the web tool after the RIBuild project has ended. If AAU is not willing to do so, the RIBuild partners will have to transfer the exploitation rights to an external business team. See table 9.

### 3.7 Risk assessment

Table 10 shows the risk assessment of implementing the web tool.

**Table 10. Risk assessment**

	<b>KER: Web tool</b>	<b>Degree of importance of the risk related to the final achievement of this Key Exploitable Result. Please rate from 1 to 10 (1 low- 10 high)</b>	<b>Probability of risk happening Please rate from 1 to 10 (1 low - 10 high)</b>	<b>Risk Grade</b>	<b>Scope and type of potential intervention</b>	<b>Feasibility/Success of Intervention Please rate from 1 to 10 (1 low- 10 high)</b>	<b>Priority Level</b>
<b>1</b>	<b>Partnership Risk Factors</b>	2	2	<b>4</b>		1	<b>4</b>
	Disagreement on ownership rules	5	3		Legal mediation of ownership disputes and patent review	1	
	Industrialization at risk: a partner declares bankruptcy.	1	1		Initiate consortium meeting to explain usage issues and redefine roadmap of exploitation	1	
	Industrialization at risk: a partner declares bankruptcy.	1	1		maintain communication with exiting expert and organise hand-over and training	1	

<b>2</b>	<b>Technological Risk Factors</b>	2	3	<b>6</b>		1	<b>6</b>
	Better technology emerges	1	1		Re-evaluation of technology and further optimisation to match/outperform new benchmark	1	
	Limited market (flow limitations)	3	5		redesign of valve configuration to enhance range of device	1	
<b>3</b>	<b>Market Risk Factors</b>	1	1	<b>1</b>		1	<b>1</b>
	Exploitation disagreement				Discuss exploitation proposals and ensure that exploitation is beneficial and in the interest of marketing the technology	1	
	Difficulty in market penetration/customer reception and acceptance of technology	1	1		Additional market studies, customer surveys and assessment of product shortfalls	1	
<b>4</b>	<b>IPR/legal Risk Factors</b>	1	1	<b>1</b>		1	<b>1</b>
	Competitors replicate technology	1	1		Stricter control in in patent usage and aggressive pursuit of legal action	1	
<b>5</b>	<b>Financial/management Risk Factors</b>	6	4	<b>24</b>		7	<b>168</b>
	Weak exploitation of the material	5	3		Market research and revision of exploitation plan	5	
	Difficulties in identifying economic actors willing to maintain the database	7	5		Dissemination to the most promising audience	9	
<b>6</b>	<b>Environmental/regulatory Risk Factors</b>	1	1	<b>1</b>		1	<b>1</b>
	Not in compliance with regulations	1	1		Assessment of legal/regulatory requirements and alteration of product to comply	1	

Figure 4 shows a priority map for risks of implementing the web tool, based on the risk assessment presented in Table 10. The financial and managerial risk is high due to the possibility of weak

exploitation of the material and difficulties in identifying economic actors willing to maintain the database. The risk will be controlled through market research, revision of exploitation plan and dissemination to the most promising audience.

All the other risks are low and will therefore be monitored, but not handled with specific actions.



Figure 4. Priority map

## 4 Further developments of plans

A final version of the communication plan and exploitation plan will be prepared at the end of the project.

At the end of the project the results from RIBuild and the information about the results will be ready to be distributed and used. The final communication plan will describe

- the background and objectives of the plan
- the partners involvement in disseminating the results
- the key messages
- the target audience
- the channels for disseminating the results
- the communication activities, e.g. the content of the information kit.

At this time we will also know if RIBuild have succeeded in making a web tool that can be exploited by the practitioners. We will also know by what reservations the web tool can be used. The final exploitation plan will describe:

- the background and objectives of the plan
- the relevant KERs from RIBuild
- the route to implementation of the KERs
- the partners contribution and activities
- the risk assessment.