Project no. SPI-CT-2008-219301-NET-HERITAGE

NET-HERITAGE

EUROPEAN NETWORK ON RESEARCH PROGRAMME APPLIED TO THE PROTECTION OF TANGIBLE CULTURAL HERITAGE

Instrument:

Deliverable 3.1

Report on common research gaps and priorities

Due date of deliverable: 31 May 2010

Actual submission date: 20 July 2010

Start date of project: 1 October 2008 Duration: 3 Years

Ministry of Cultural Heritage and Activities (Italy)

Project coordinator: Antonia Pasqua Recchia

Project co-funded by the European Commission within the Seven Framework Programme (2007- 2013)		
Dissemination Level		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

INDEX

1. INTRODUCTION

This deliverable report on task 3.1 by the Work Package 3 leader, the Ministry of Education, University and Research (MIUR) presents work undertaken as part of the ERA-NET 'European network on Research Programme applied to the Protection of Tangible Cultural Heritage - NET-HERITAGE'. Specifically, it covers the first task under Work Package 3: *the implementation of strategic activities between RTD programmes applied to the Protection of Tangible Cultural Heritage.* The report describes the aims of task 3.1 and the work achieved between January 2009 and May 2010.

1.1 Context and overview of Strategic Activity performed in Net-Heritage

Work Package 3 aims at :

- Identify the RTD priorities and topics most relevant to create sustainable approach to tangible cultural heritage protection.
- Develop joint strategies for addressing and implementing research and technological activities of strategic importance for European governments in this specific sector.
- Establish a strategic framework and partnership for RTD programmes among the Partner member states. Examine long term funding scenarios and generate recommendations for future joint activities.
- Make recommendations on possible strategic test issues for transnational exploitation.

The aims of task 3.1 as taken from the Description of Work are:

To provide an enhanced coordination framework among Partners engaged in national programmes and activities in the field of protection of tangible cultural heritage. Ongoing research will benefit from a better integration into a European Research Area (ERA) network and from a new approach leading to the convergence of long-term research strategies. To prepare this area of research for joint transnational research activities on a European scale (to be developed in WP 4 and WP 5), an important element will be to link together research programmes, particularly in regard to RTD priorities. Fostering and implement the comparing and discussion within the national research networks in the field, including national research institutions, universities, stakeholders and technology platforms, i.e. ECTP. The identification and analysis of common strategic RTD priorities will be the major output of this task. [Task Leader: MUR, Italy]

2. PROCEDURE ADOPTED FOR STRATEGIC ACTIVITY IDENTIFICATION

WP3 aims at fostering and implementing a discussion on the identification, analysis and comparison of the strategic RTD priorities with the involvement of the relevant national research networks, including:

- national research institutions [e.g. CNR, CNRS, CSIC….]
- universities [Centre of Excellence…]
- stakeholders [Conservator Associations…..]
- technology platforms [ECTP, Photoelectronic…..]

2.1. Setting up of National Consultation/Technical Panels:

In order to better identify and define the RTD priorities and topics most relevant to create sustainable approach to tangible cultural heritage protection, the Partners were invited to set up Consultation Panels including the components most relevant at national level in the field.

2.2. National Consultation/Technical Panels goals and activities

Within the period April 2009 and October 2009 the National Consultation/Technical Panels were invited to:

- Identify RTD priorities most relevant to create sustainable approach to tangible cultural heritage protection, starting from the 9 topics listed in the DoW and individuating, for each of them, any relevant subtopic. This activity includes also:
  - Research topics and subtopics description and gaps identification.
  - State of the art of the identified topics and sub-topics
  - Comparison and discussion with universities (Centre of Excellence…), national stakeholders (Regional Authorities, Conservator Associations) and technology platforms (ECTP, Photoelectronic…..)

The National Consultation/Technical Panels were asked by 15 June 2009 to:

- If necessary, add new topics within the umbrella of protection of tangible cultural heritage with a maximum of three sub-topics.
- Add sub-topics to the existing topics if deemed essential.
- Send back to MIUR your comments by 15 June using the enclosed excel file.

MIUR gathered all Partners comments and suggestions, updated accordingly the research topics and subtopics table and sent the final table of topics and subtopics for Partners evaluation on 15 July 2009.
The Partners were asked to:

- For each sub topic identify a rate between 1 (low) to 5 (maximum) for the following categories: needs, strengths and scientific priorities, *which are defined as follows:*
  - *Needs : recognized gap in knowledge for the protection of tangible cultural heritage*
  - *Strengths : capacity to perform research in the specific sub topic*
  - *Scientific priorities : importance in terms of research need*

- Send to MIUR the table with scores by September 30th.

The Criteria to identify common RTD strategies decided in the 6th month Meeting in Berlin were:

The identification of common RTD strategies will be conducted on sub-topics with scores from 4 to 5.

LIST of TOPIC SUBTOPIC EVALUATED

TOPIC 1	TOPIC 2	TOPIC 3	TOPIC 4
Environmental assessment and monitoring (pollution, climate change, seismic risk)	**Investigation of damage mechanisms to establish preventive conservation strategies**	**Measurement instruments of practical relevance for end-users**	**Innovation on materials and technologies for conservation and maintenance**
1.1 Critical levels of synergic pollutants in a context of environmental condition (indoor/outdoor).	2.1 Multidisciplinary approach on the synergic interactions between environment and materials.	3.1 Portable instruments for in situ measurements.	4.1 Development of new and appropriate materials and technologies for the upgrading or the construction of conservation buildings/rooms.
1.2 Preventive approach against extreme natural events (seismic events, flooding, storms, landslides, fire), and first aid measures.	2.2 Interactions between specific environmental factors (temperature, humidity, …) and complex artifacts made by different materials.	3.2 Non invasive instruments and methodologies for diagnosis and monitoring.	4.2 Development or improvement of products for restoration and conservation with low impact on the historical content of artifacts.
1.3 Impact of climate change on materials and structures and adaptation of technologies to mitigate the negative effects.	2.3 Best conservation practices against specific attacks (physical, chemical, biological, ..) to prevent damage on specific materials.	3.3 Intelligent multi-sensor systems for early warning (modeling, local network for monitoring systems), including telediagnosis.	4.3 Identification and assessment procedures to evaluate the fitness for use of new and goal oriented products to define common guidelines and pre-standards.
1.4 Changes in hydrogeological conditions in the ground : technologies for stabilising the historic structures.	2.4 Damage mitigation - to include salvage, recovery, recycling and reuse of materials.	3.4 Re-engineering of instruments and techniques to simplify and to adapt their use.	

TOPIC 5	TOPIC 6	TOPIC 7	TOPIC 8
Evaluation of treatments and materials used in conservation at present and over recent decades, assessing their suitability and future consequences	**Alteration and conservation of materials with special focus on modern materials used in Contemporary Art and Architecture and also as cultural information storage (CDs, DVDs, etc)**	**Anthropic pressure evaluation and management**	**Security technologies and systems in museums, libraries, archives and for the movement of artefacts**
5.1 New solutions for development, assessment and reporting of analysis protocol for the time effects evaluation of treatments (e.g. cleaning, biocides…) and materials.	6.1 Development of strategies and procedures for storage and preservation of multi media supports and readability of the stored content.	7.1 Development of management systems on quality and sustainability of indoor/outdoor cultural heritage environments.	8.1 Development of sensors and devices for a safe handling, movement, transport and exhibition of artefacts and related guidelines.
5.2 Innovative solutions for compatibility, durability and reversibility of new materials and treatments.	6.2 Innovative proposals for conservation and durability of contemporary art materials (i. e. plastics, ceramics, new alloys, glasses, new dyes, concrete, mortars)	7.2 Development, testing and validation of mobility models to reduce environmental impacts to unmovable cultural heritage (emission, vibration..).	8.2 Development of integrated systems for effective prevention, detection and reaction to risk situations at different scale (e.g. fire, theft, vandal attacks, etc).
5.3 Modelling and simulation for predictive evaluation and validation of materials and treatments.		7.3 Development of scientific criteria and tools to measure and regulate tourist impact on cultural heritage sites.	8.3 Development of techniques to support the identification of fakes or stolen artefacts with special reference to the insurance issues
5.4 Impact of modern finishing materials and techniques on historic structures.			8.4. Techniques for inventory, cataloguing and traceability of cultural heritage objects.

TOPIC 9	TOPIC 10	TOPIC 11
Tele-survey and Geographic Information System for protection and management of tangible cultural heritage	**Contemporary cultural heritage in spatial contexts**	**Prenormative studies for the guaranteed protection and management of tangible cultural heritage**
9.1 Web mapping and Web GIS innovative tools for the tele-monitoring and remote control of the archaeological sites and cultural landscapes.	10.1 Preservation of industrial heritage: objects, buildings and landscape.	11.1 Development of Quality Management Systems (planning, implementation, assessment, reporting and quality improvement) addressed to the process of conservation of cultural heritage.
9.2 Development of innovative and aesthetically acceptable devices for the tele-survey of movable artefacts.	10.2. Preservation of 20th century military heritage: objects, buildings and landscapes.	11.2 Prenormative activities goal-oriented to improve the reproducibility and repeatability of testing results.
9.3 Development of advanced systems for the tele-survey and remote fruition of underwater cultural heritage.		

3- TOPICS DESCRIPTIONS AND EVALUATION OF NEEDS, STRENGTHS AND SCIENTIFIC PRIORITIES

Topic 1

Environmental assessment and monitoring (pollution, climate change, seismic risk)

Environmental conditions associated to air pollution are responsible for damage to building materials. Soiling, corrosion and biodeterioration are a consequence of climate, microclimate, deposition and accumulation of particulate matter. The current scenarios of multi-pollutant trends in Europe and the world indicate that the effects of industrial, civil and transport emissions will constitute a serious threat of weathering on artworks. Given this prospect, there is an urgent need for more accurate damage assessment, and improved techniques for the diagnosis and monitoring of the state of conservation of the movable and immovable cultural heritage affected by changing environmental conditions. Thus, different critical levels must be identified regarding synergic environmental indoor/outdoor pollutants, which are changing in comparison with the past, in terms of types and concentrations in the air. The impact of climate change will vary according to different materials and structures, and technologies must be adapted and improved to mitigate its negative effects. Moreover, changes in the composition of the atmosphere related to climate change seem to furnish a more suitable habitat for the life of microorganisms, modifying the impact of surface alterations.

In the perspective of such global change, extreme natural events (seismic events, flooding, storms, landslides, fires, etc.) show a variation in frequency and strength, imposing the need for a preventive approach against extreme events in order to establish appropriate measures of emergency aid.

Climate change also influences the hydrogeological conditions in the ground. New approaches for the monitoring and control of such conditions are necessary, as well as new technologies for stabilising historic structures threatened by ground changes.

The research gaps of this topic are the following:

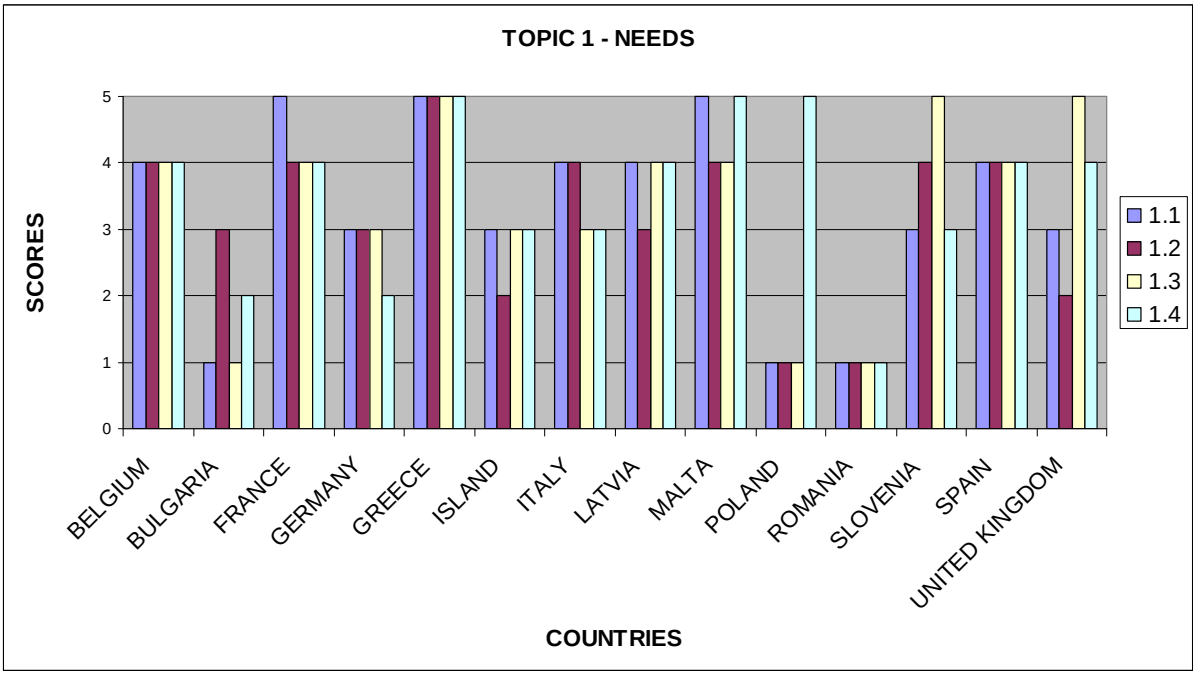
1.1 Critical levels of synergic pollutants in a context of environmental conditions (indoor/outdoor).

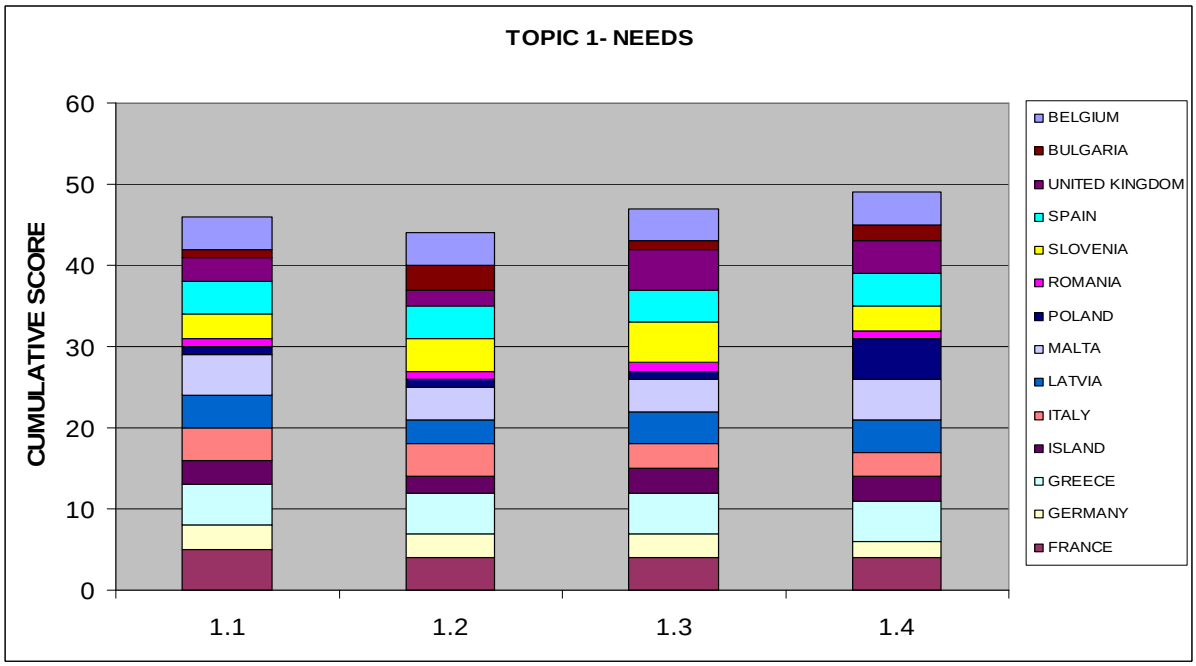
1.2 Preventive approach against extreme natural events (seismic events, flooding, storms, landslides, fire), and emergency aid measures.

1.3 Impact of climate change on materials and structures and adaptation of technologies to mitigate negative effects.

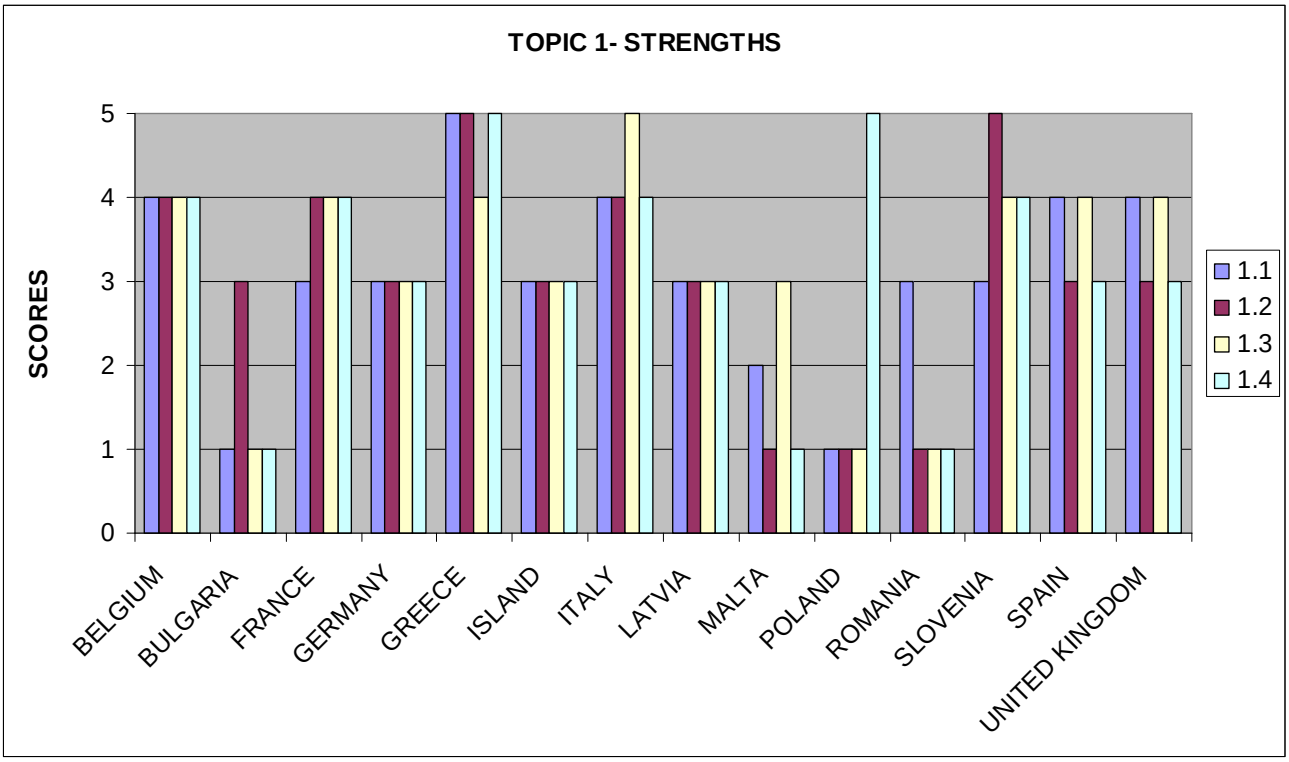
1.4 Changes in hydrogeological conditions in the ground: technologies for stabilising historic structures.

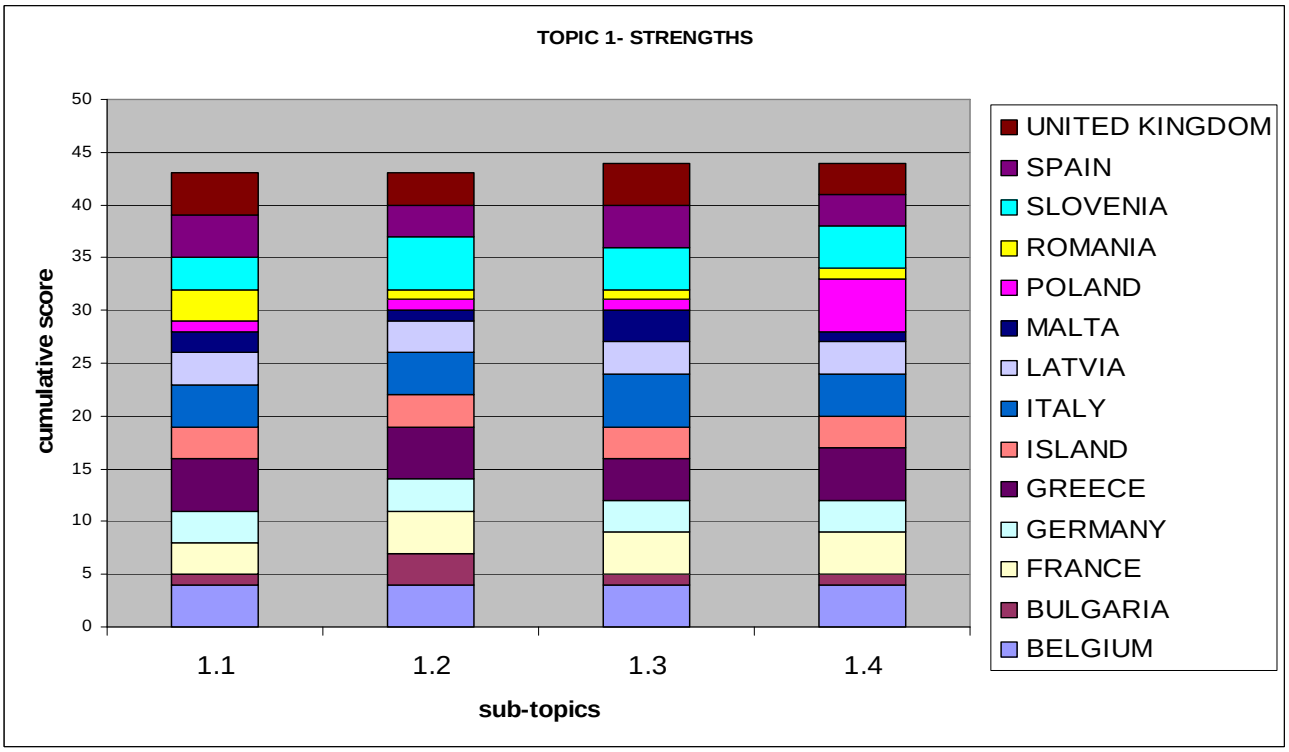
TOPIC 1: NEEDS



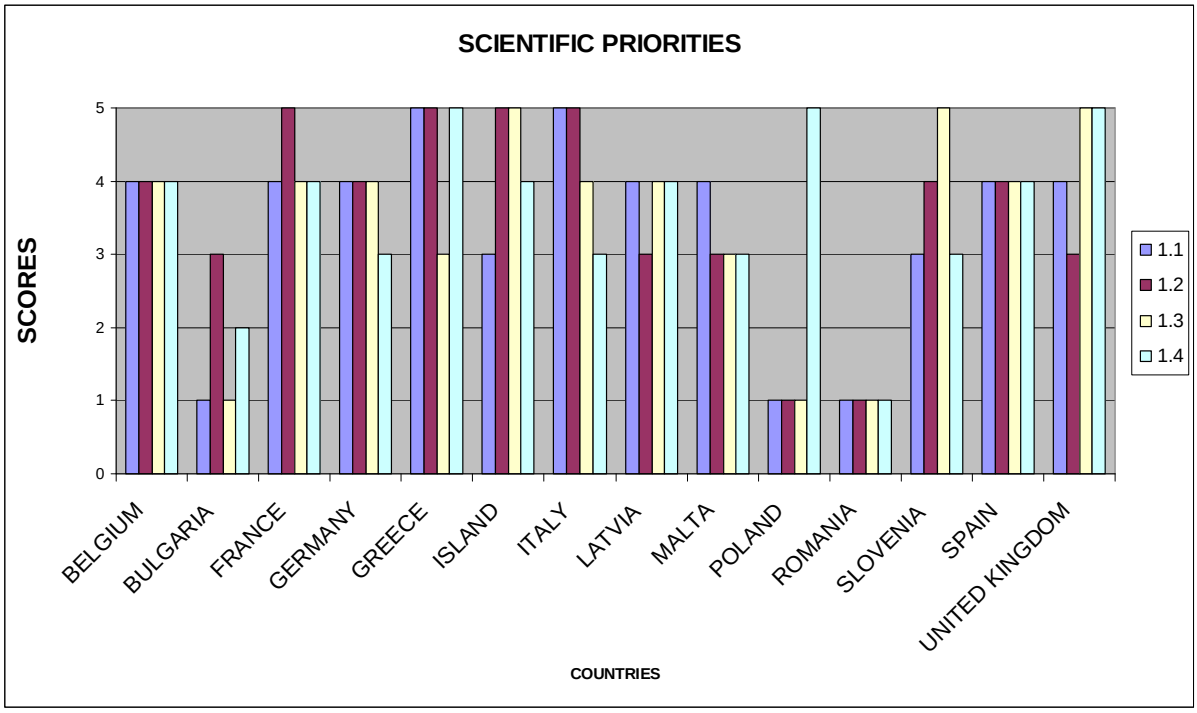


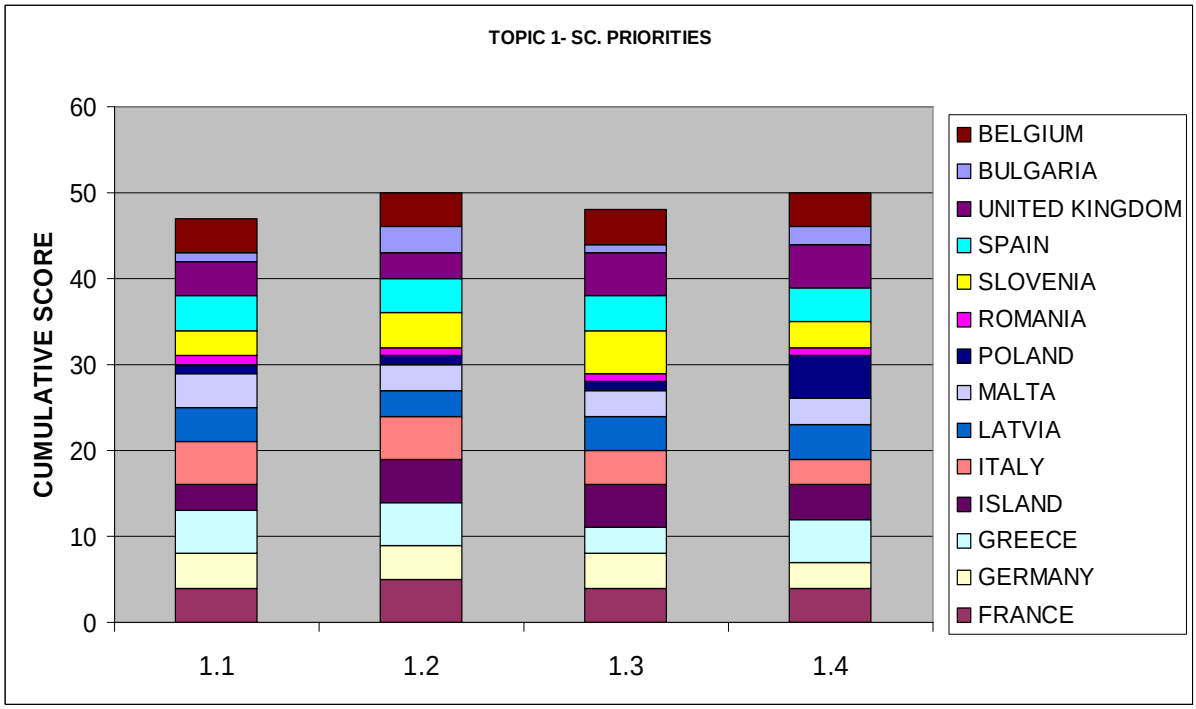
TOPIC 1 : STRENGTHS





TOPIC 1 : SCIENTIFIC PRIORITIES





Topic 2

Investigation of damage mechanisms to establish preventive conservation strategies

The causes of deterioration of artworks, both indoor and outdoor, are manifold, and very often the damage mechanism changes depending on the presence of particular environmental factors. For instance, gaseous pollutants, such as sulphur dioxide, can attack calcareous artefacts to a greater or lesser extent, depending on the degree of relative humidity, being less active in dry environments. Moreover, synergic effects have been described, in which the action of a single pollutant is amplified by other factors: typical examples are light and certain pollutants. The issue is important because, although recommendations exist concerning the total luminous exposure of light sensitive artefacts, the allowed limits are valid if only light is present, while they may have to be reduced when dealing with a complex environmental situation. Despite its crucial importance, to date few studies have tackled this topic. In addition, climate changes alter the distribution and amount of different damage factors, and therefore new reaction paths, which could lead to unforeseen deterioration results, have to be expected. It is quite clear that a good knowledge of the mechanisms by which the environmental factors overall affect artefacts is an essential prerequisite for the best conservation practice.

The research gaps of this topic are the following:

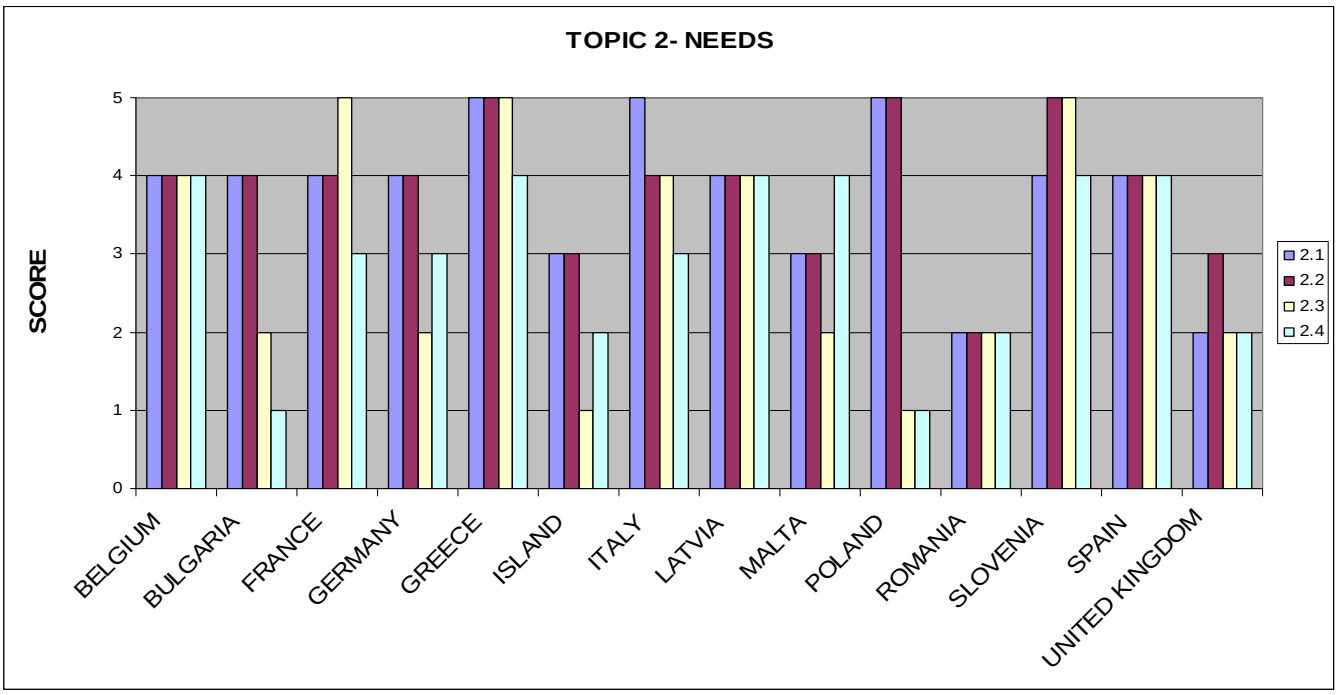
2.1 Multidisciplinary approach to synergic interactions between environment and materials.

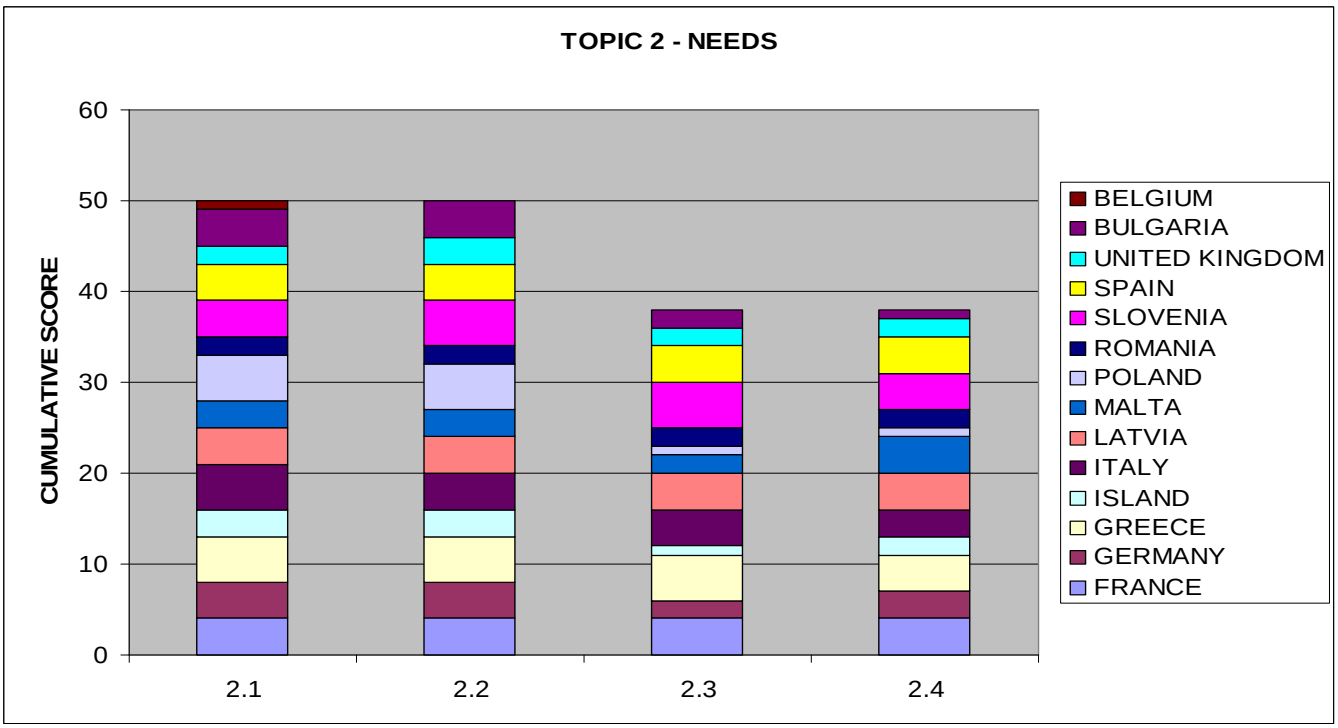
2.2 Interactions between specific environmental factors (temperature, humidity, etc.) and complex artefacts made in different materials.

2.3 Best conservation practices against specific attacks (physical, chemical, biological, etc.) to prevent damage on specific materials.

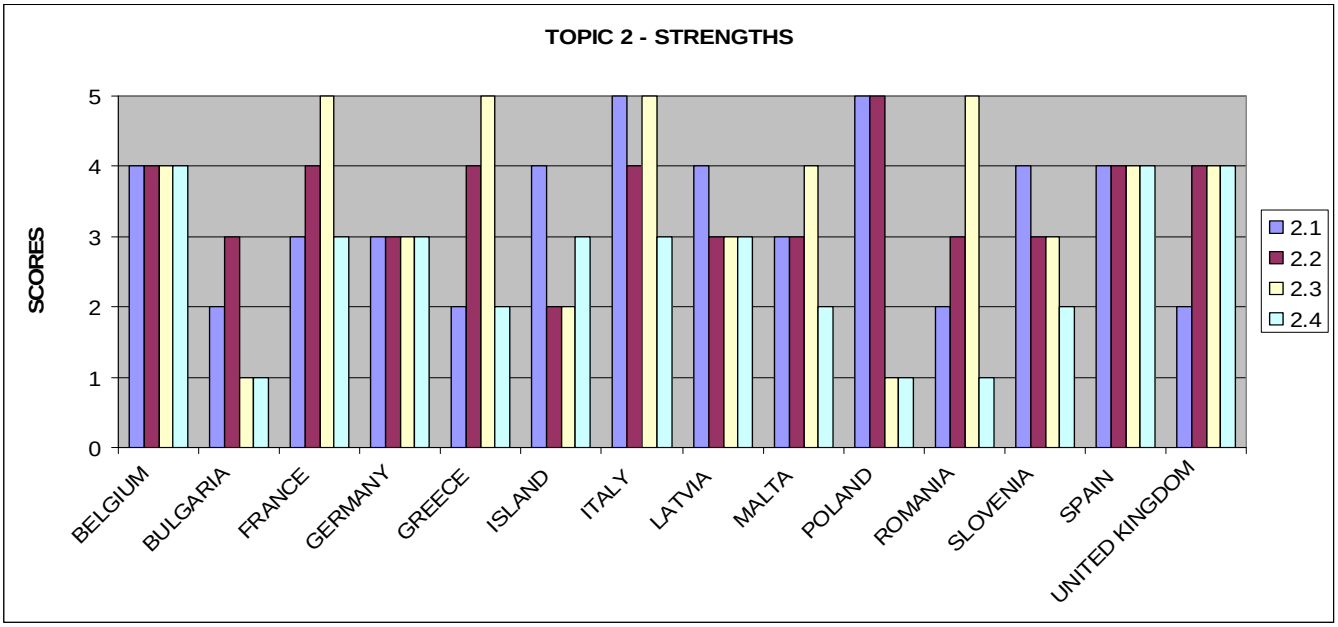
2.4 Damage mitigation – including the salvage, recovery, recycling and reuse of materials.

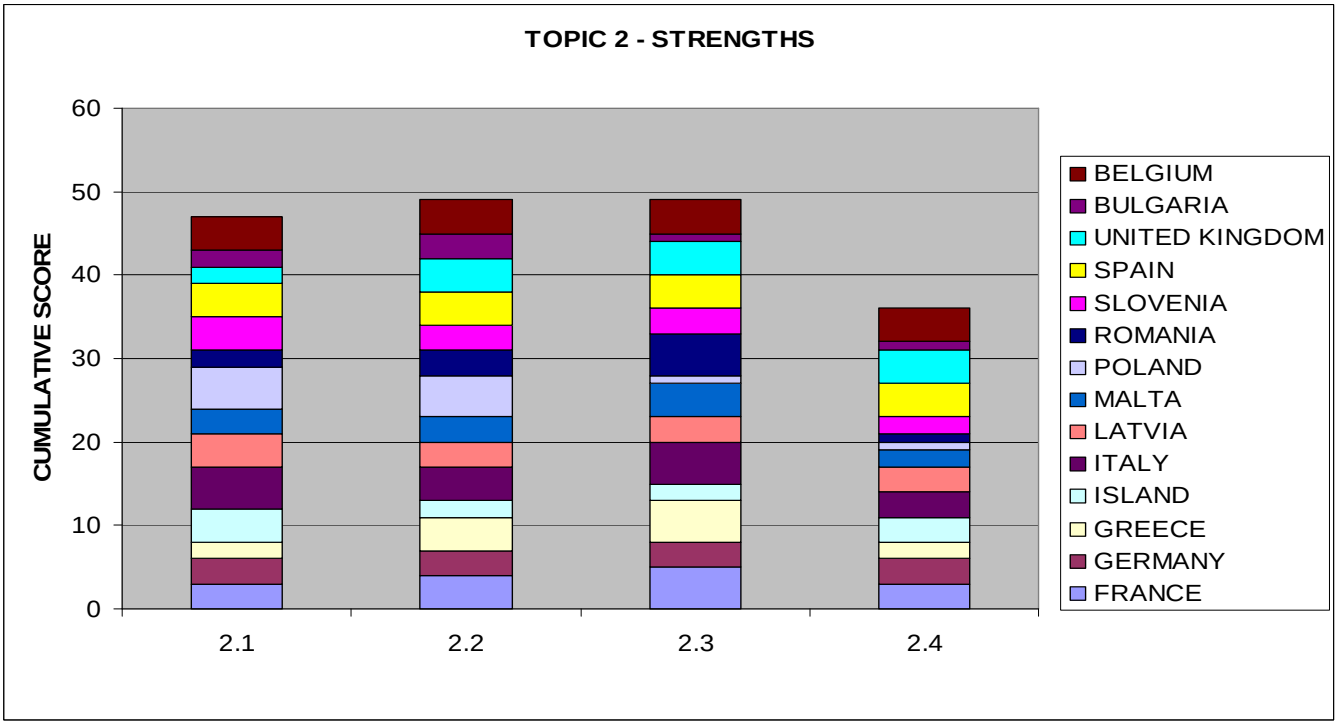
TOPIC 2: NEEDS



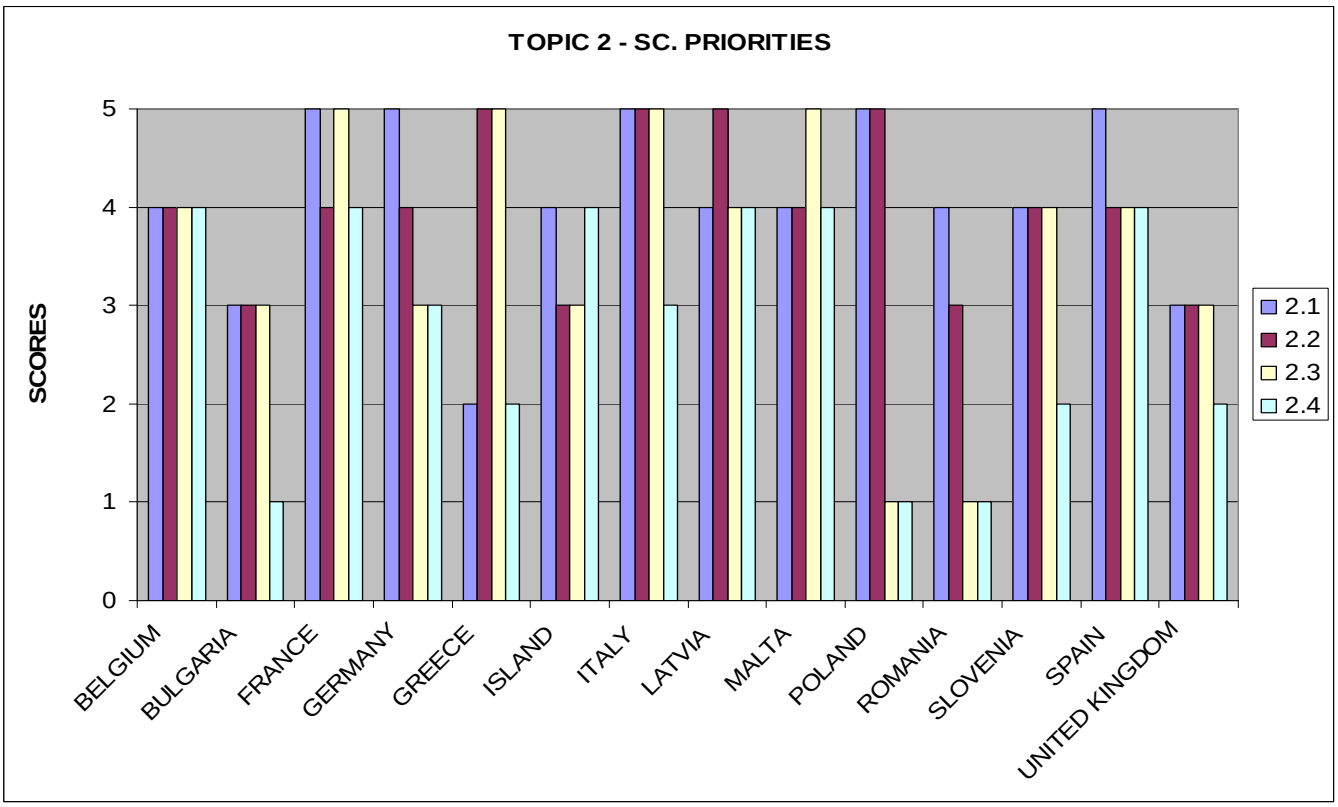


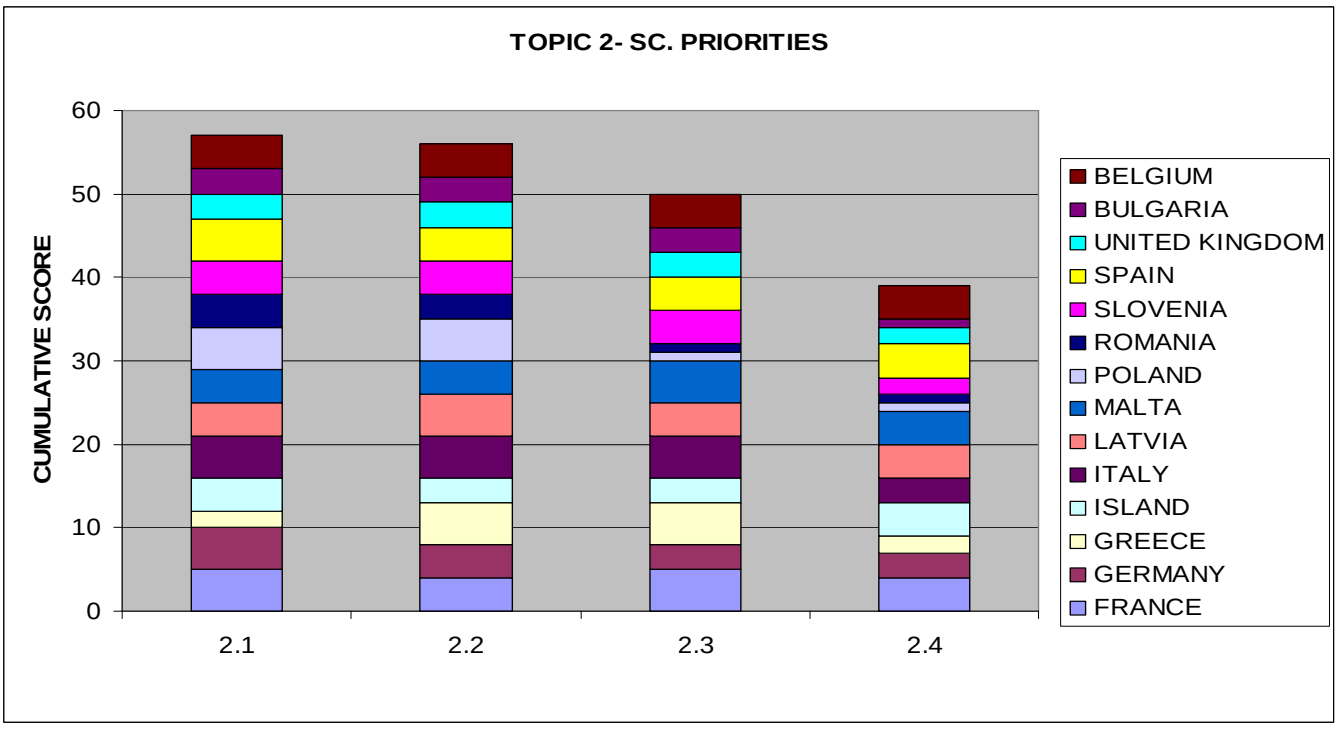
TOPIC 2: STRENGTHS





TOPIC 2: SCIENTIFIC PRIORITIES





Topic 3

Measurement instruments of practical relevance for end-users

Nowadays scientific laboratories are equipped with powerful analytical instrumentation that can supply accurate information concerning the constituent materials and state of conservation of artworks. However, two main drawbacks are related to the usual instrumentation available on the market. The first concerns the non invasiveness of measurements. Ethical reasons impose that the artworks remain unaltered when investigated. Modern techniques make it possible to perform analyses on very small samples to avoid damaging the object under study, but since the sampling is necessarily limited, the results cannot be extended to the whole object. Recently non invasive techniques for diagnostics and data collection have increased rapidly, but very often the single technique is not self-sufficient, requiring integration with other possibly non invasive techniques. For example, with regard to the change in atmospheric pollutants detected over the recent period, the non invasive detection and identification of organic materials is particularly challenging, and much work is required to monitor the changing trends of surface weathering. The second drawback concerns with the transportability of instrumentation. In fact, for intrinsic reasons (large artworks, monuments, frescoes, and so on) or safety reasons, many artefacts cannot be moved to a research laboratory, so transportable instruments are necessary. Indeed, many portable devices are now available, but their miniaturization does not always guarantee good sensitivity and accuracy. In this context, the field of telediagnosis of artworks, in a similar fashion to telemedicine, could assure a safe and powerful tool for monitoring the preservation state of artefacts. Of course, it is important to monitor not only the objects themselves, but also the environment where they are located. Accordingly, there is need for aesthetically acceptable multi-sensor systems, which are capable of integrating most environmental parameters and of raising the alert for possible risk situations. In this field, too, a great deal of work is still required, to guarantee a good, safe transmission of data and sufficient accuracy. Currently, it is thought that most of the suggested improvements could be attained by re-adapting instruments and techniques already in use in other fields, such as biomedicine.

The research gaps of this topic are the following:

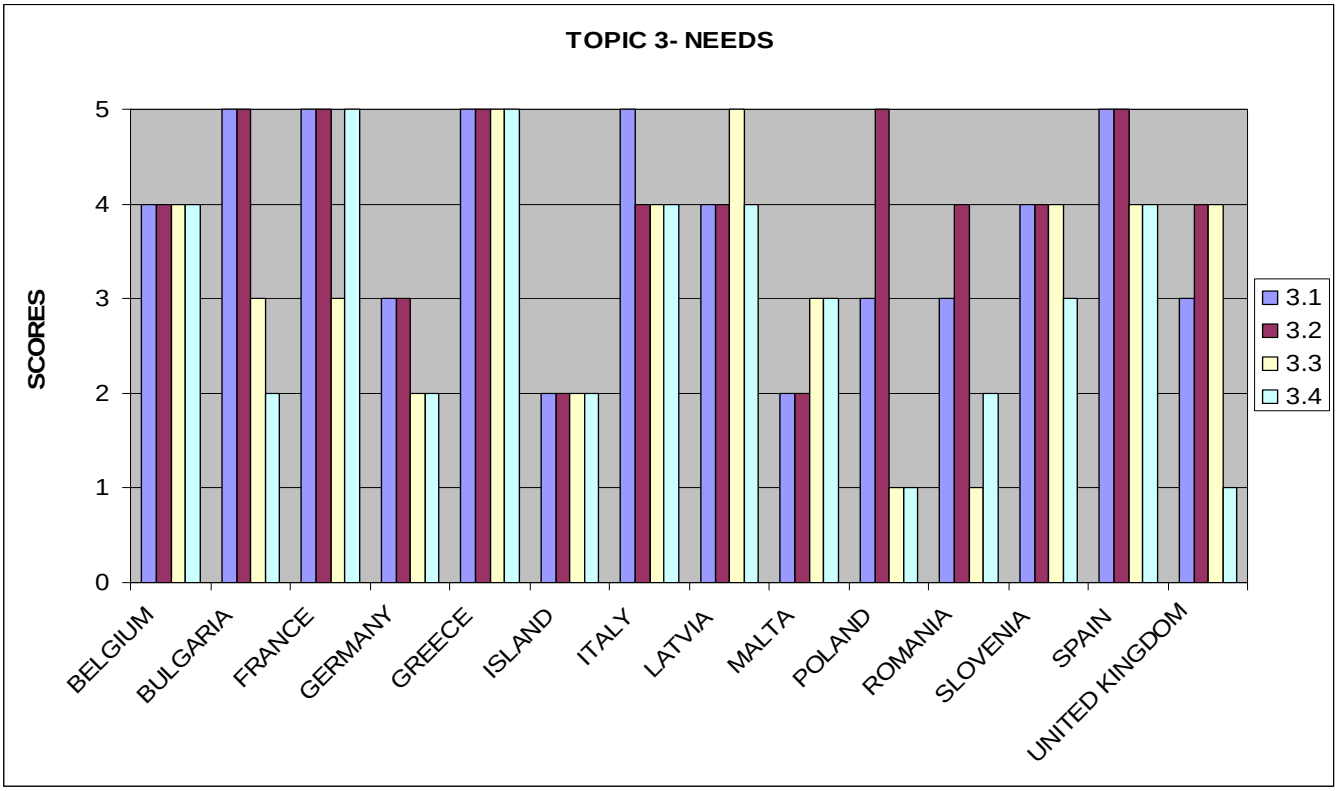
3.1 Portable instruments for in situ measurements.

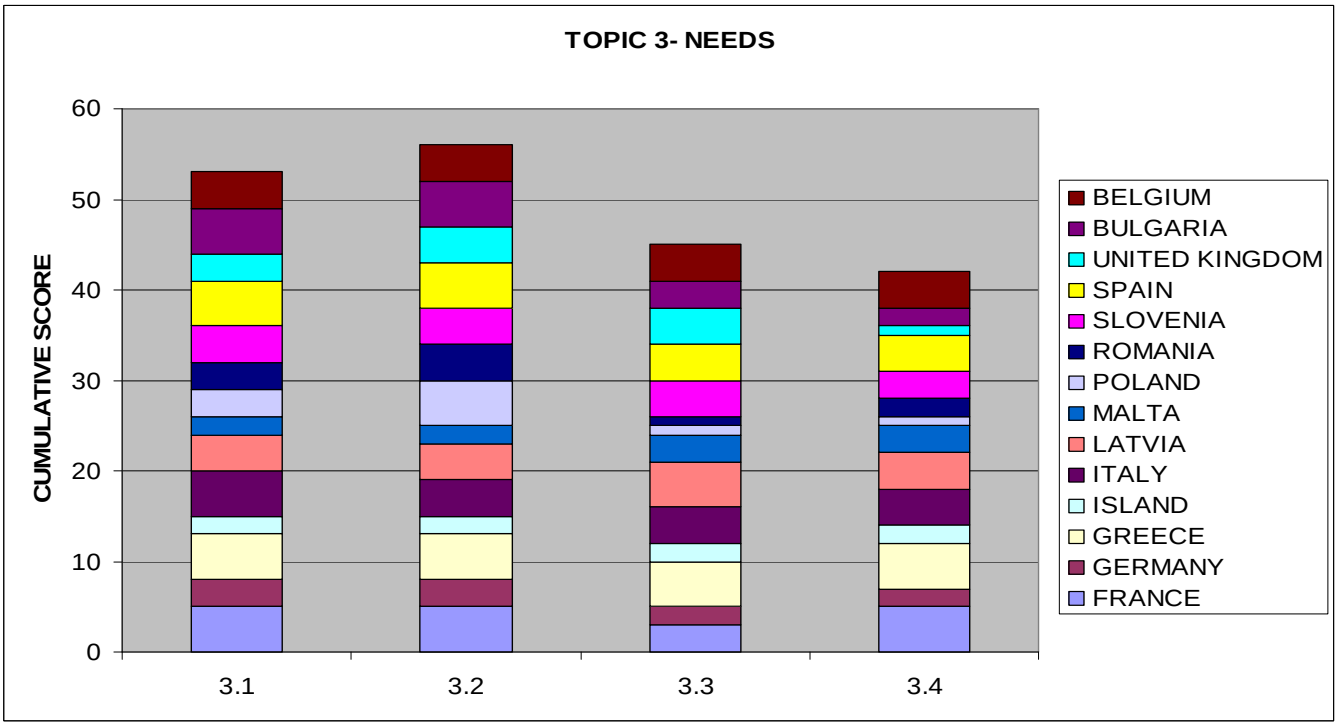
3.2 Non invasive instruments and methodologies for diagnosis and monitoring.

3.3 Intelligent multi-sensor systems for early warning (modelling, local network for monitoring systems), including telediagnosis.

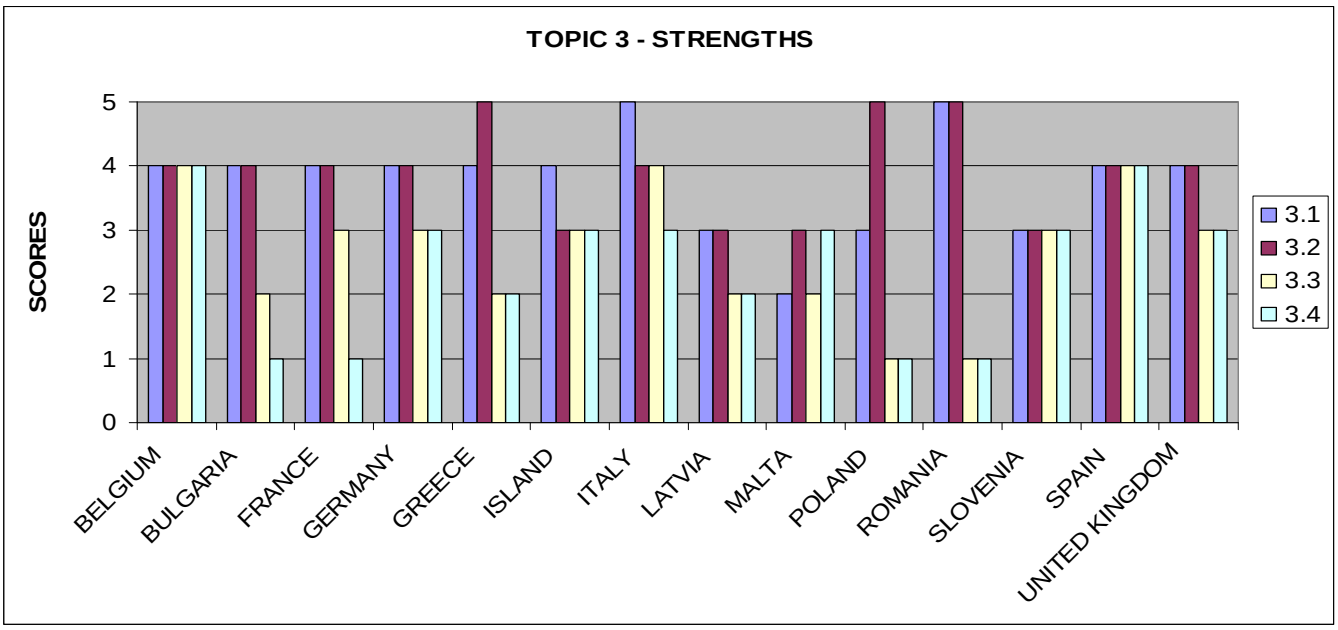
3.4 Re-engineering of instruments and techniques to simplify and adapt their use.

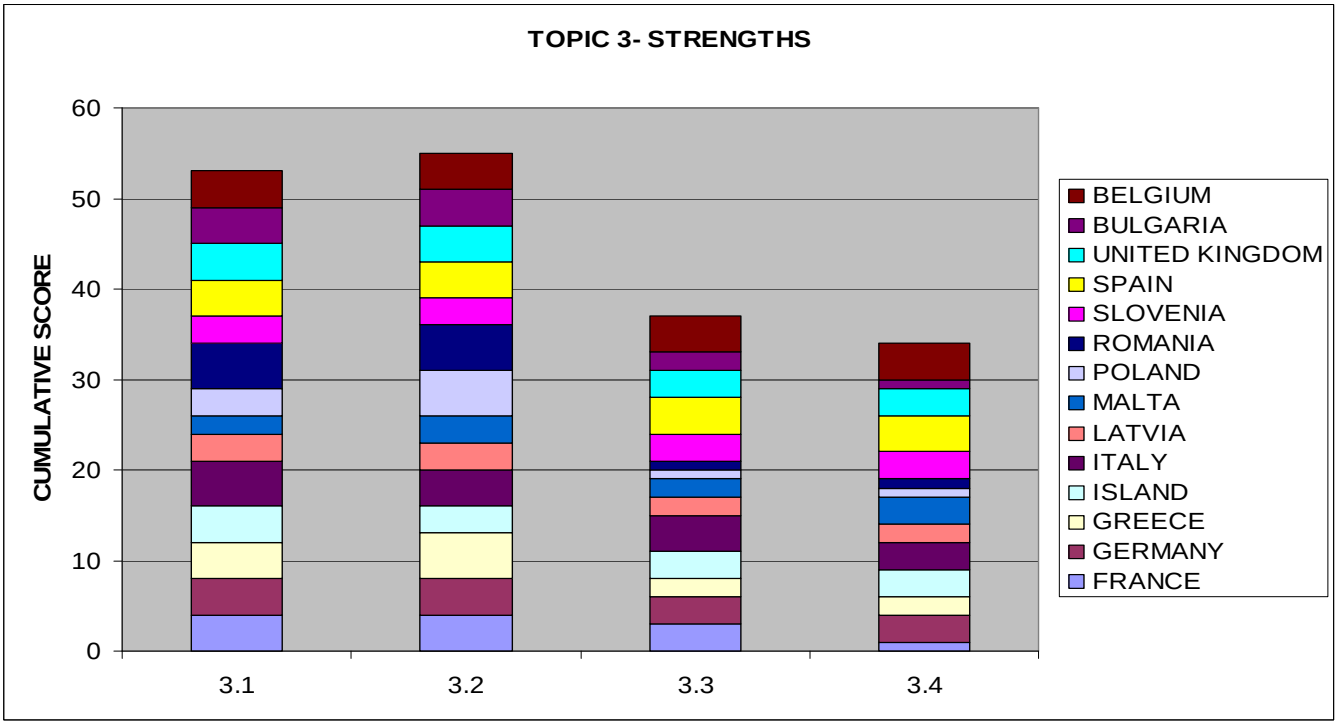
TOPIC 3: NEEDS



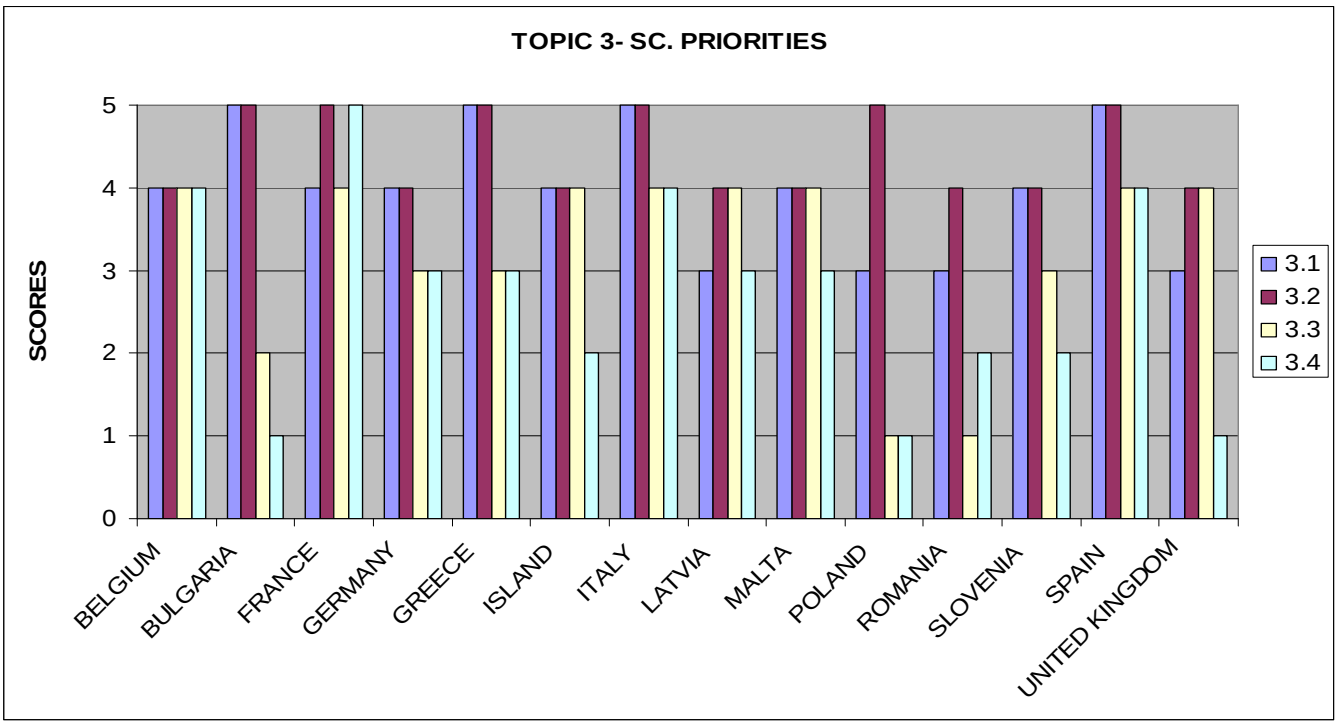


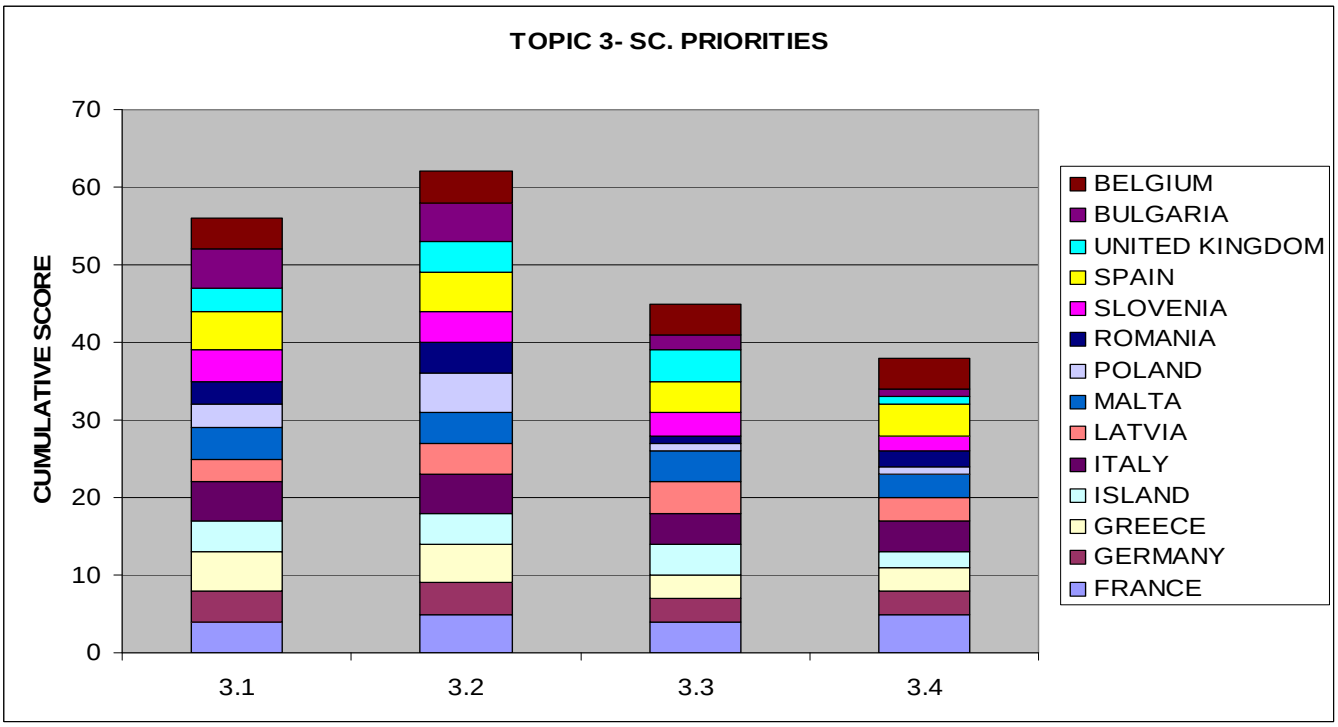
TOPIC 3: STRENGTHS





TOPIC 3: SCIENTIFIC PRIORITIES





Topic 4

Innovation of materials and technologies for conservation and maintenance

Conservation is key to preventing deterioration of monuments and artefacts of historical interest: it is one of the main conditions for transmitting cultural heritage to future generations. This goal can be achieved by using materials and technologies that ensure the long term permanence and durability of artworks. For this reason, it is necessary to improve non destructive and micro-invasive examination techniques for artworks, providing data on the geometry of structural elements and components of historical materials. On the basis of such knowledge, it will be possible to develop new technologies which will ensure the conservation of cultural sites, and movable and immovable artefacts, with a low impact on them.

Methods for diagnosing of the state of conservation of monuments and artworks will provide a wealth of information and experience that must be made available not only to the institutions devoted to conserving the cultural heritage, but also to private and public organizations engaged in construction and building renovation. Given of the importance of this issue, there is a need for further development and improvement of instruments and methodologies aimed at facilitating information and experience exchange. The sharing of tested technologies applied to building renovation will help to evaluate restoration work and to develop more appropriate means of consolidating artworks.

Furthermore, at present, it is crucial to perform research into the possibility of applying High Energy Saving and Environmental sustainability models (resulting from Eco Building, Bio Housing, etc…) to historic monuments, an issue of current relevance, being strongly linked to salvage strategies for urban areas, aimed at improving the quality of life of local communities. To obtain such results, new materials and energy sources, suitable for different types of historic buildings, have to be developed.

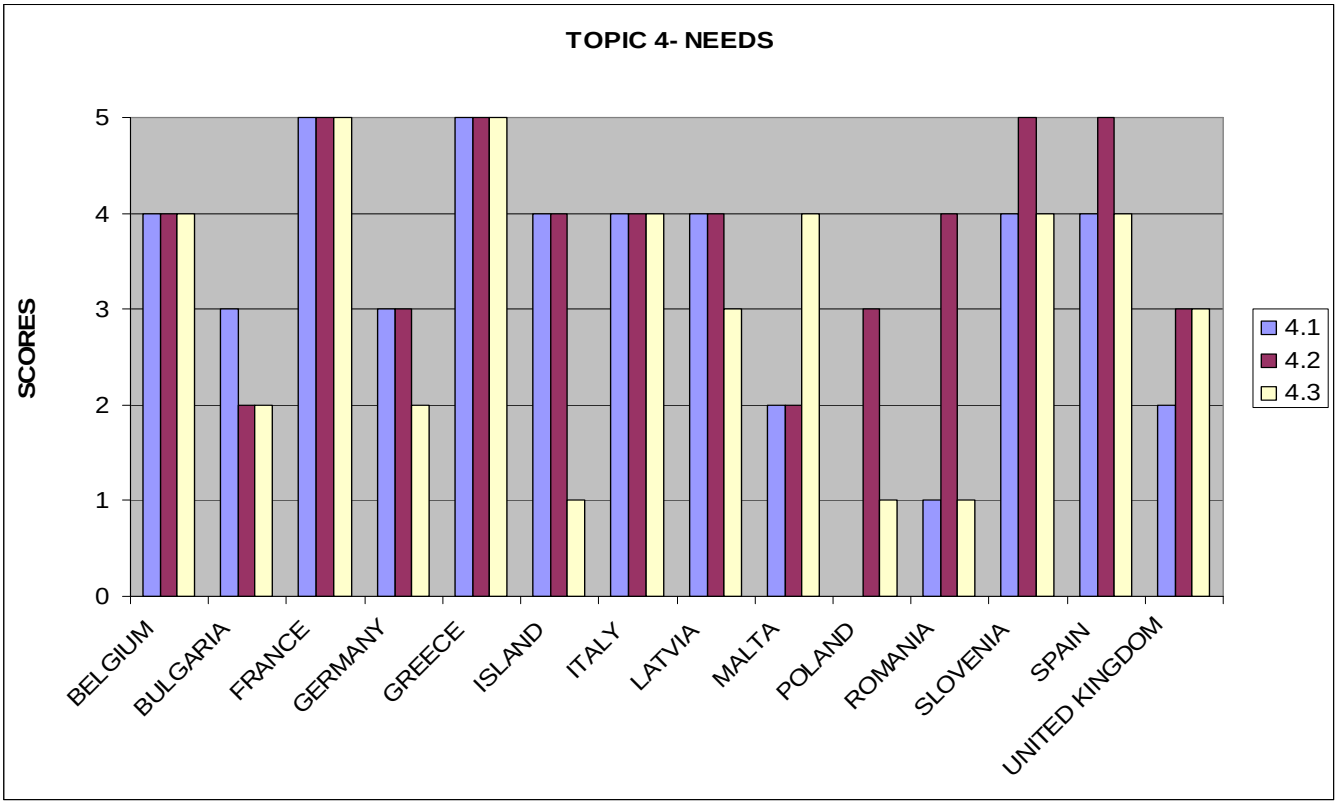
The research gaps of this topic are the following:

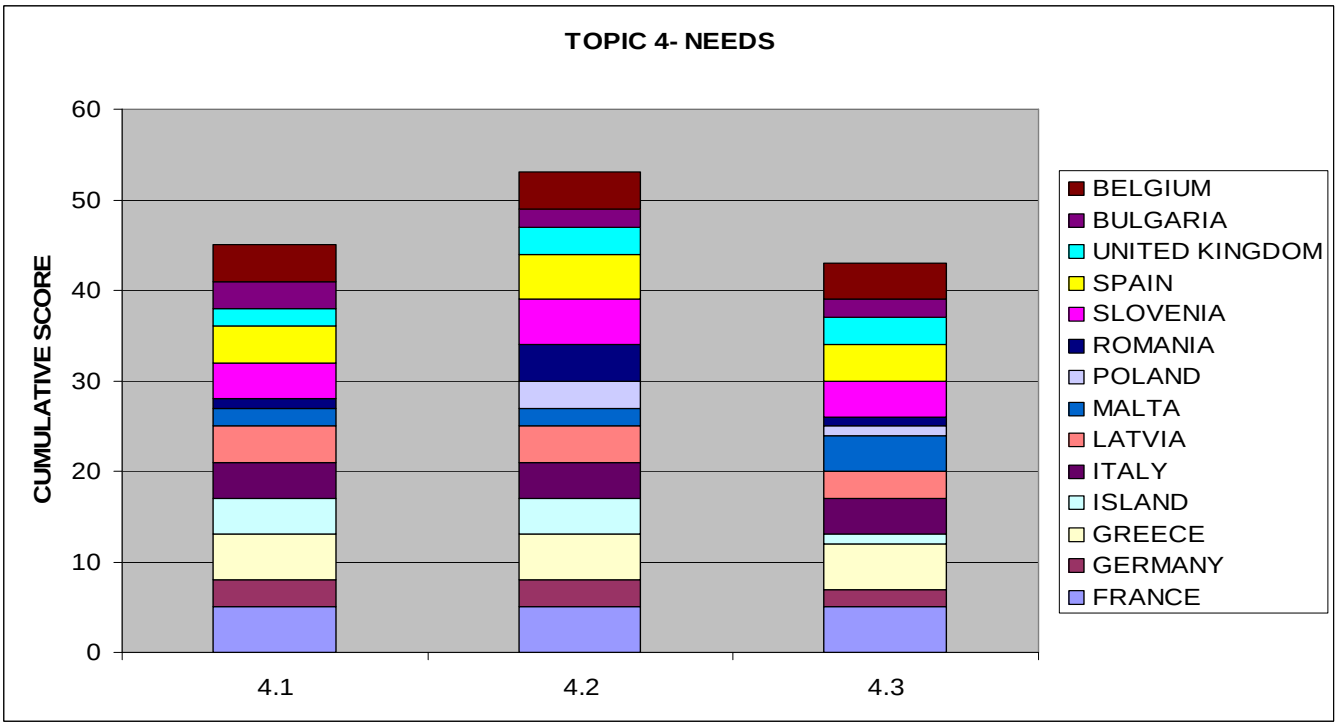
4.1 Development of new and appropriate materials and technologies for the upgrading or construction of conservation buildings

4.2 Development or improvement of restoration and conservation products with low impact on the historical content of artefacts.

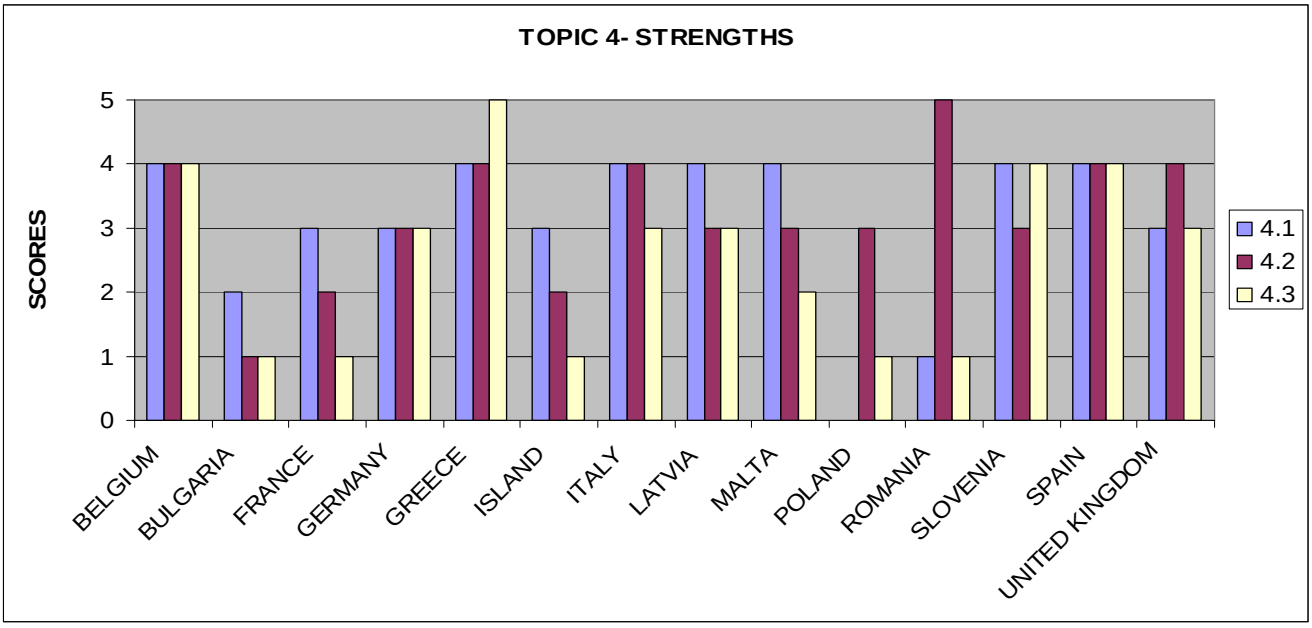
4.3 Identification and assessment procedures to evaluate the fitness for use of new and goal-oriented products to define common guidelines and pre-standards.

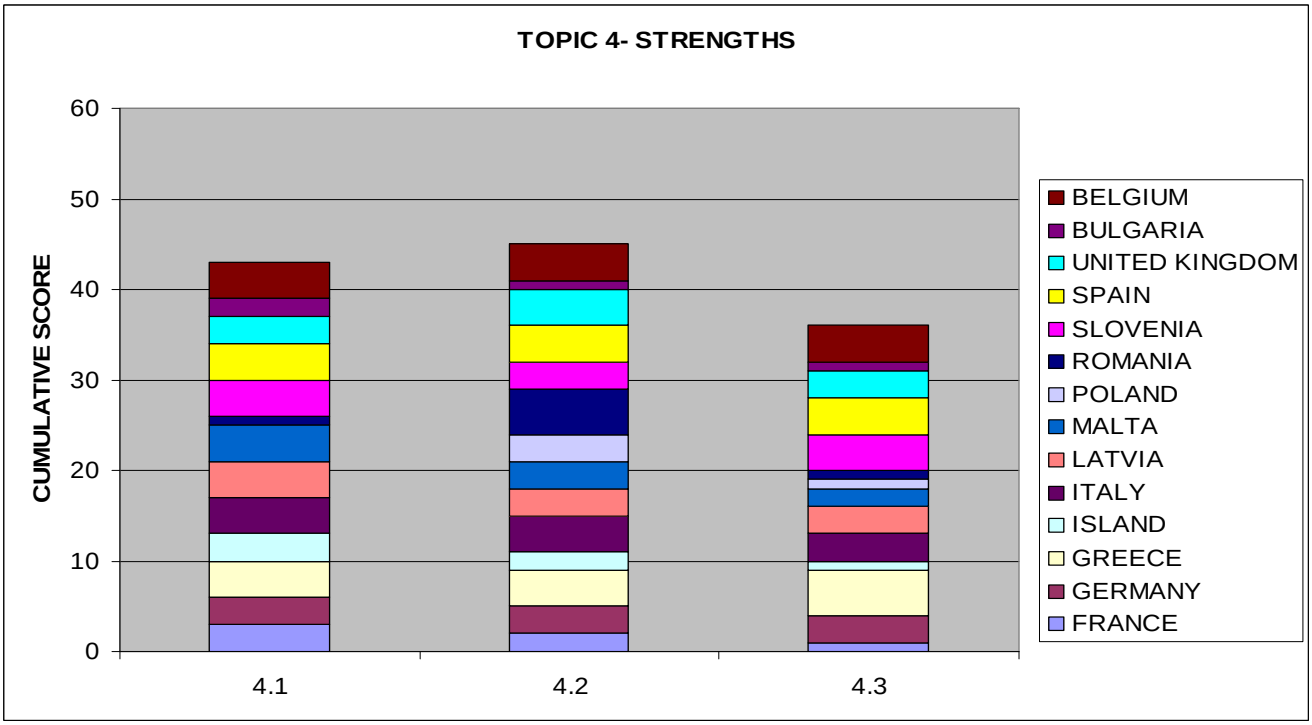
TOPIC 4: NEEDS



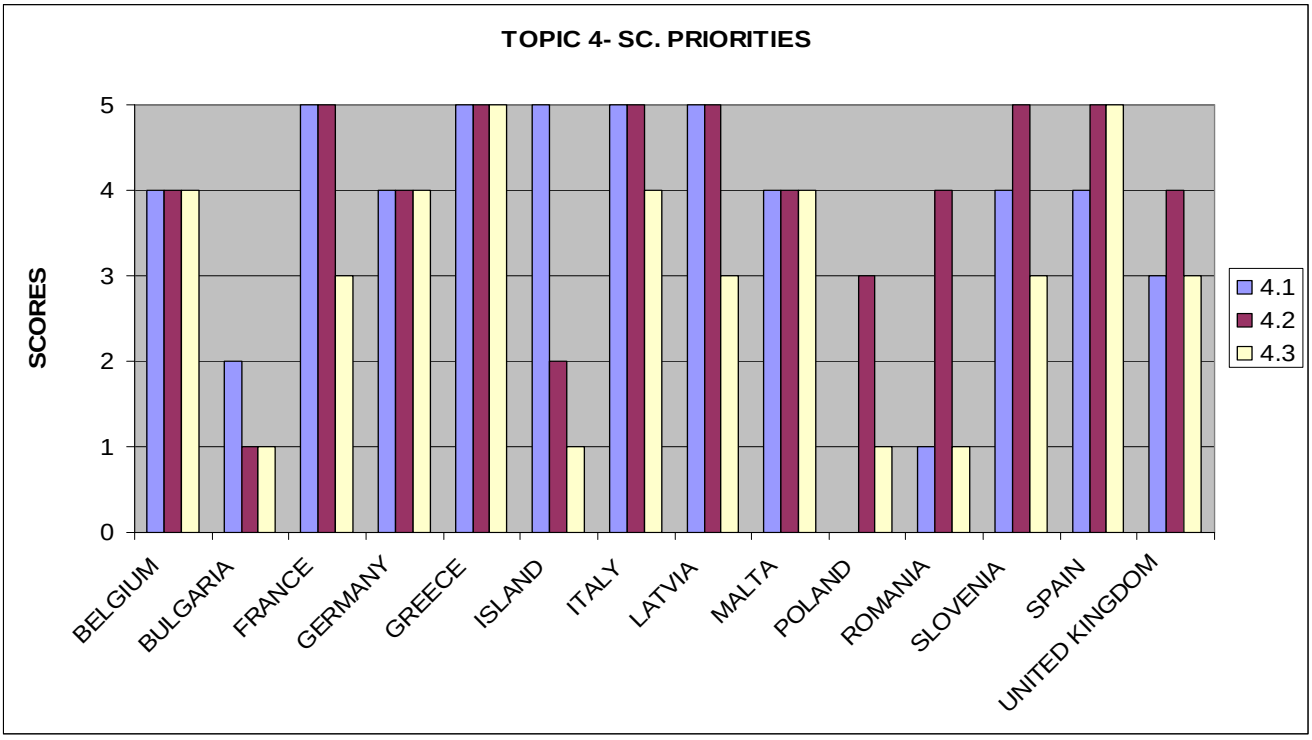


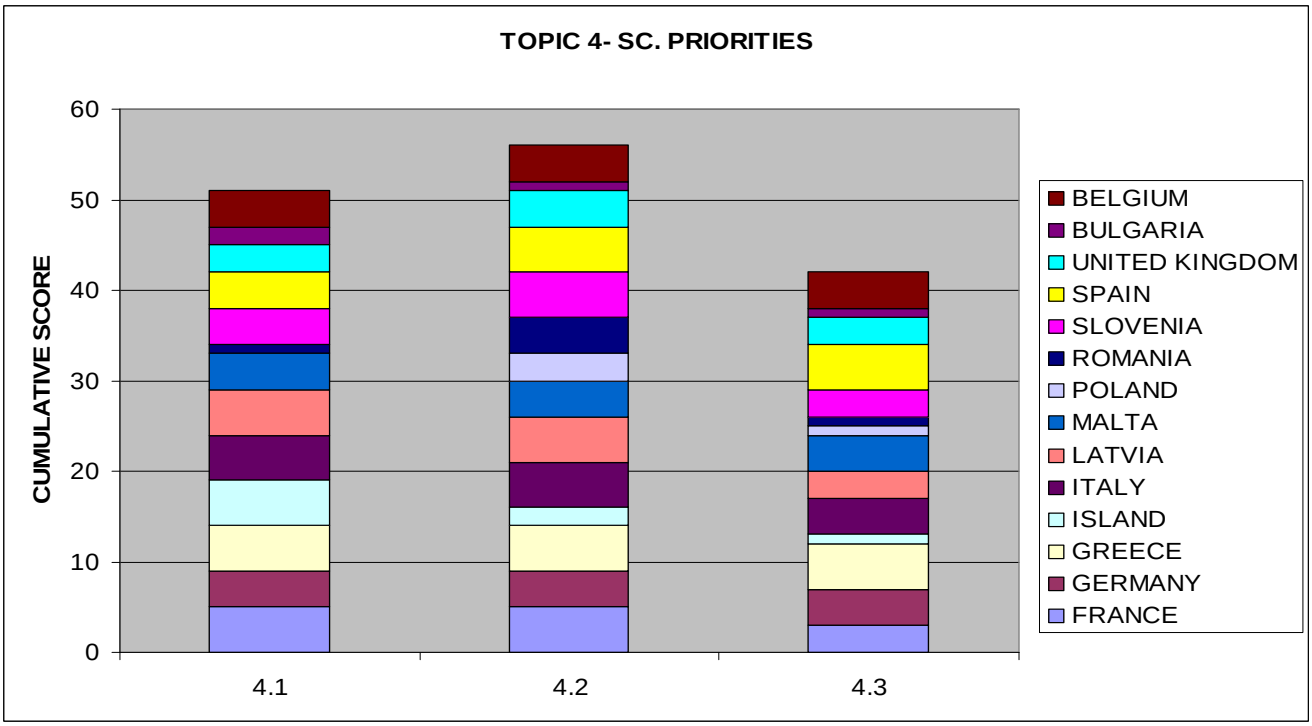
TOPIC 4: STRENGTHS





TOPIC 4 : SCIENTIFIC PRIORITIES





Topic 5

Evaluation of treatments and materials used in conservation at present and over recent decades, assessing their suitability and future consequences

Cultural heritage artefacts are unique and composite materials, which should be protected and preserved in all of their components.

All products/treatments used for conservation purposes must be tested along ageing, as regards compatibility, durability, permanence and reversibility. No standard analysis and reporting protocols are currently available, either for the assessment of new products, or for the evaluation of the treatments that have been used until now.

The protocol must comprehend not only physical, mechanical and optical tests, but also methods for the evaluation of possible chemical, structural and biological modifications that the conservation product/treatment could induce, in both short and long time scales.

Theoretical degradation models and simulation should be developed.

The research gaps of this topic are the following:

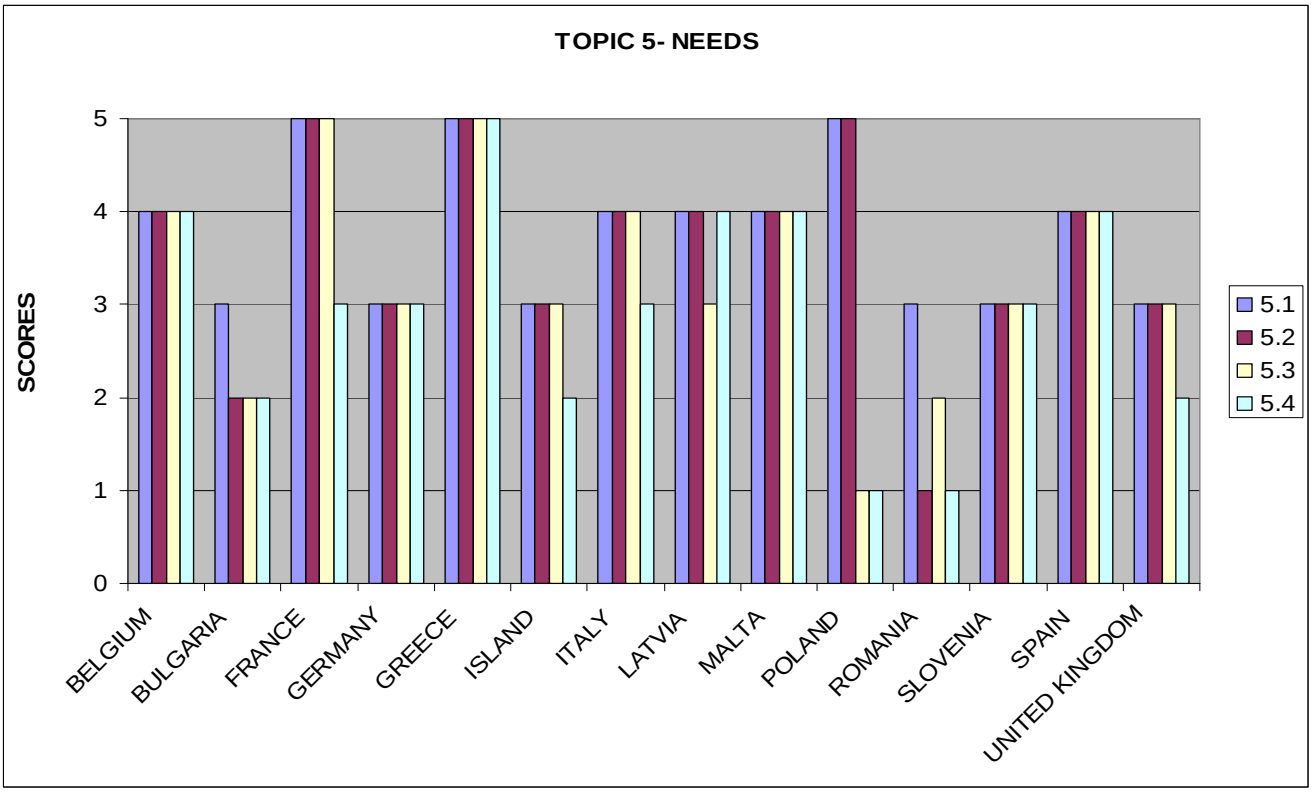
5.1 New solutions for development, assessment and reporting of analysis protocol for the time effect evaluation of treatments (e.g. cleaning, biocides, etc.) and materials.

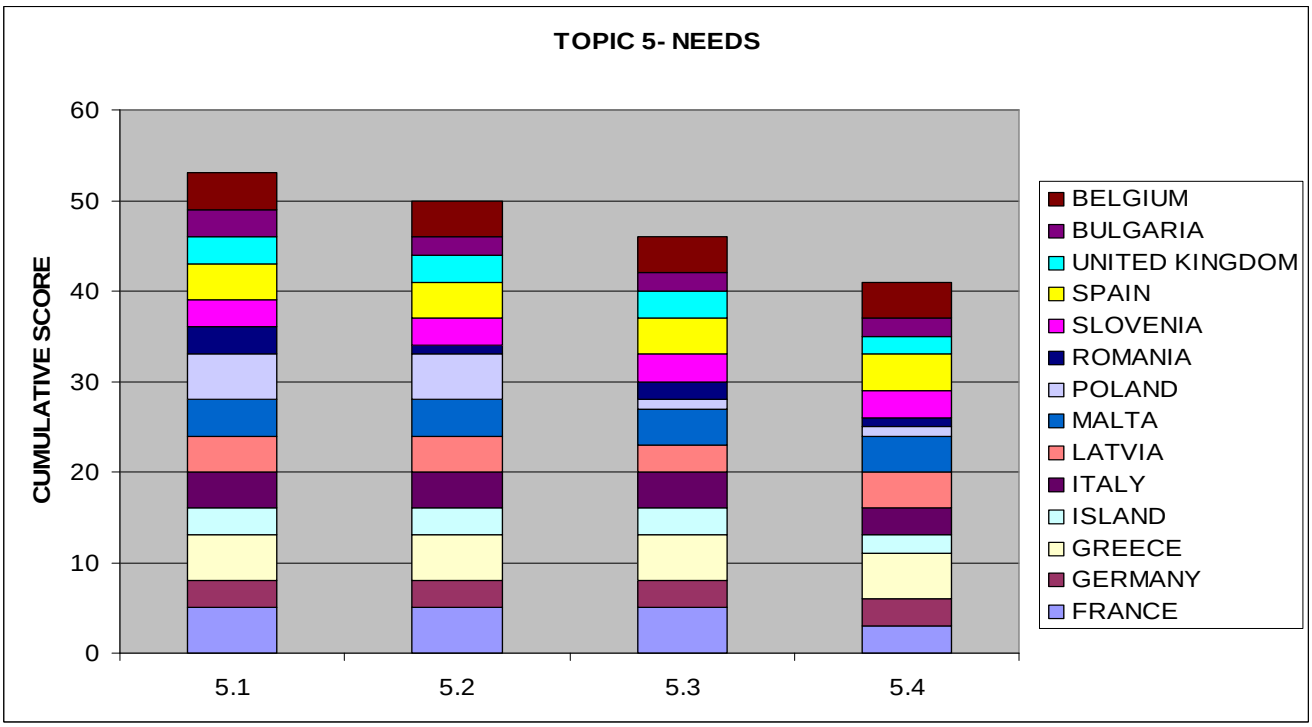
5.2 Innovative solutions for compatibility, durability and reversibility of new materials and treatments.

5.3 Modelling and simulation for predictive evaluation and validation of materials and treatments.

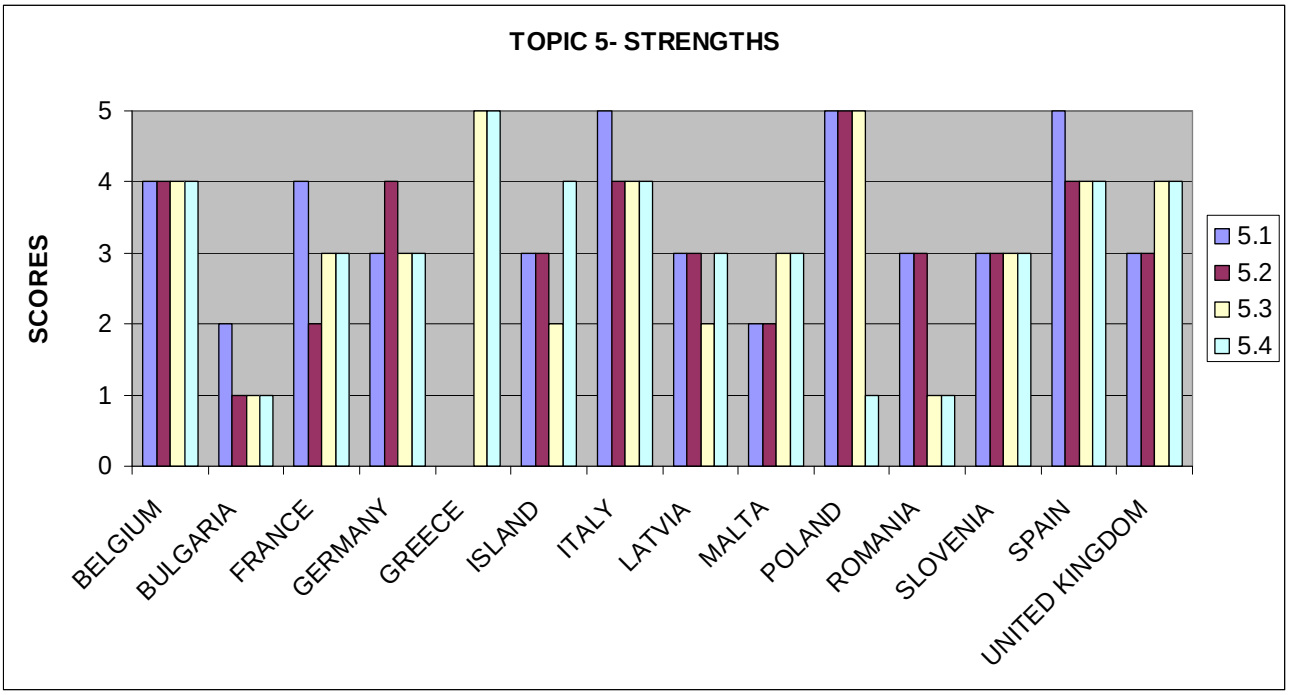
5.4 Impact of modern finishing materials and techniques on historic structures.

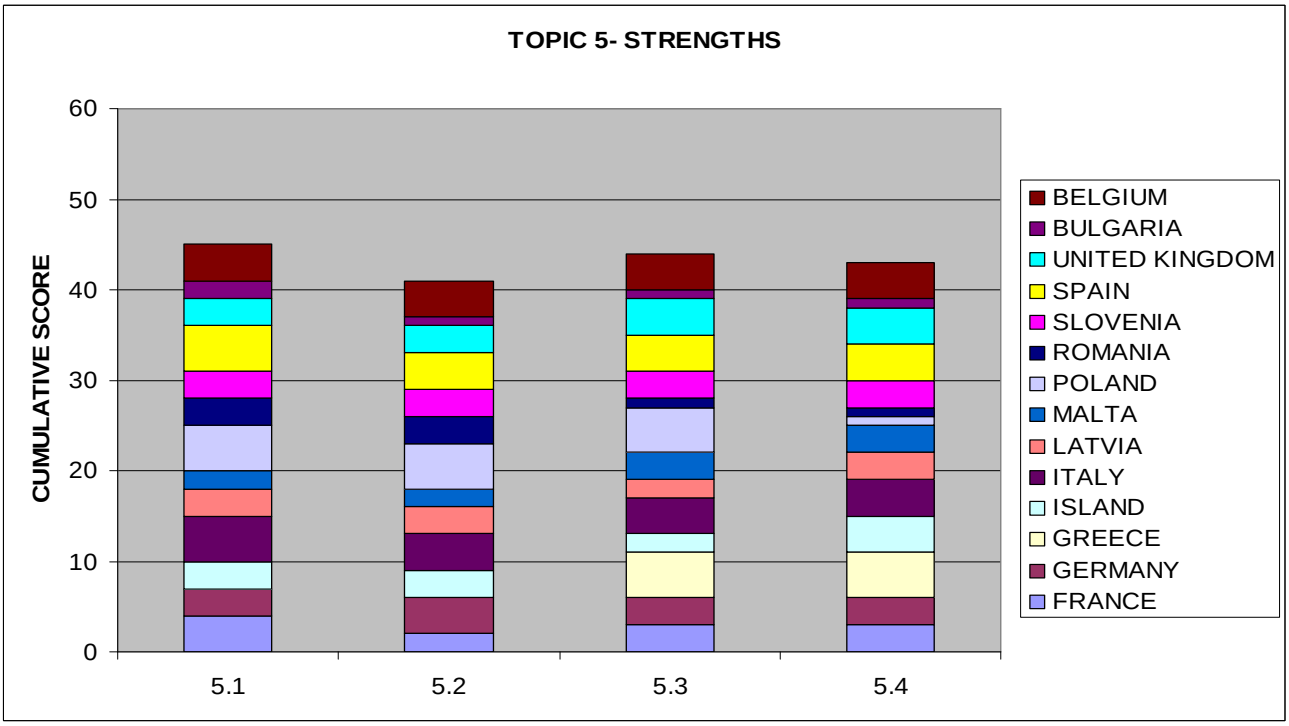
TOPIC 5: NEEDS



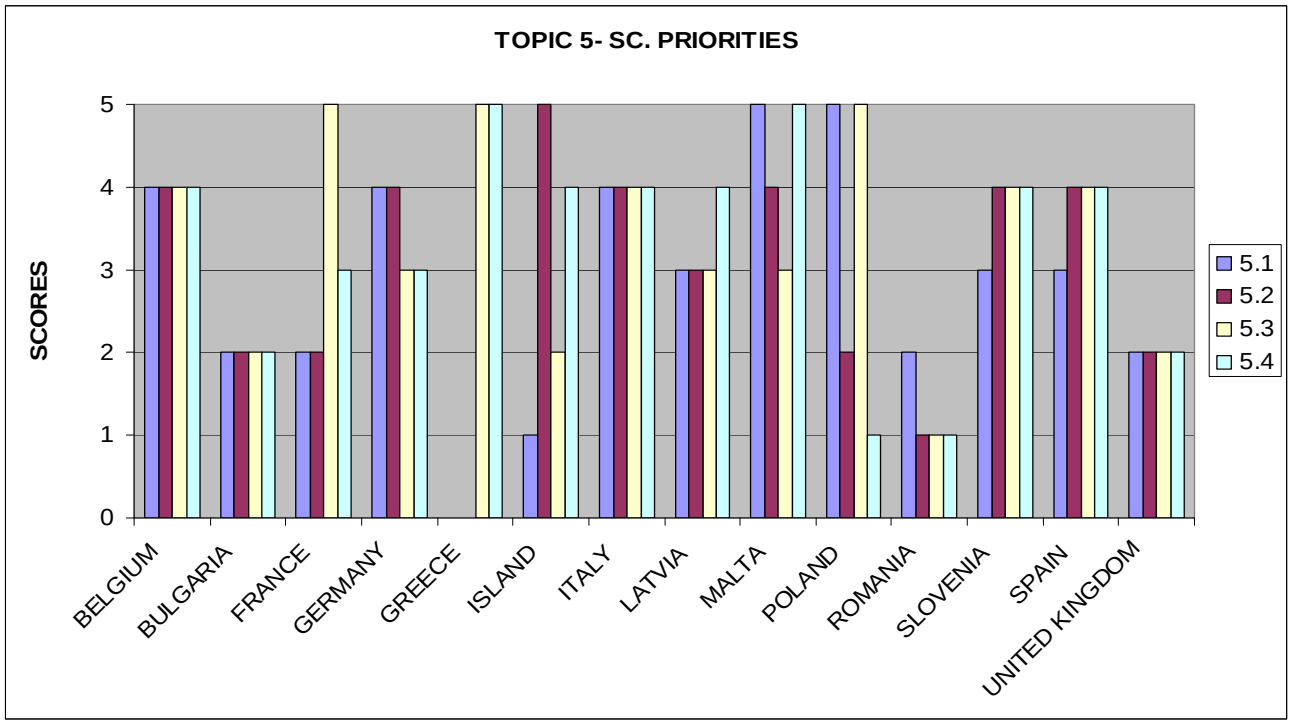


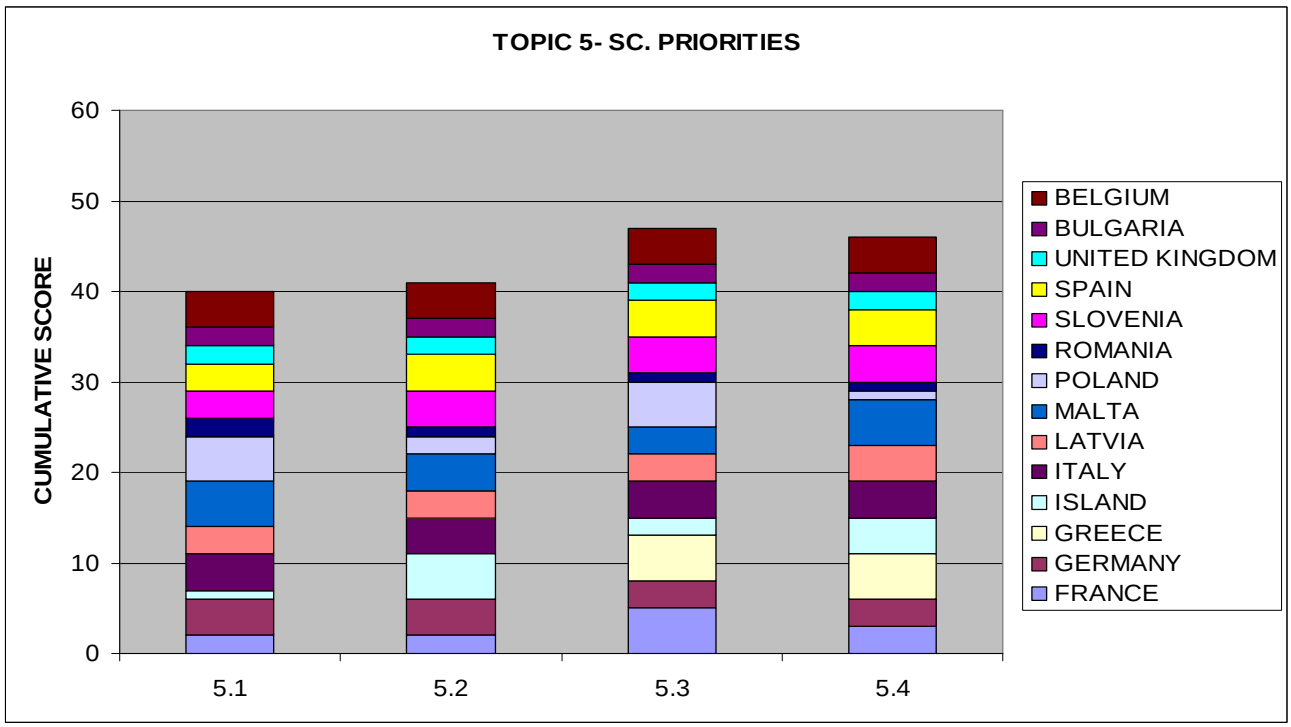
TOPIC 5: STRENGTHS





TOPIC 5: SCIENTIFIC PRIORITIES





Topic 6

Alteration and conservation of materials with special focus on modern materials used in Contemporary Art and Architecture and also as cultural information storage (CDs, DVDs, etc)

Very often artists are eager to use recently introduced materials to create their works of art. The reason is not only the novelty of the material itself, but also because the new material's properties appear the most suitable ones to match the artist's requirements. Moreover, materials used in art are usually no more than materials available on the market for use in the everyday life. Going back to the eighteenth century, a typical example is given by the pigment Prussian blue, which was synthesized in the early years of the century and, few years later, was already widely used in house paints, for dyeing fabrics, and in Dutch and Italian paintings as well. Thanks to the development of chemistry and material science, in particular since the second half of the nineteenth century, many new materials became available, for which, however, few or no data at all were known concerning their durability and fastness. It is worth remembering the severe fading of many paintings by Van Gogh, who used the new dye eosin, quite unstable to the light, for pink hues. However, the problem is not limited to pigments and dyes, but involves many other materials, such as new alloys, glasses, concrete and plastics. The use of polymers in the realization of modern and contemporary artworks is of particular concern, because they are often composed of plastics also constituting objects in daily use, which purposely have a limited lifetime to avoid excessive amounts of waste. Accordingly, if such art objects are to be preserved for the enjoyment of future generations, appropriate studies concerning optimum environmental conditions and consolidation procedures for such artefacts must be carried out.

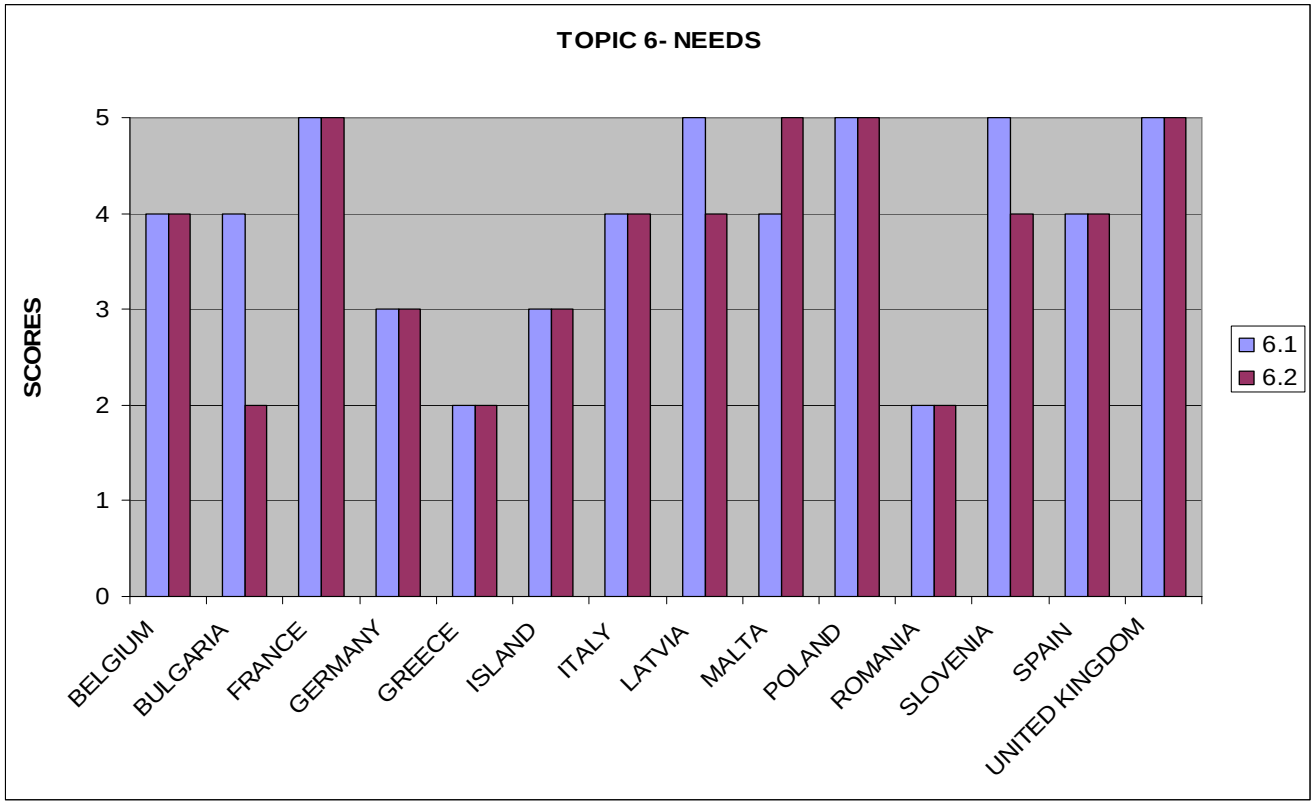
A further important aspect involves the modern devices for information storage. In fact, the storage of archive materials on discrete media is a task of forbidding complexity and expense. There are no easy, cheap options for the long term care and storage of individual tapes, cassettes, or discs. With a mass storage system, technology advances in storage density can deliver continual reductions in the space requirements for an archive. It is quite common to have multiple tiers of storage in a Hierarchical Storage System. At the top of such a hierarchy is solid state memory, relatively expensive, but very quick to deliver content. The next layer down might be fast, high quality hard disk drives. Moving down the stack, progressively cheaper, slower storage mediums can be employed, to the point where, at the bottom of the stack, removable optical or tape-based storage is viable, due to the acceptability of slow access times.

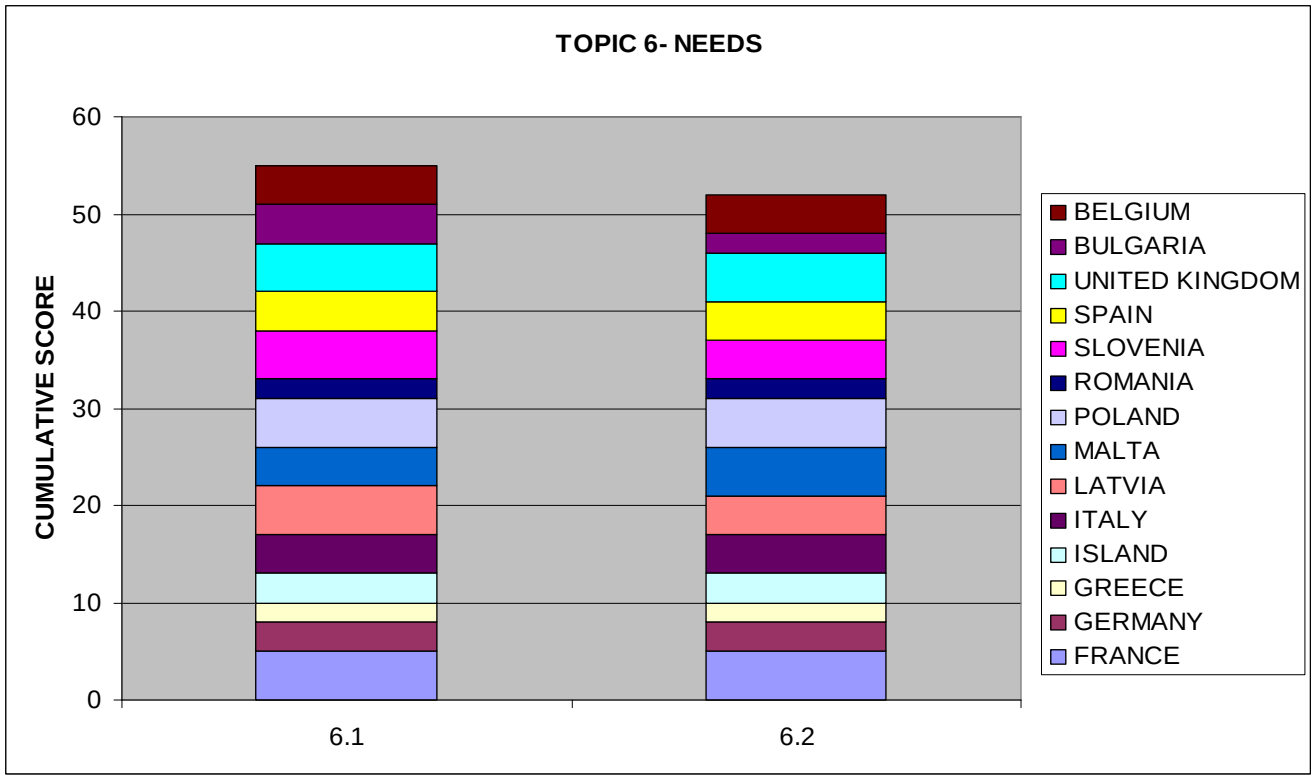
The research gaps of this topic are the following:

6.1 Strategies and procedures for the storage and preservation of multimedia supports and readability of stored contents.

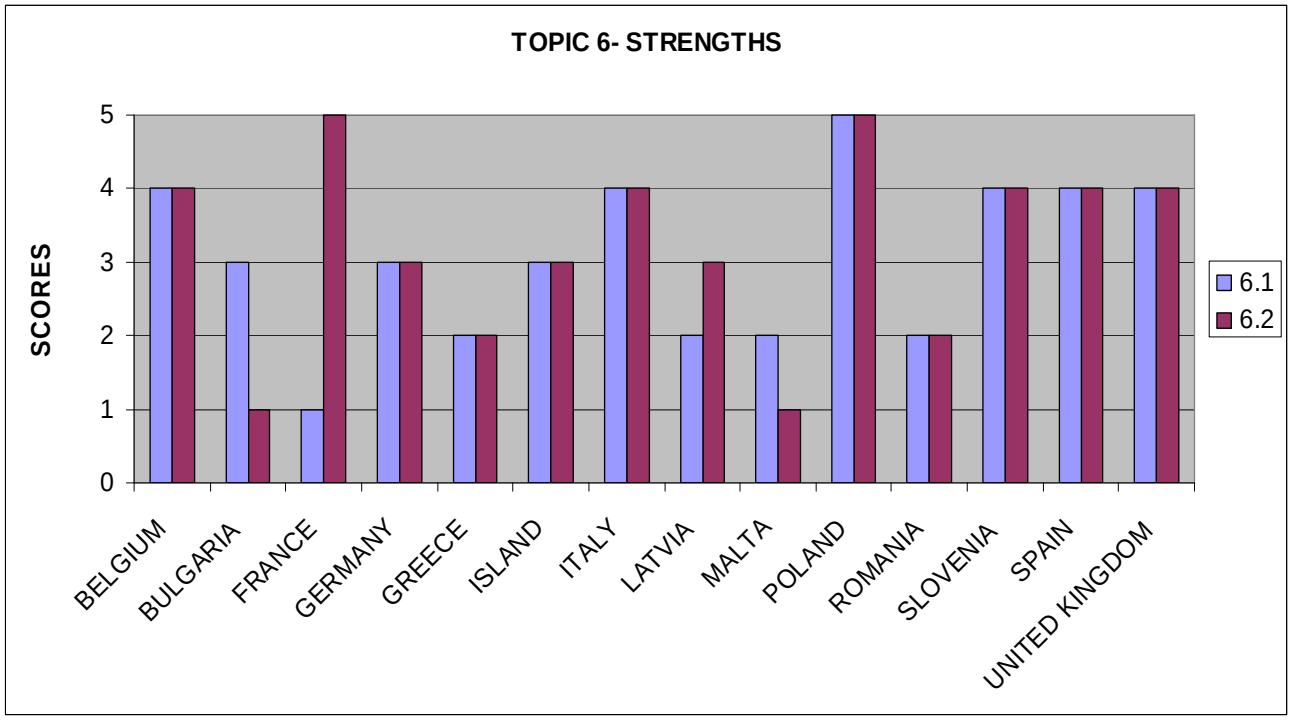
6.2 Innovative proposals for the conservation and durability of contemporary art materials (i.e. plastics, ceramics, new alloys, glasses, new dyes, concrete, mortars).

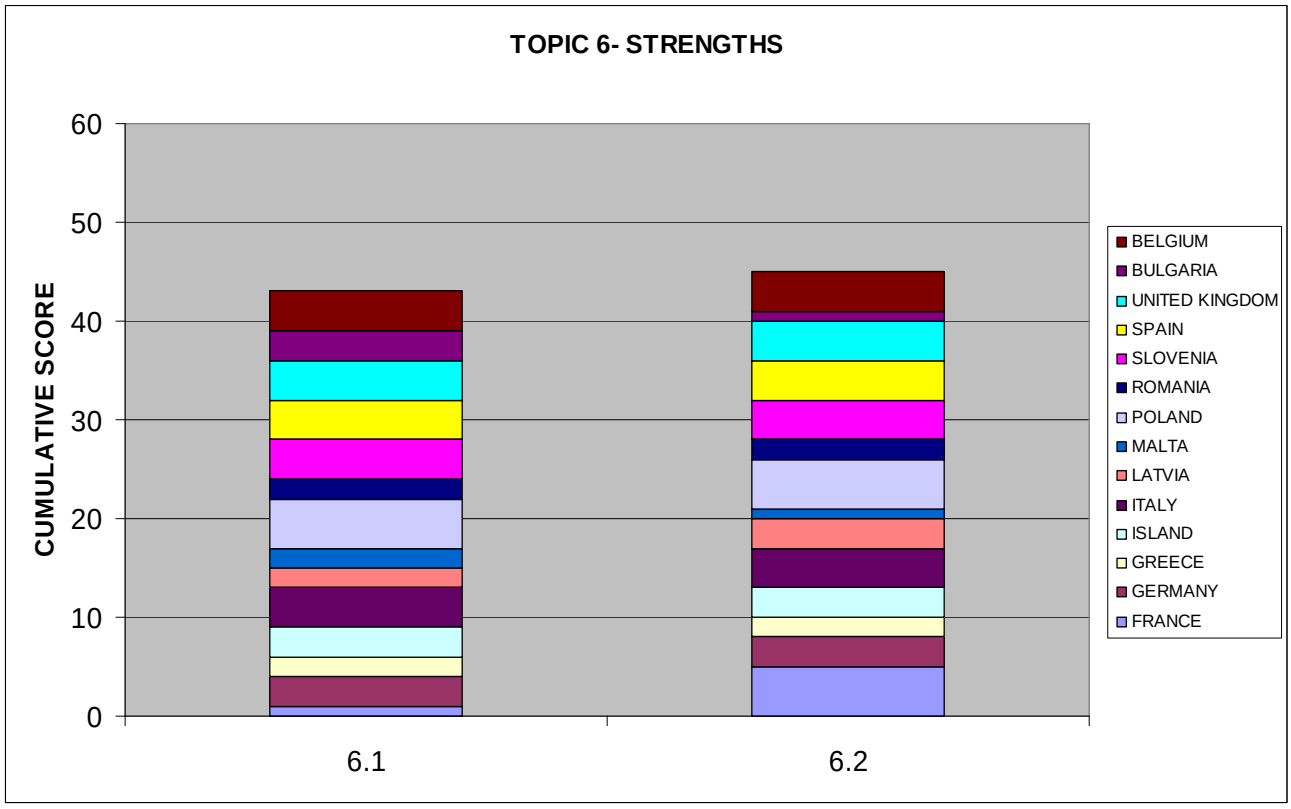
TOPIC 6:NEEDS



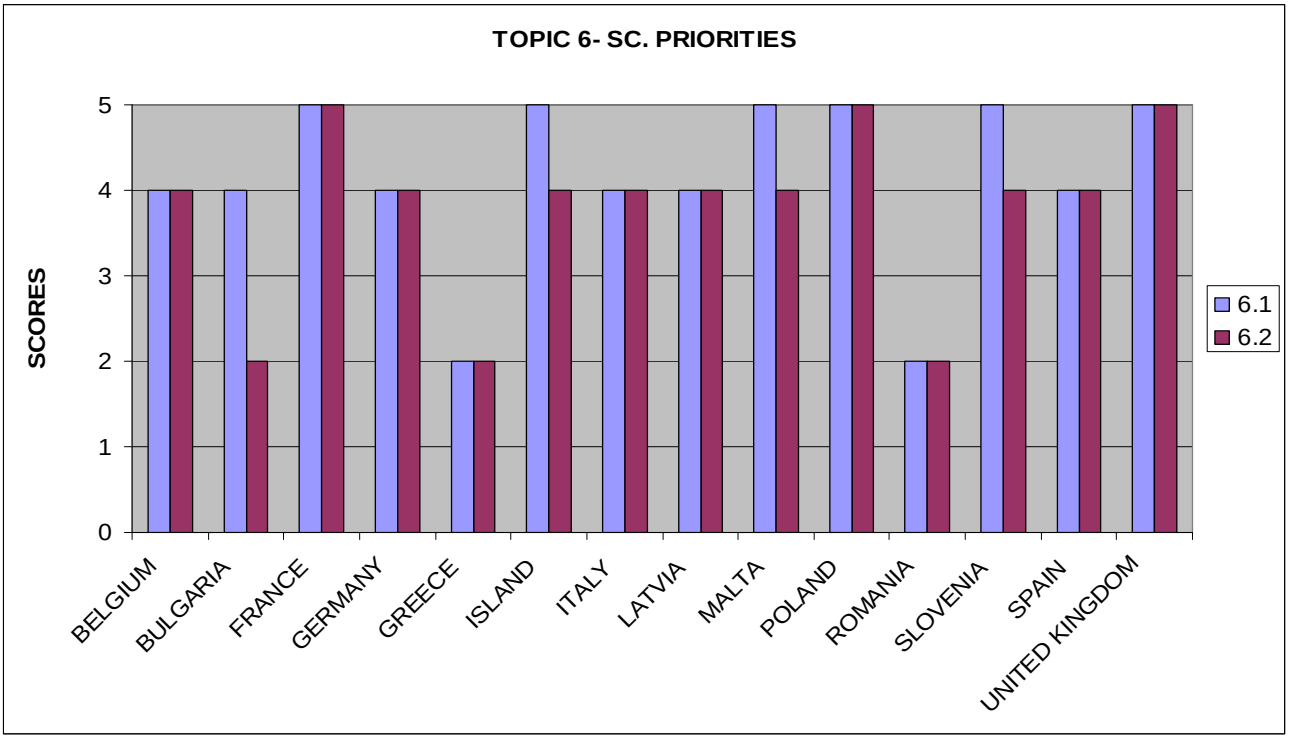


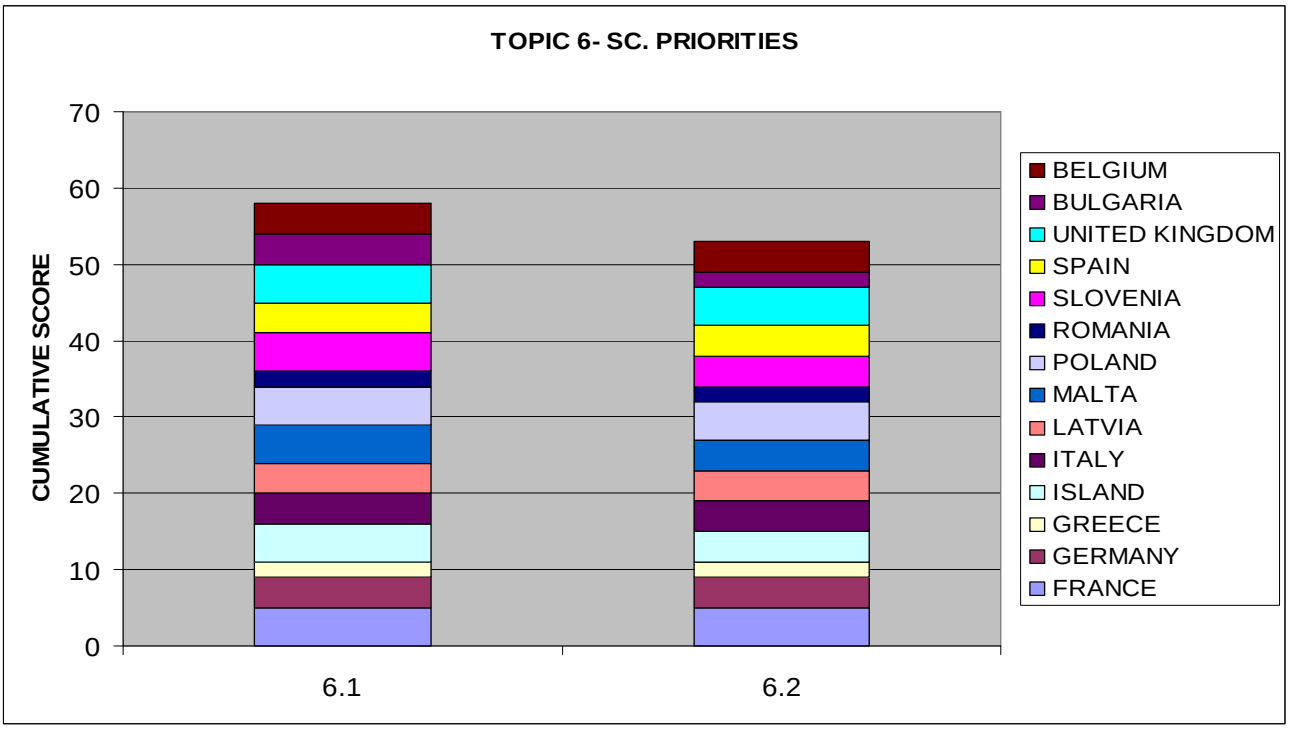
TOPIC 6: STRENGTHS





TOPIC 6: SCIENTIFIC PRIORITIES





Topic 7

Anthropogenic pressure evaluation and management

Development of management systems for quality and sustainability of indoor/outdoor cultural heritage environments.

Cultural heritage environments are complex systems composed by works of art and human presence. Moreover the attention has to be focused not only on a single cultural object (monument or painting), but also on the overall context (outdoor and indoor), which identifies the site.
Sites can represent, for instance, cultural identities having different spatial or temporal characteristics, or geo-morphological typologies; processes and actors operating in a site (e.g. stakeholders or tourists) interact all together in a demand and supply mechanism.
Only taking into account all these aspects the proper management system can be developed for a sustainability of indoor/outdoor cultural heritage environments. This management have to be set up by means of projects that study the scientific criteria and tools to measure and regulate tourists' impact on cultural heritage sites, that develop simulations of real situations and finally validate them.

Similar approaches characterize, for instance, the guidelines of the management plans of UNESCO sites, and the Common Implementation Strategies related to Analysis of Pressure and Impacts of human activities on different sites (surface and underground water).
For example, recent experiences confirm the need of the validation of models. In fact a smooth evaluation of the impact on immovable cultural heritage can arise real heavy consequences of application of unsuitable mobility models.

The management system should take into proper account conservation and cultural aspects, such as technical aspects, visit length and period, main curiosities, personal knowhow …etc..
Finally, facilities and technologies aimed to support differently impaired people should be also accurately studied.

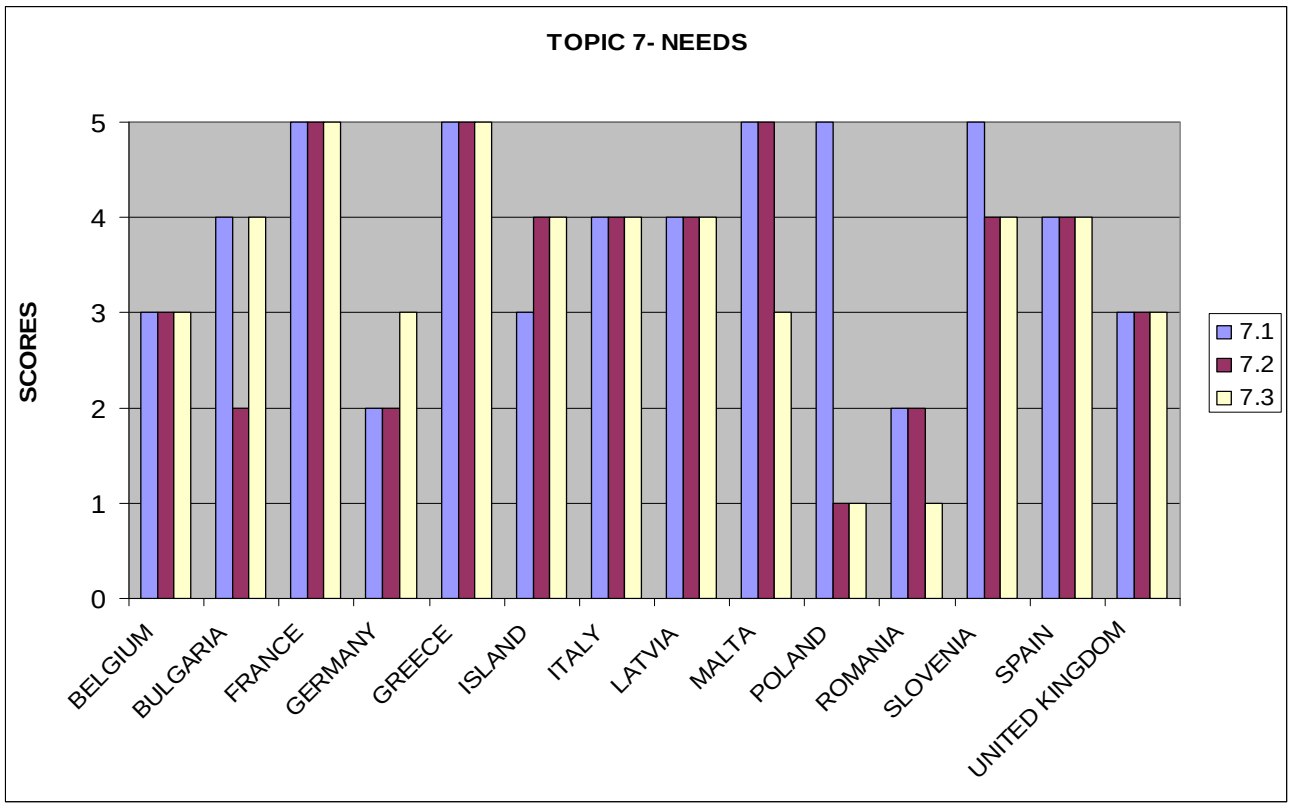
The research gaps of this topic are the following:

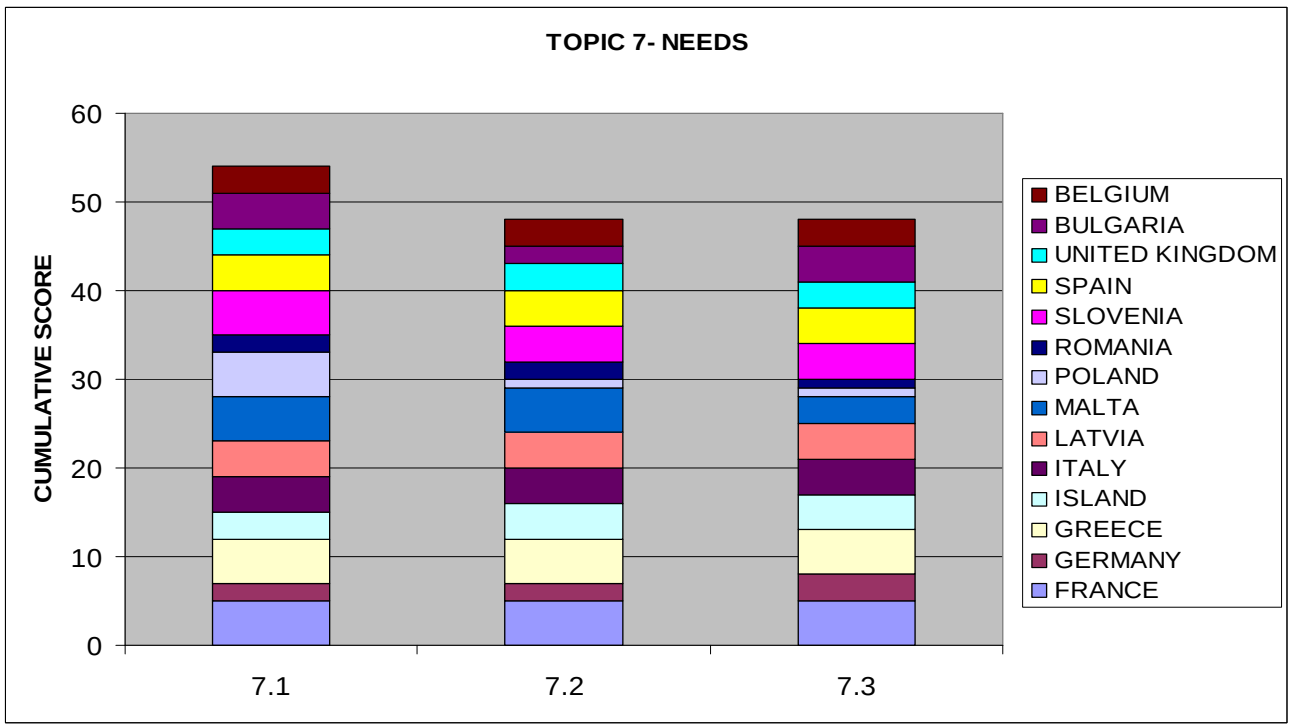
7.1 Development of management systems for quality and sustainability of indoor/outdoor cultural heritage environments.

7.2 Development, testing and validation of mobility models to reduce environmental impacts on unmovable cultural heritage (emissions, vibrations, etc.)

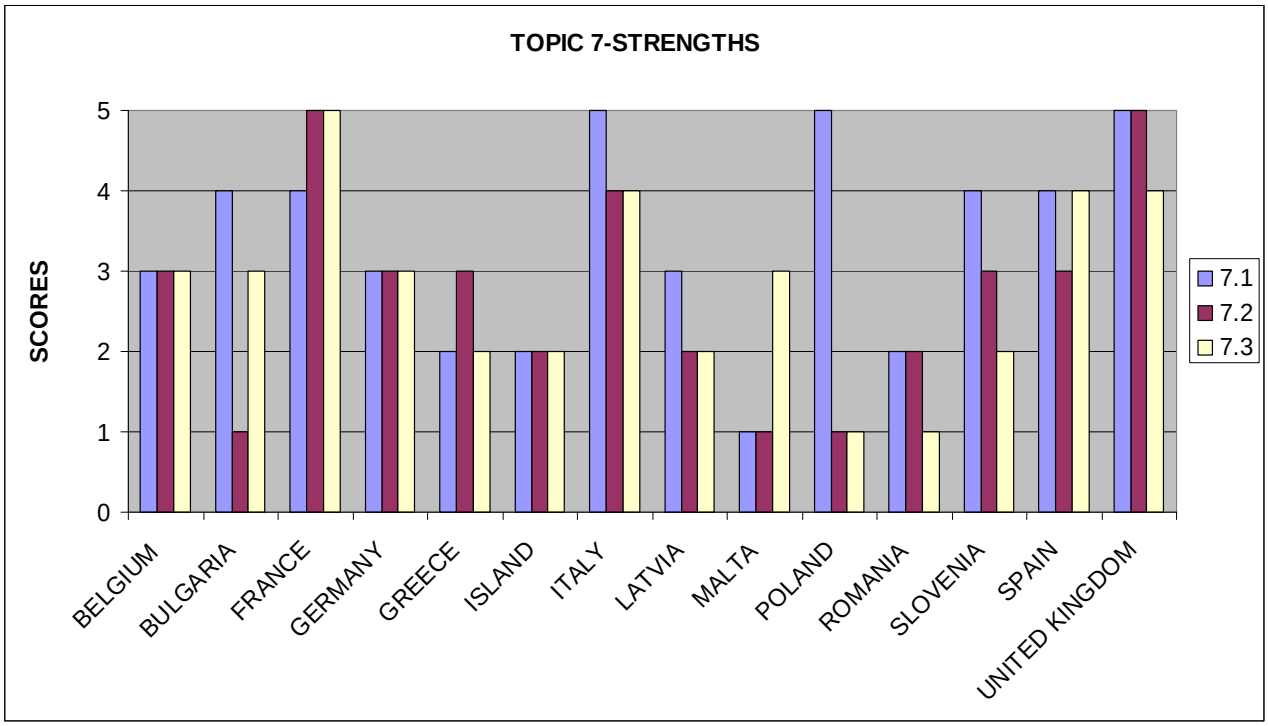
7.3 Development of scientific criteria and tools to measure and regulate tourists' impact on cultural heritage sites.

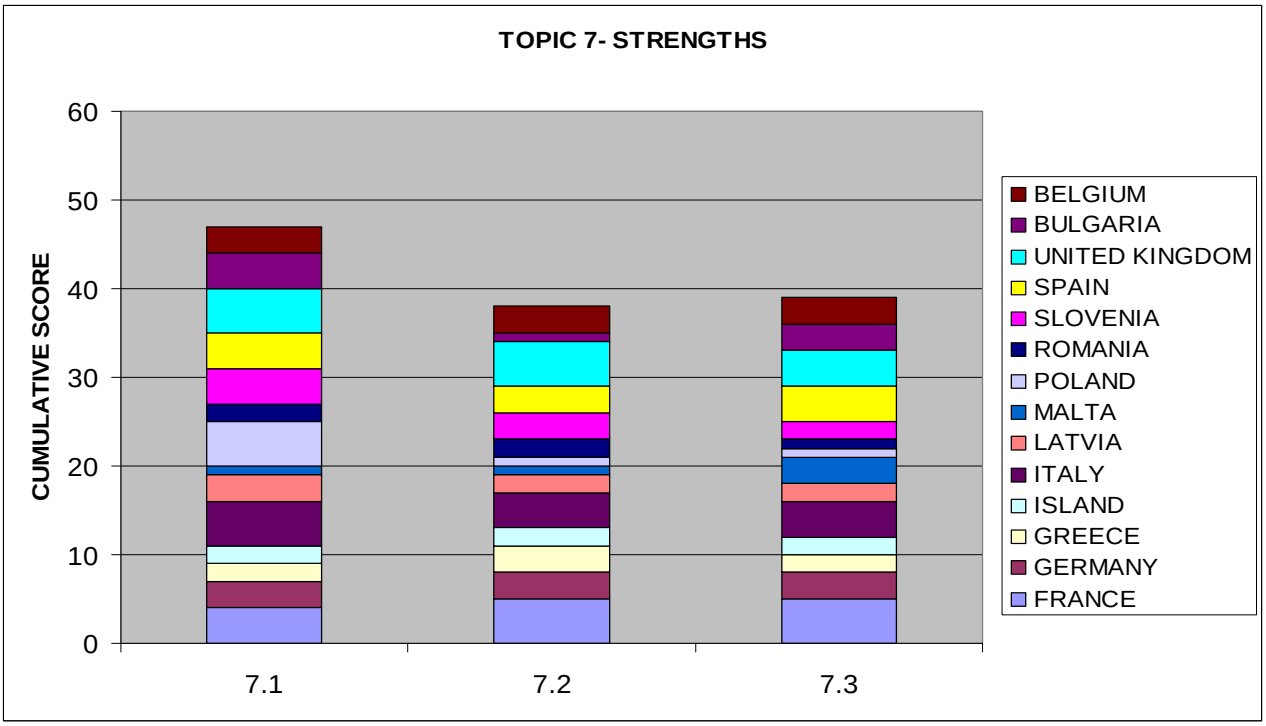
TOPIC 7: NEEDS



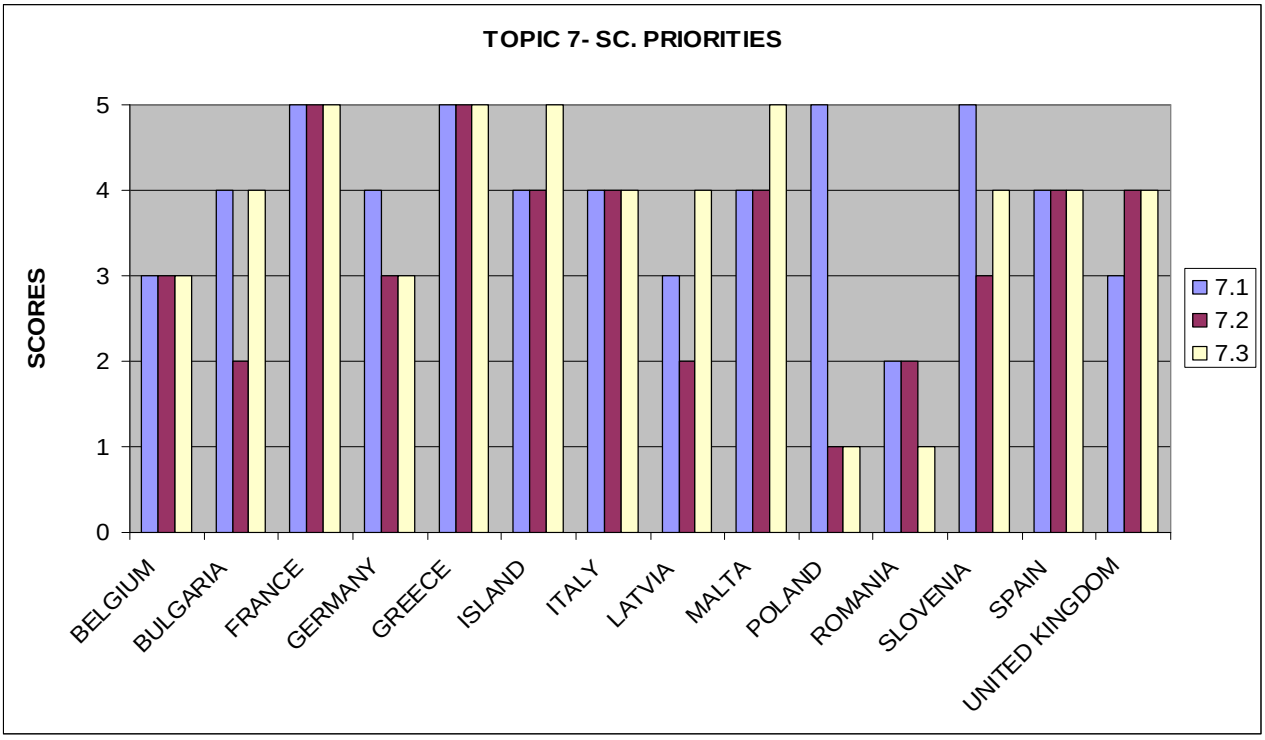


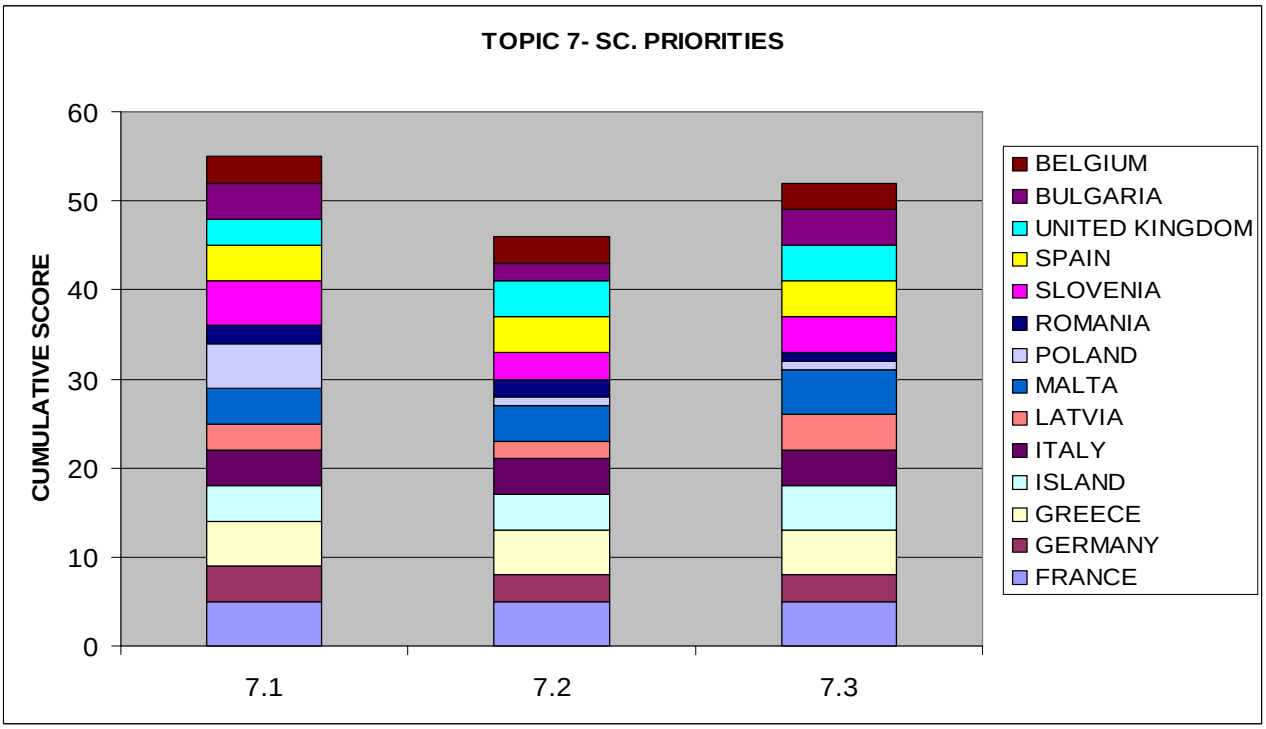
TOPIC 7: STRENGTHS





TOPIC 7: SCIENTIFIC PRIORITIES





Topic 8

Security technologies and systems in museums, libraries, archives and for the movement of artefacts

The protection of cultural heritage objects and documents is a mandatory requirement for all European countries. Besides policies of preservation, conservation and restoration, a new strategic policy of defence from illicit trafficking, theft and fraud, should be assessed.

The aim is to study and develop protection methods and products to allow a permanent and univocal identification of moveable cultural heritage objects.

No widely applicable methods are so far available: RFID (radio frequency identification device) tags exist, but they can be removed from the art object, and their use on paper or parchment can induce a chemical degradation of the support due to the penetration of adhesives. Many producers offer erasable inks. They are used on the background of a document so that when an attempt is made to erase information, the ink rubs off in that area; the ink will also react in the same manner as solvent/chemical reactive inks do, providing two security features in one. This kind of ink obviously cannot be used in the cultural heritage field. No tracing inks are available for the manual marking of documents. Marked inks exist for printing and cannot be used for cultural heritage objects.

The main idea is to offer conservators the possibility to use, at the same time and in the same document/art object, various easy and affordable methods to mark movable items.

An ink - invisible to naked eye but detectable with friendly non-destructive techniques - will allow the insertion of a reference (shelf mark, signature, etc.) on the cultural heritage object and a microchip will be inserted into the bulk. The microchip should be programmed in order to provide a database on the document (owner, inventory, shelf-mark, kind of document or object, etc.) and will be detectable and traceable by radio frequency technology.

The research gaps of this topic are the following:

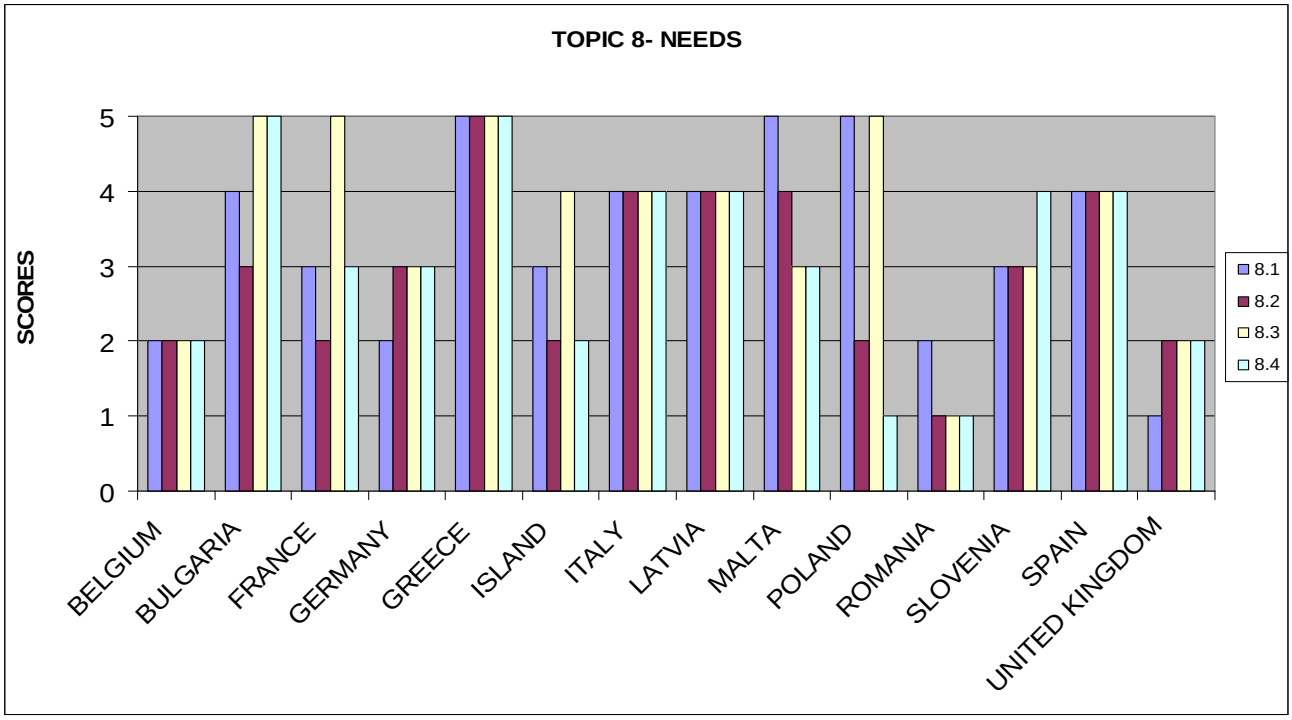
8.1 Development of sensors and devices for a safe handling, movement, transport and exhibition of artefacts and related guidelines.

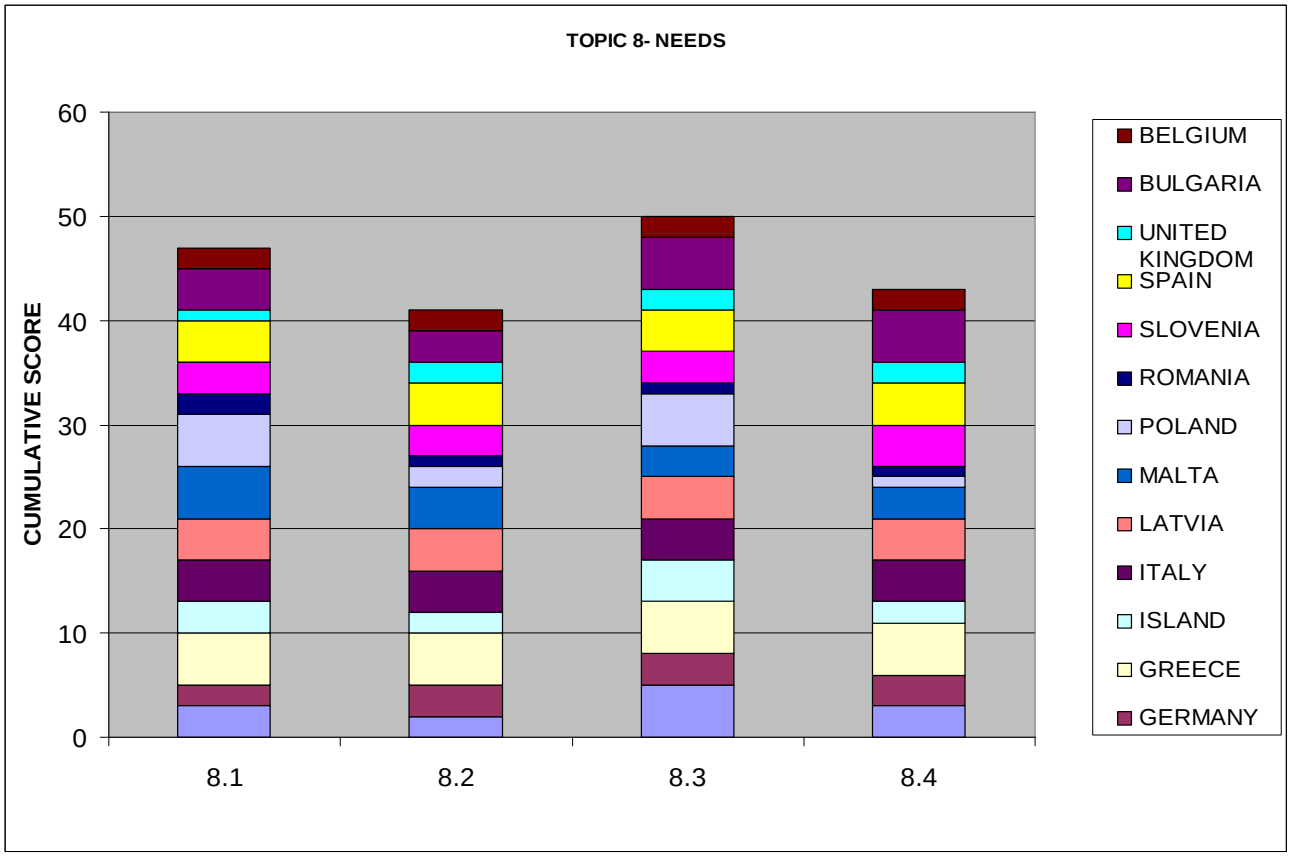
8.2 Development of integrated systems for effective prevention, detection and reaction to risk situations at different scales (e.g. fire, theft, vandal attacks, etc.).

8.3 Development of techniques to support the identification of fakes or stolen artefacts with special reference to insurance issues.

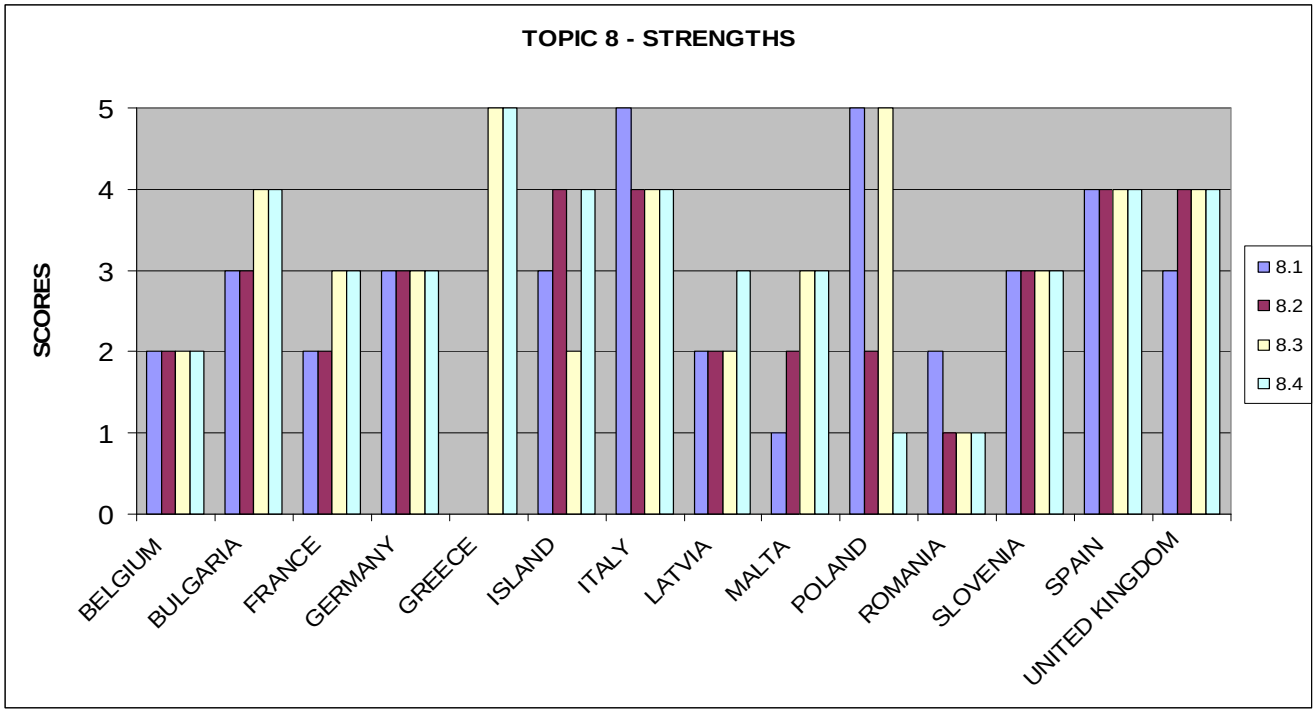
8.4. Techniques for inventorying, cataloguing and tracing of cultural heritage objects.

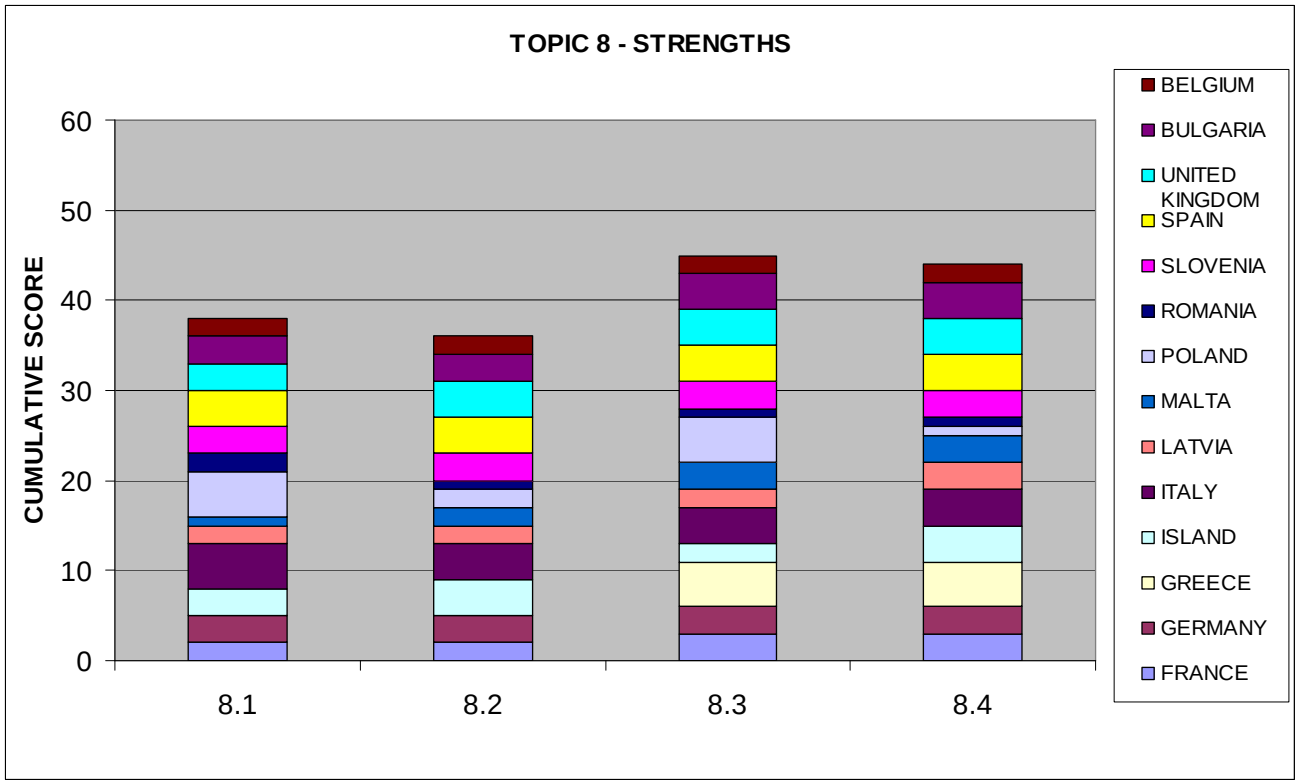
TOPIC 8: NEEDS



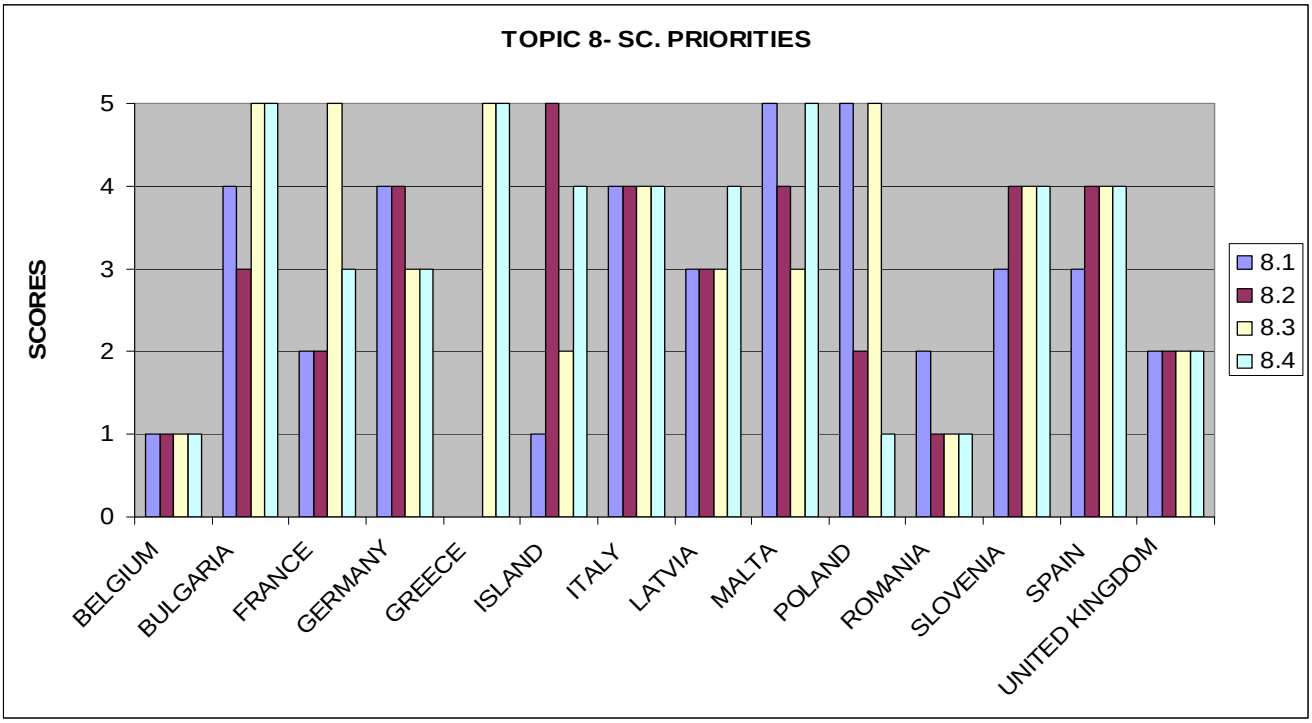


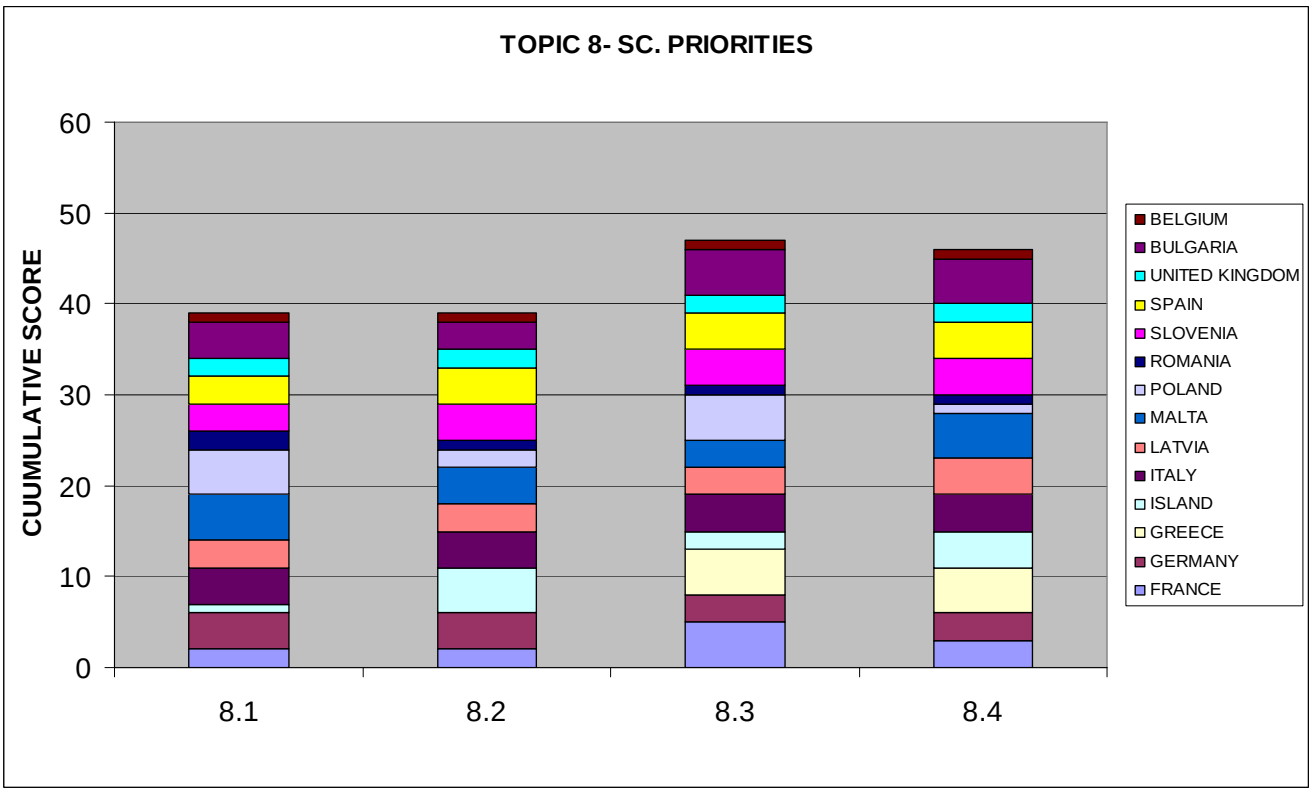
TOPIC 8: STRENGTHS





TOPIC 8: SCIENTIFIC PRIORITIES





Topic 9

Tele-survey and Geographic Information Systems for protection and management of tangible cultural heritage

The integrated use of tele-survey and Geographic Information Systems (GIS) for the protection and management of tangible cultural heritage is an interdisciplinary issue, which combines a wide variety of methods and technologies. Over the last decades, much interest has focused on the use of both aerial and space remote sensing techniques, integrating traditional archaeological methods and innovative ICT tools to support research projects on tangible cultural heritage. In particular, the improved capability of active and passive sensors has enhanced Earth Observation technologies, not only for the identification and documentation of ancient landscapes, sites and monuments, but also for the management and preservation of cultural and environmental heritage. Any archaeological evidence can only be protected once it has been georeferenced, documented - also with respect to its context - and stored within proper Information Systems. In this regard, an effective use of web-based GIS is playing a major role within Information Society policies and practices, as an integrated environment in which to store, analyse and share spatial data.

Today there is an urgent need for strengthening the integration of GIS, remote control and monitoring systems, in order to support protection and monitoring activities at the local and regional levels. Such systems are particularly suitable in dealing with security problems, and the development of new data processing techniques can offer important results in providing protection from natural and anthropogenic risks, in the control of visitors access and defence against illicit acts. A specific case is constituted by underwater cultural heritage, which poses peculiar challenges relating to data recording, underwater monitoring and reconstruction of the submarine environment.

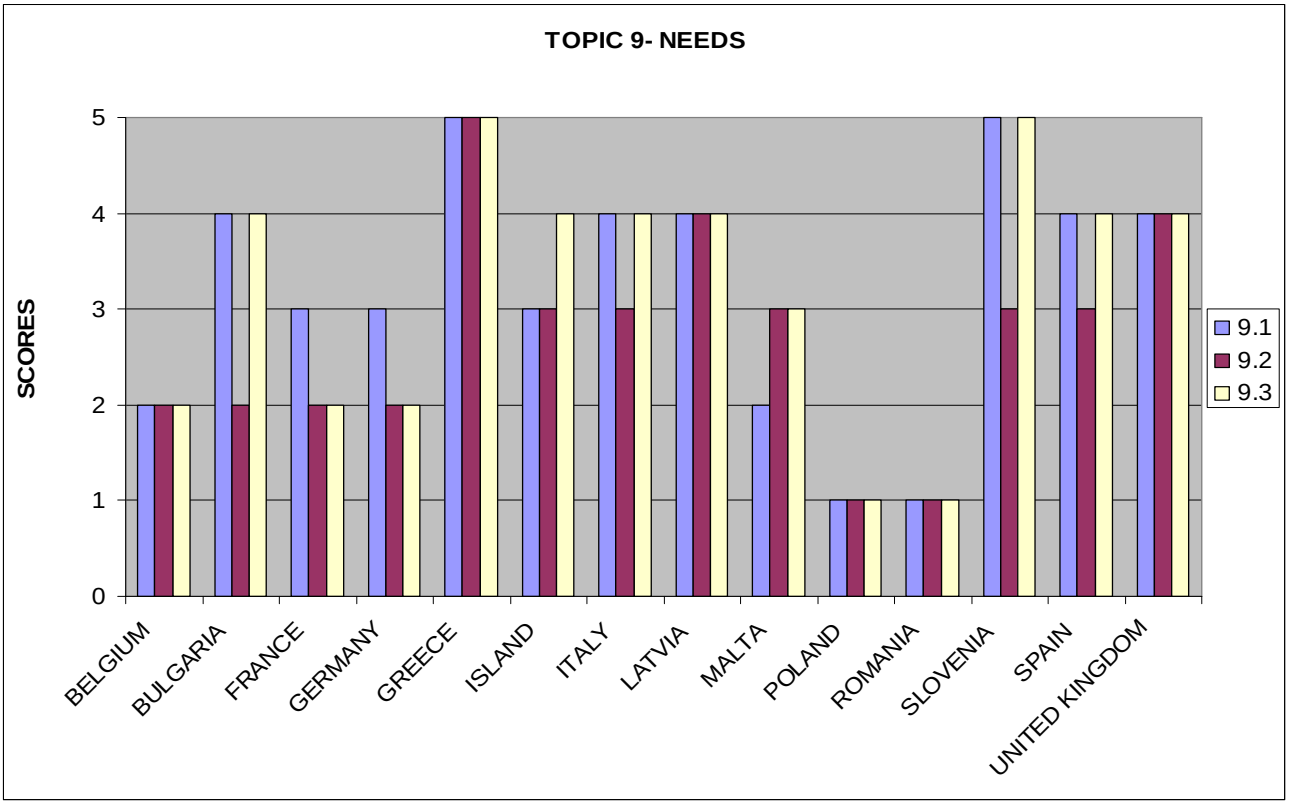
The research gaps of this topic are the following:

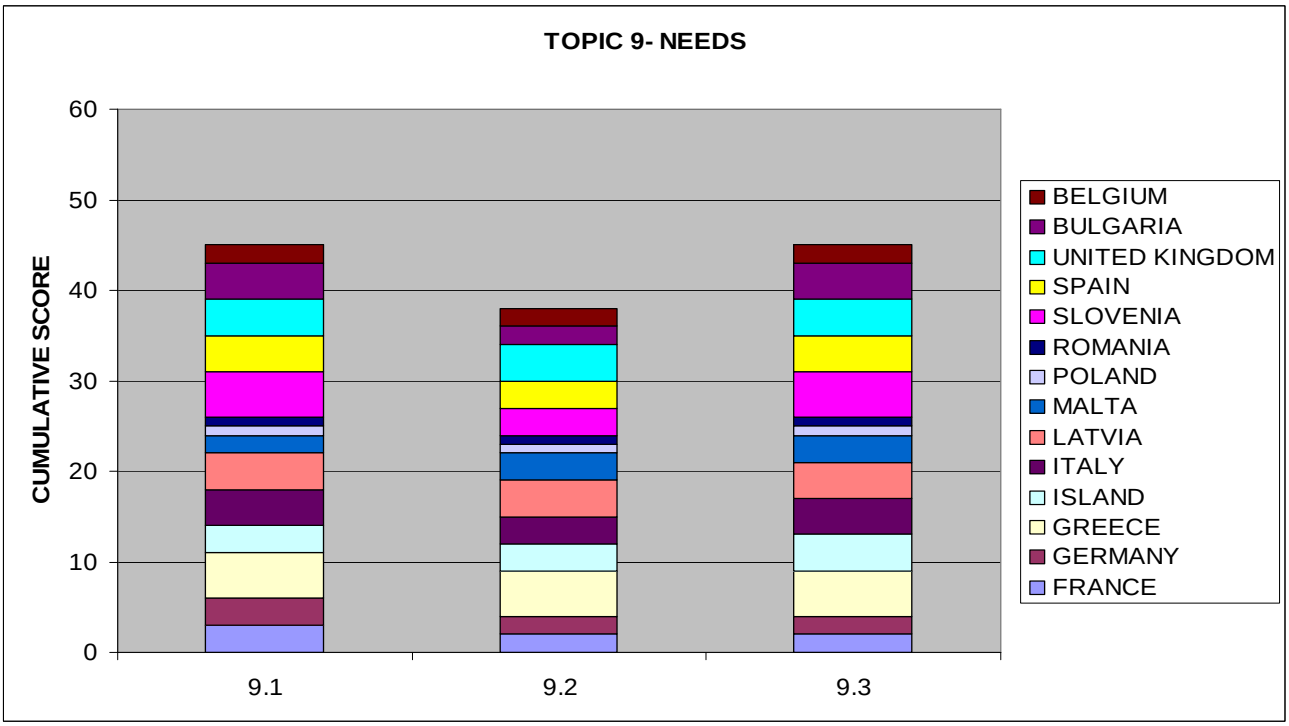
9.1 Web mapping and Web GIS innovative tools for the tele-monitoring and remote control of archaeological sites and cultural landscapes.

9.2 Development of innovative and aesthetically acceptable devices for the tele-survey of movable artefacts.

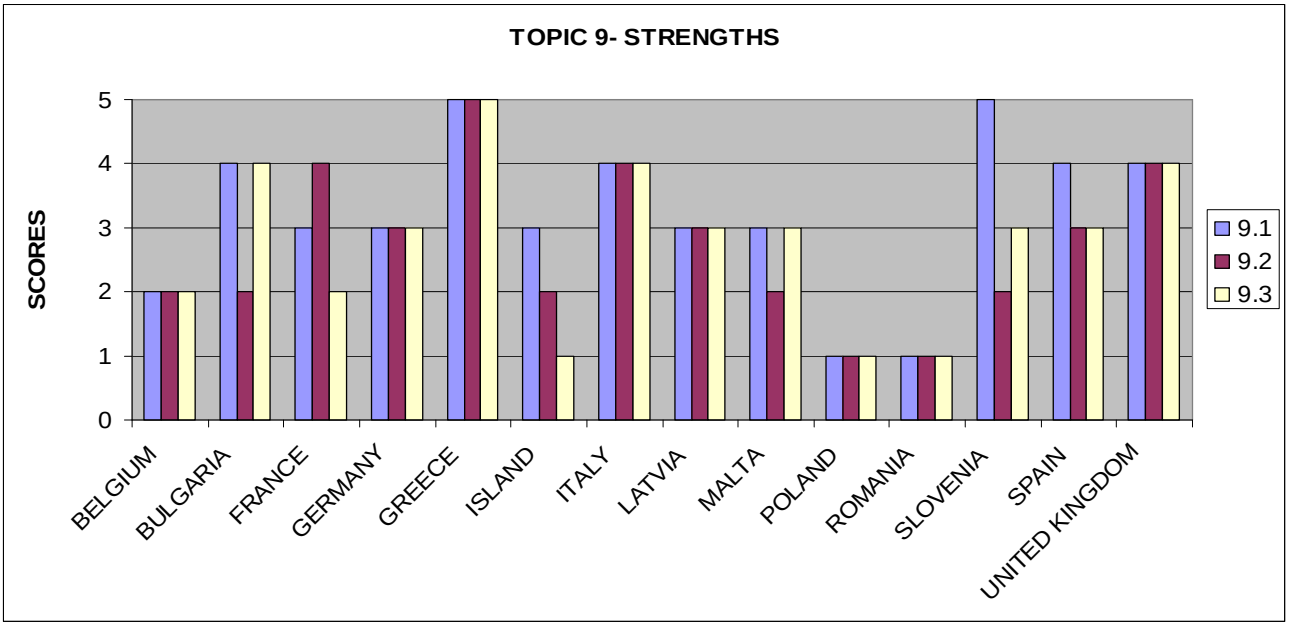
9.3 Development of advanced systems for the tele-survey and remote fruition of underwater cultural heritage.

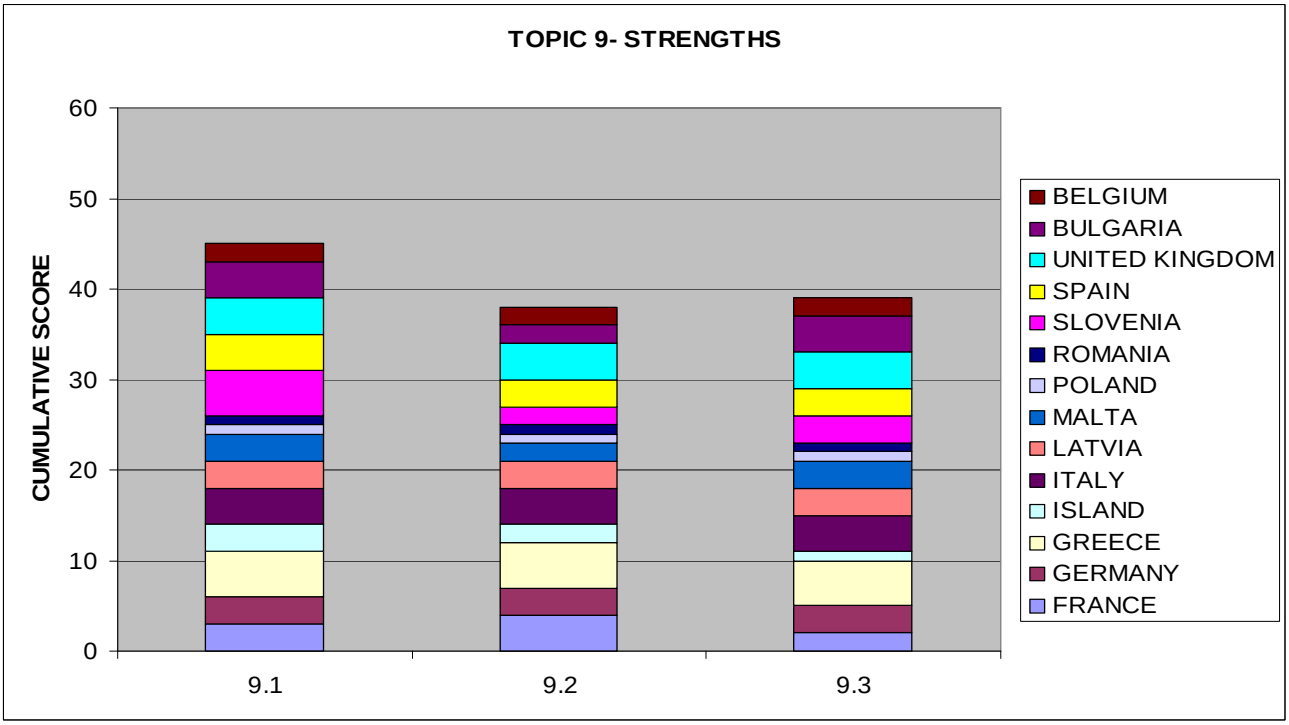
TOPIC 9: NEEDS



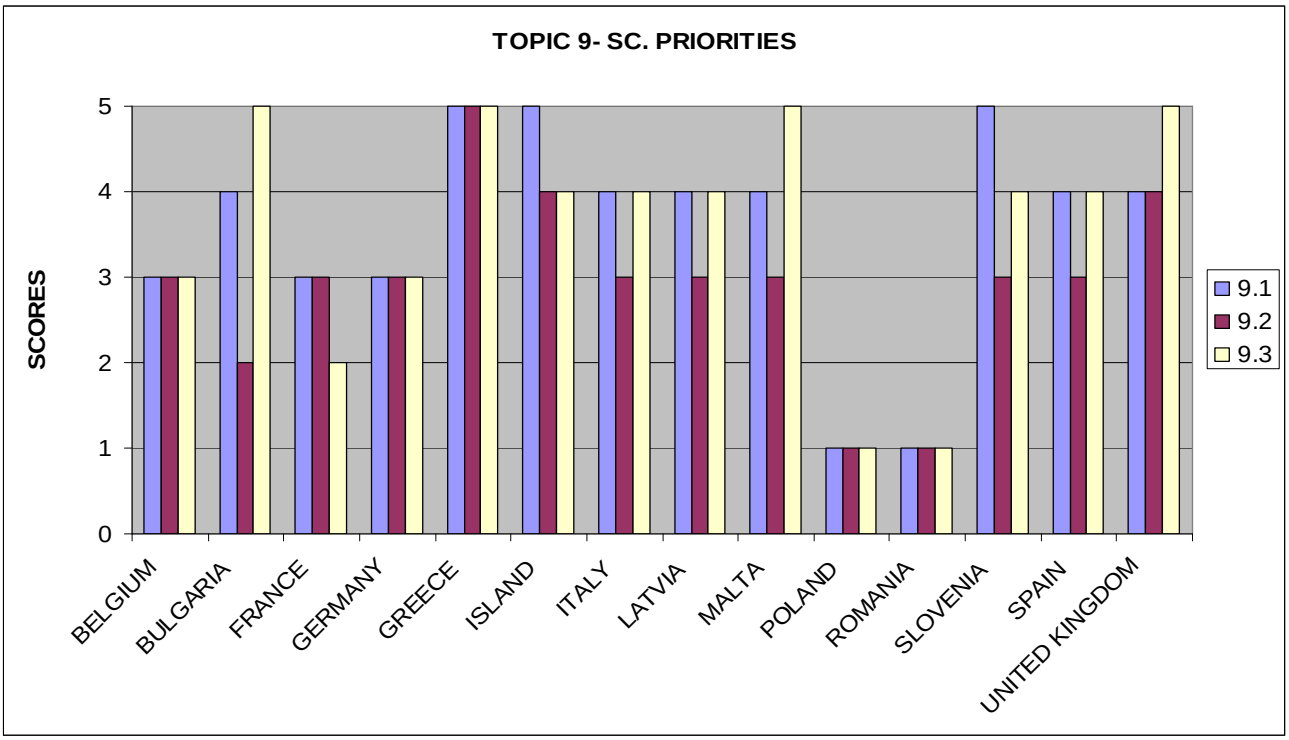


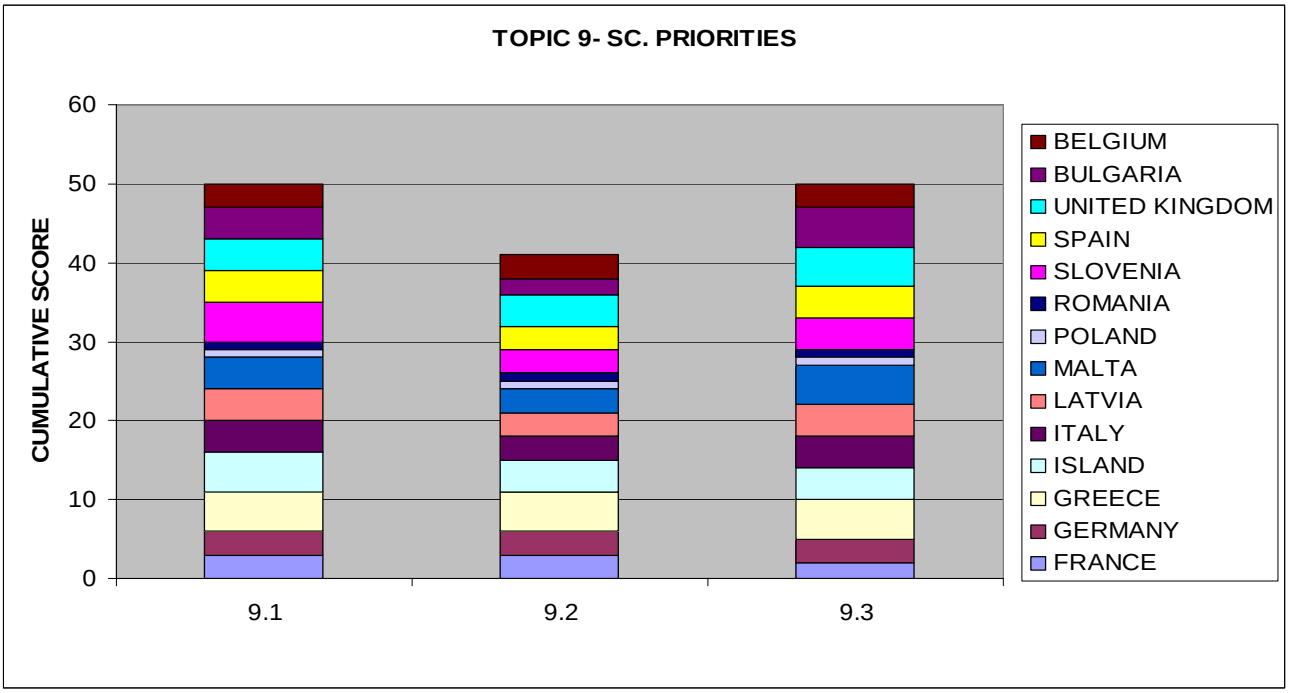
TOPIC 9: STRENGTHS





TOPIC 9: SCIENTIFIC PRIORITIES





Topic 10

Contemporary cultural heritage in spatial contexts

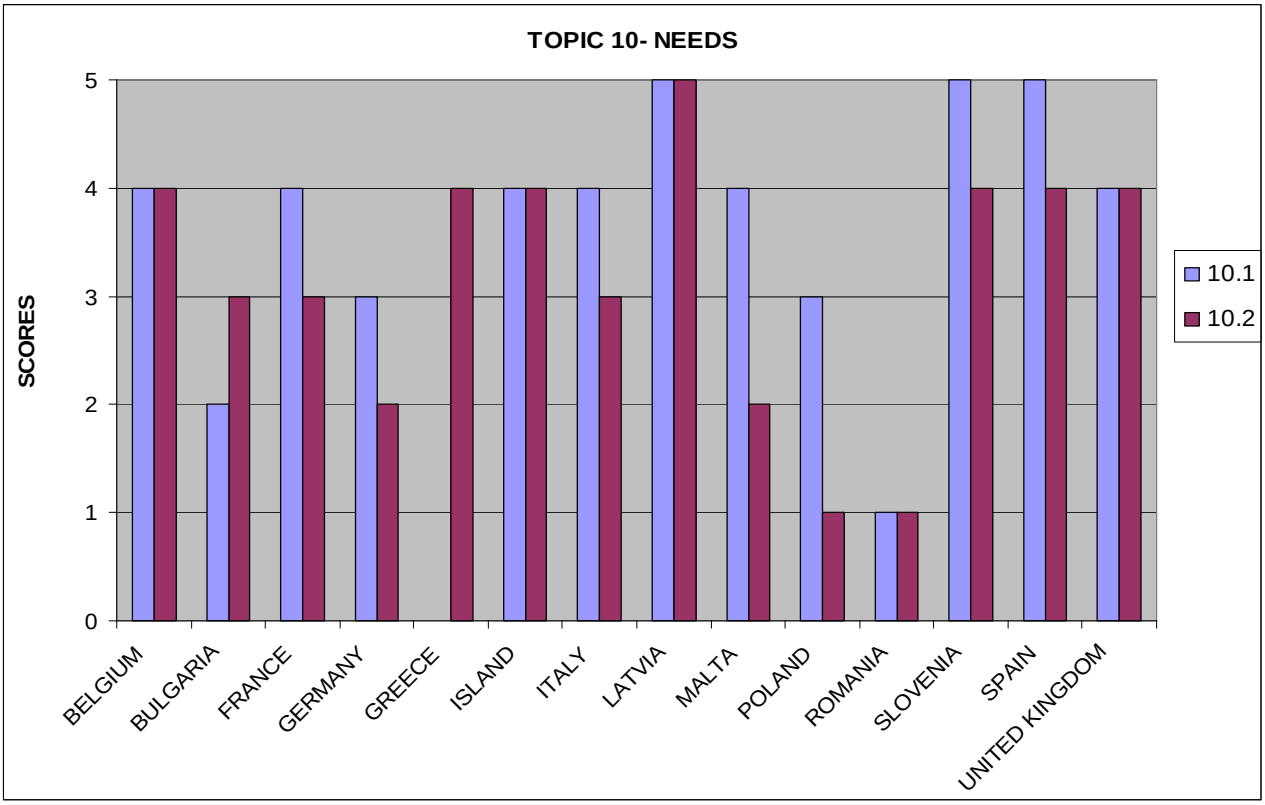
The term "Contemporary Cultural Heritage" means any witness of the culture and history of the past century. In particular, all the artefacts concerning the industrial development and the two World Wars deserve a particular care in order that information to the new generations is transmitted.
In fact, not only from the architectural point of view, but also because of their level of impact on the involved territories, many industrial and military buildings, sites and also whole landscapes (for instance the beaches and military artefacts related to the Normandy landings) represent symbols that have to be preserved for the memory of everyone. Moreover, many industrial buildings that have constituted a milestone for the social development must be preserved and, if it is possible, re-used keeping alive the memory of the place.

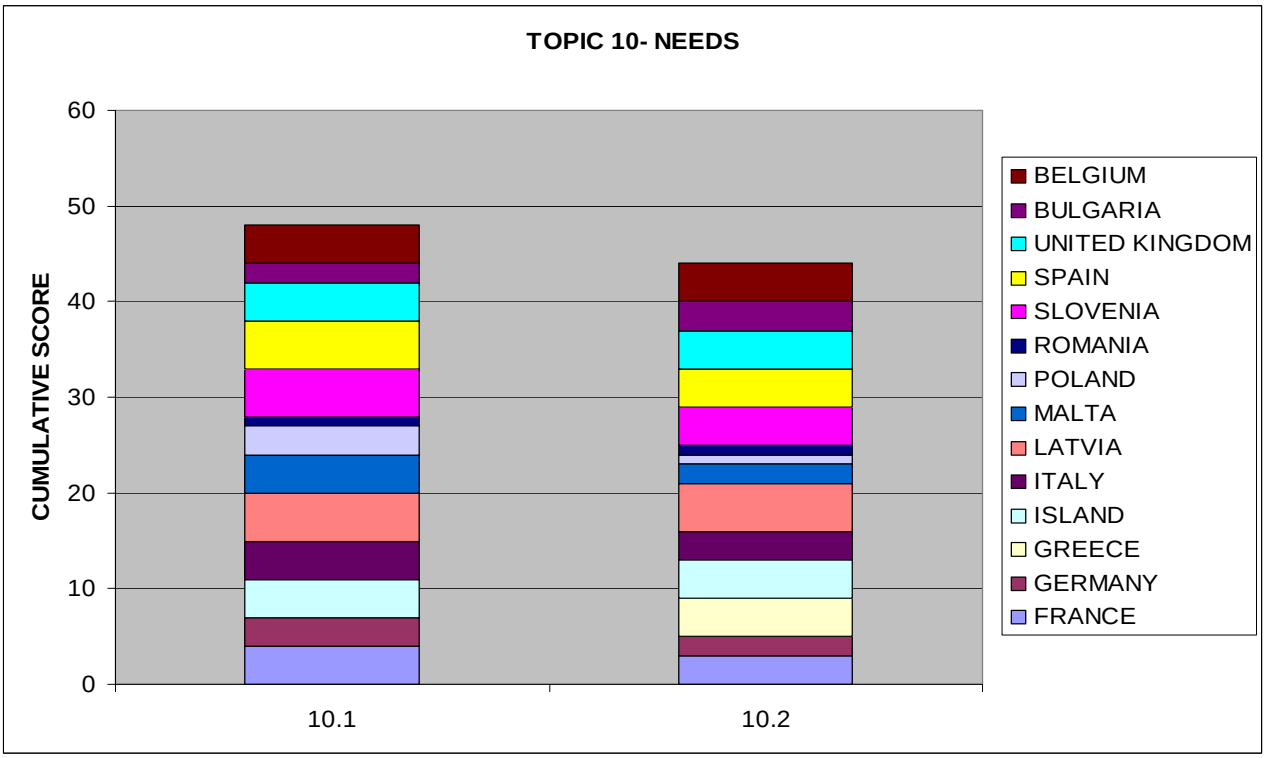
The research gaps of this topic are the following:

10.1 Preservation of industrial heritage: objects, buildings and landscapes.

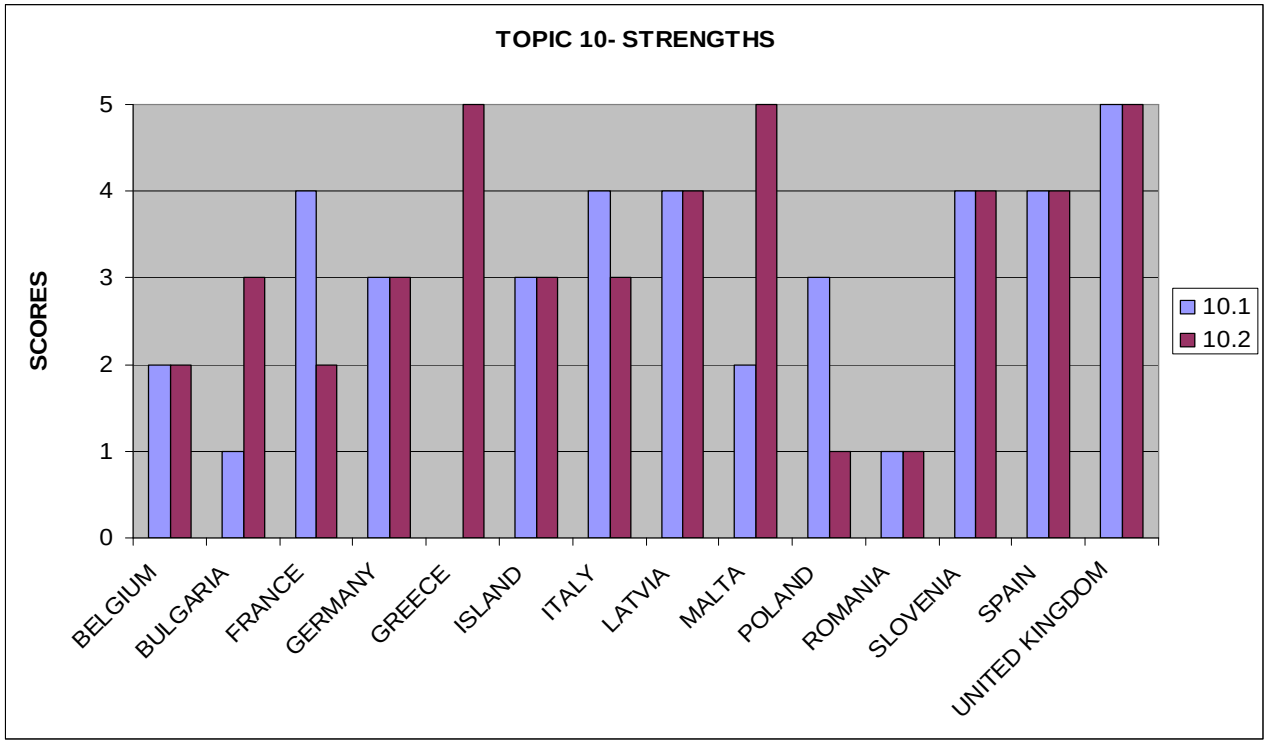
10.2 Preservation of 20th-century military heritage: objects, buildings and landscapes.

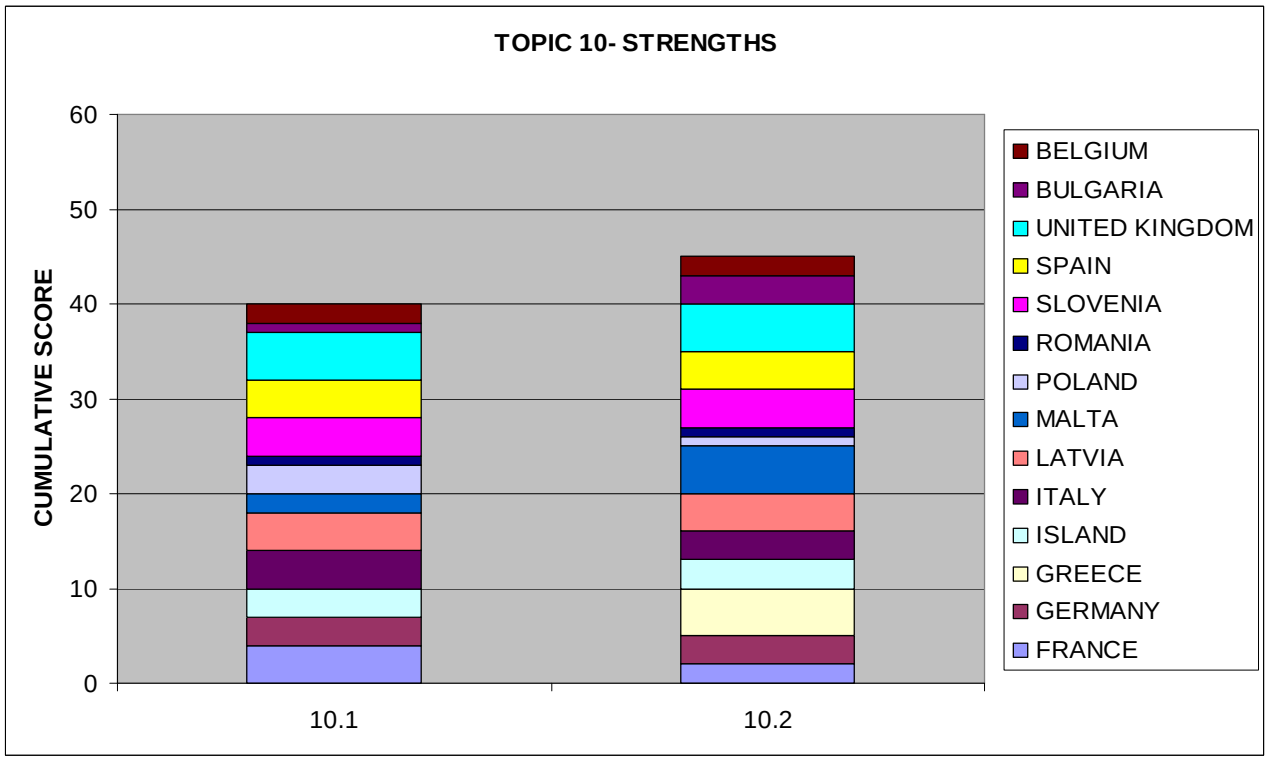
TOPIC 10: NEEDS



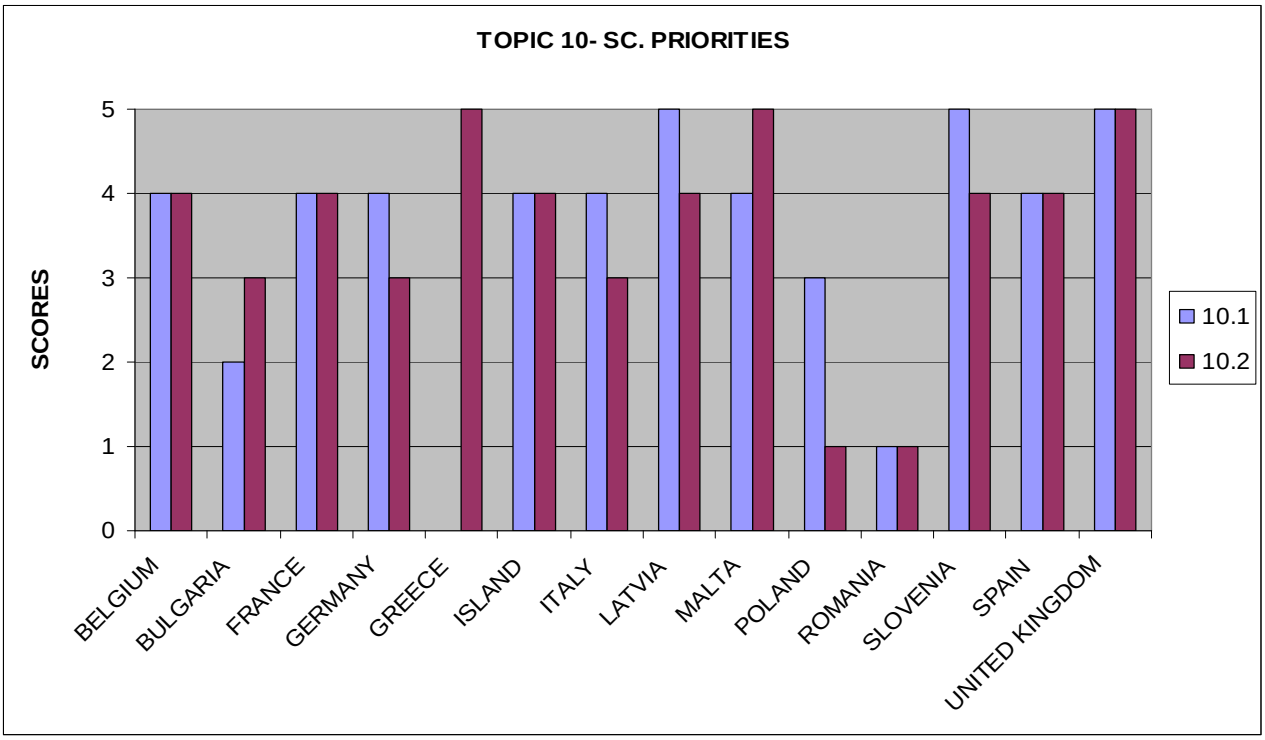


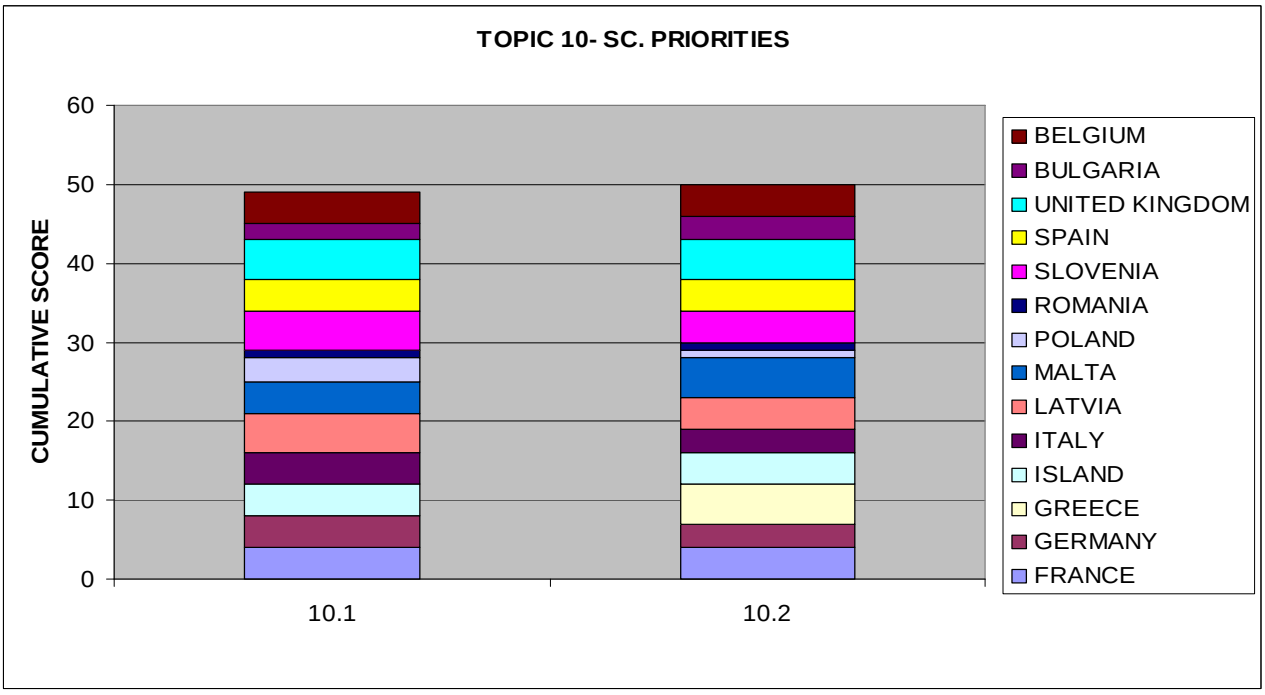
TOPIC 10: STRENGTHS





TOPIC 10: SCIENTIFIC PRIORITIES





Topic 11

Pre-normative studies for the guaranteed protection and management of tangible cultural heritage

Current standards and guidelines regulating the management of and interventions on cultural heritage are extremely diverse in European countries and needs to be unified.

Over recent years, much research work and the development of advanced technologies and tools to control the damage of precious materials have resulted in forms of cultural heritage management that respect conservations needs. In spite of this, little has been done in terms of standards and regulations at the European level.

At present, the CEN (European Committee for Standards) is recognized in the European Community as the sole body authorized to develop and set technical standards. In 2002, a creation of a new European Technical Committee 346 for Cultural Heritage (CEN/TC 346) was launched, charged with the task of proposing standards concerning the best conservation practices for movable and immovable cultural artefacts. Such standards focus on the conservation and planning of ordinary and extraordinary maintenance of cultural heritage assets. Within the objectives of CEN/TC 346 standards, attention is paid to environmental variables and the interaction of artworks with the environment.

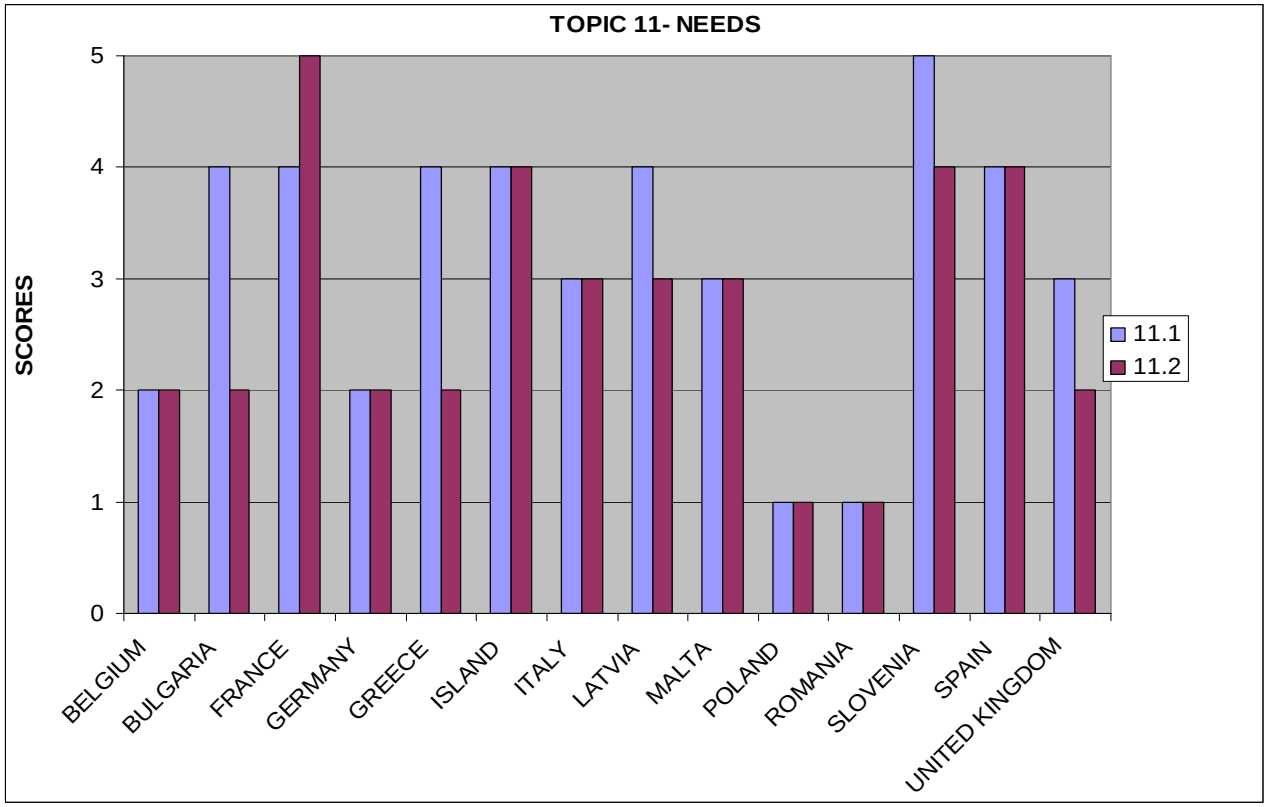
Much work remains to be done and many new commissions on different topics must be created in the future, particularly in emerging sectors, like energy efficiency.

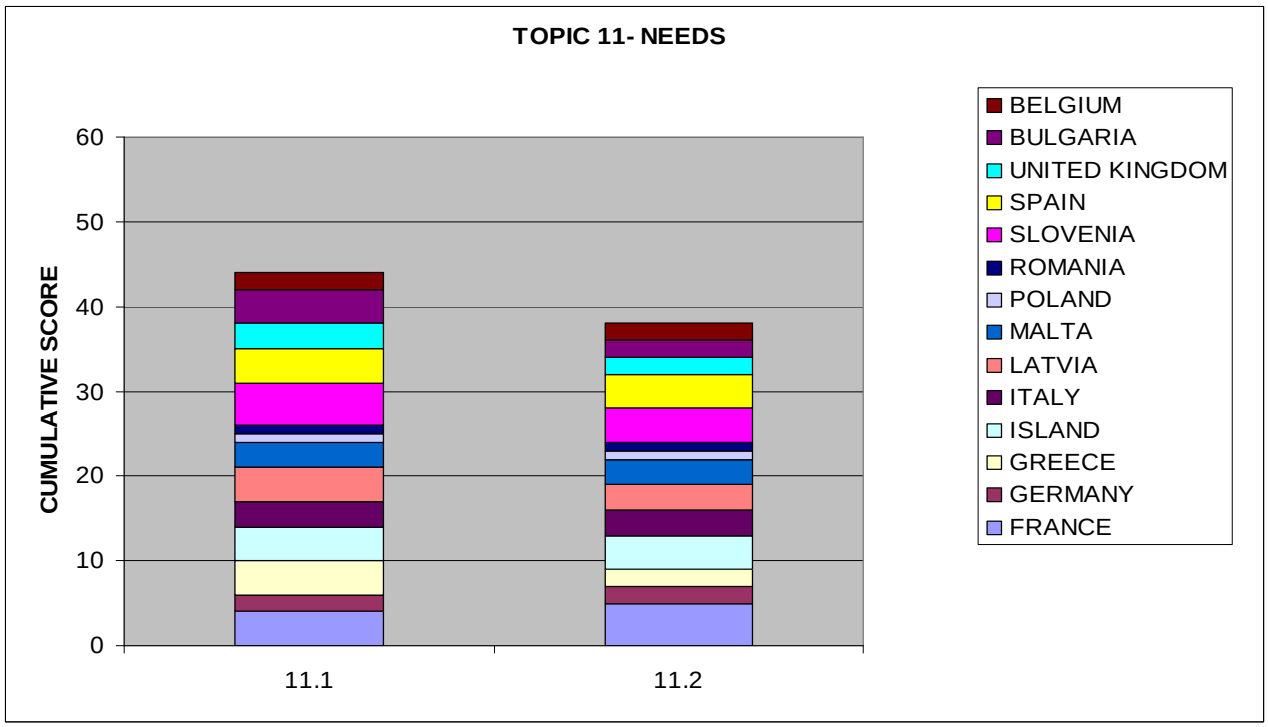
The research gaps of this topic are the following:

11.1 Development of Quality Management Systems (planning, implementation, assessment, reporting and quality improvement) addressing cultural heritage conservation processes.

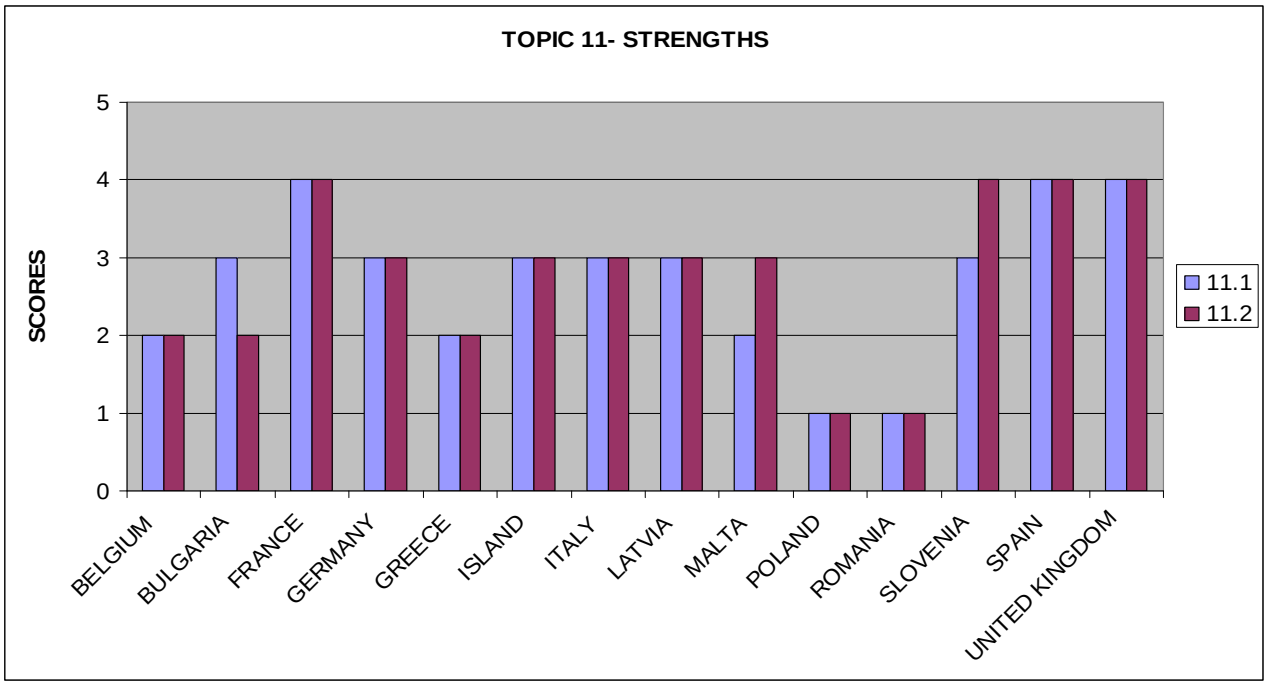
11.2 Pre-normative, goal-oriented activities to improve the reproducibility and repeatability of testing results.

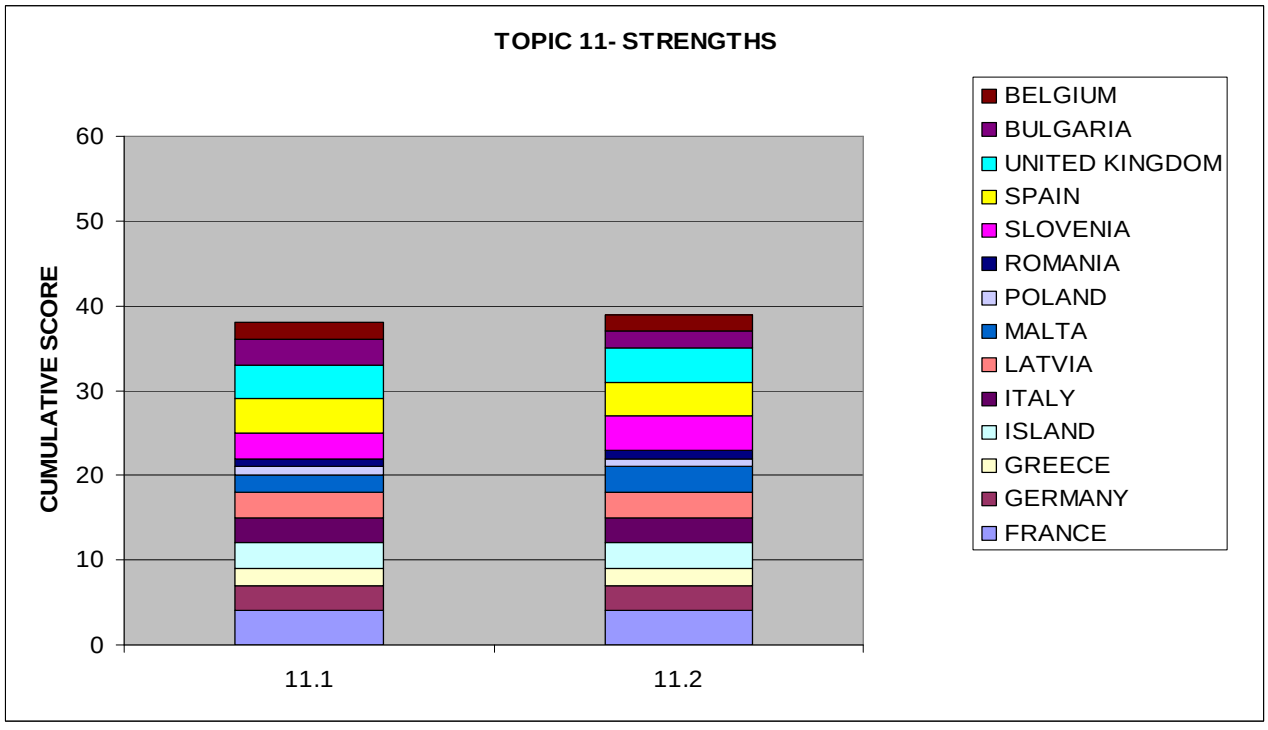
TOPIC 11: NEEDS



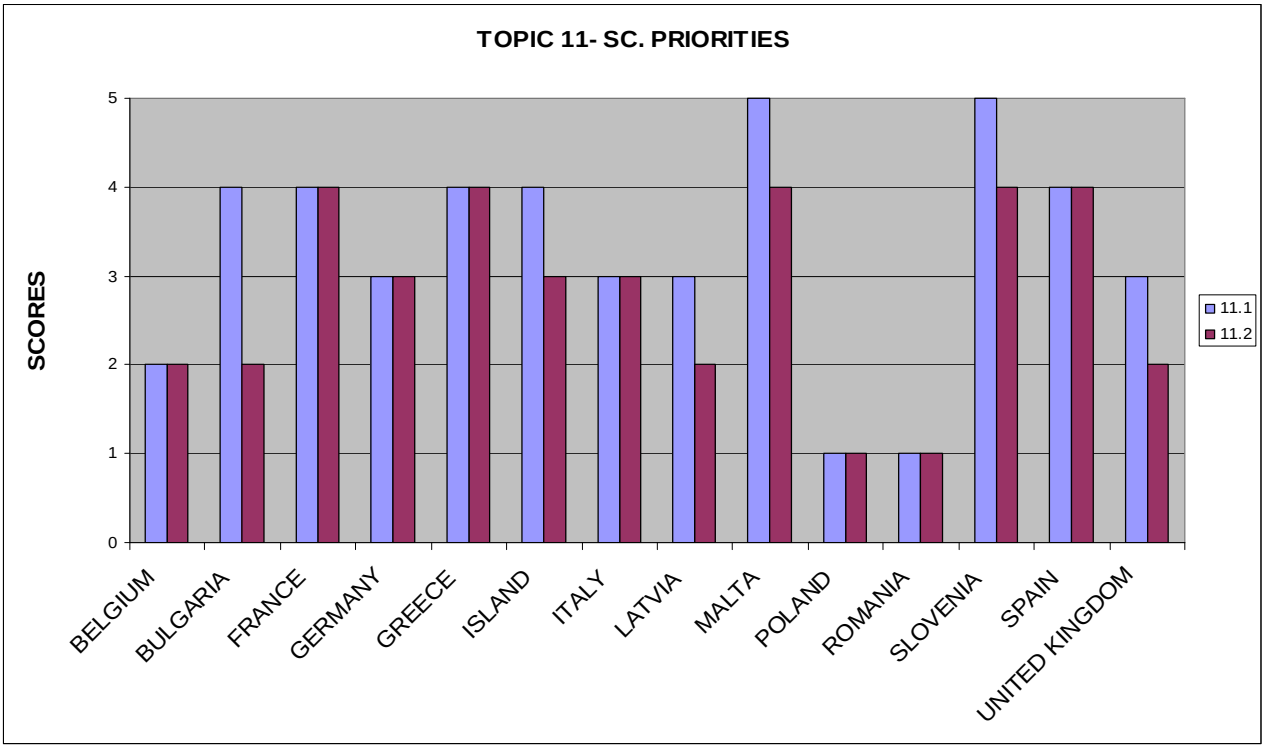


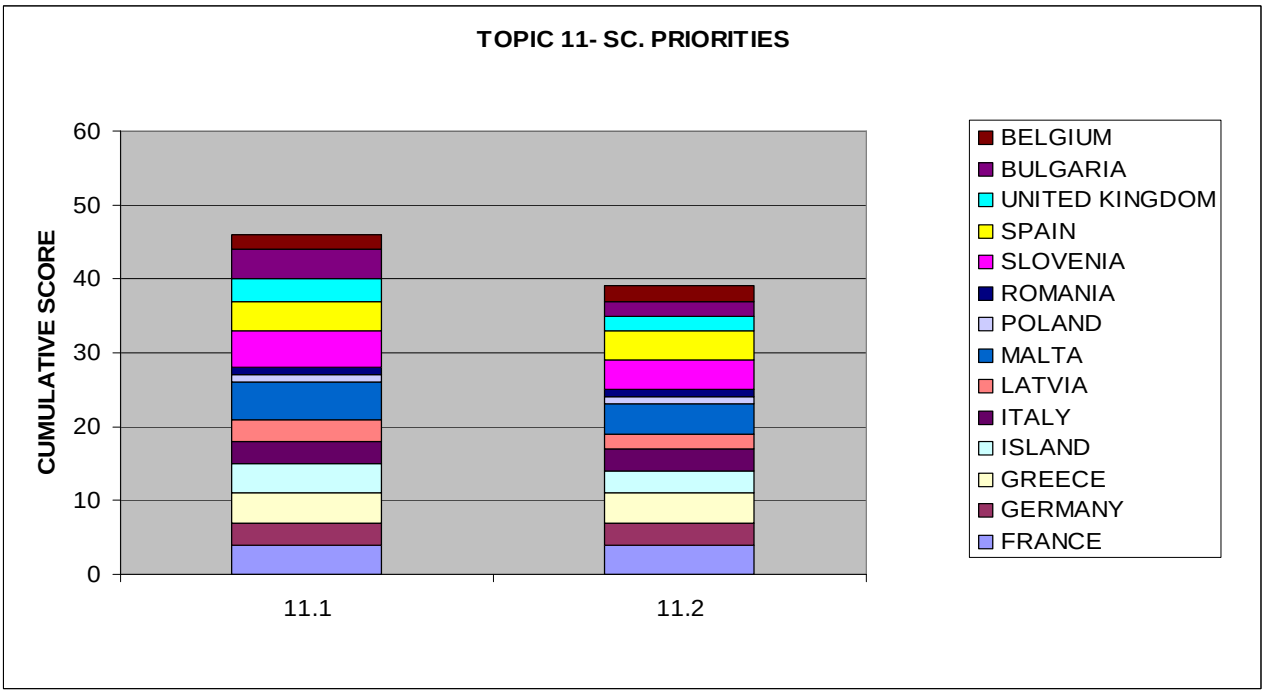
TOPIC 11: STRENGTHS





TOPIC 11: SCIENTIFIC PRIORITIES





4.COMMON NEEDS, STRENGTHS AND PRIORITIES EMERGING FROM NET-HERITAGE EVALUATION IN EUROPE

4.1 Common Needs considered in terms of research gaps existing in the specific sub topic

Table 4.1. Evaluation on "needs" of Topic 1 – 6

TOPICS	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2
BELGIUM	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
BULGARIA	1	3	1	2	4	4	2	1	5	5	3	2	3	2	2	3	2	2	2	4	2
FRANCE	5	4	4	4	4	4	5	3	5	5	3	5	5	5	5	5	5	5	3	5	5
GERMANY	3	3	3	2	4	4	2	3	3	3	2	2	3	3	2	3	3	3	3	3	3
GREECE	5	5	5	5	5	5	5	4	5	5	5	5	5	5	5	5	5	5	5	2	2
ISLAND	3	2	3	3	3	3	1	2	2	2	2	2	4	4	1	3	3	3	2	3	3
ITALY	4	4	3	3	5	4	4	3	5	4	4	4	4	4	4	4	4	4	3	4	4
LATVIA	4	3	4	4	4	4	4	4	4	4	5	4	4	4	3	4	4	3	4	5	4
MALTA	5	4	4	5	3	3	2	4	2	2	3	3	2	2	4	4	4	4	4	4	5
POLAND	1	1	1	5	5	5	1	1	3	5	1	1	1	3	1	5	5	1	1	5	5
ROMANIA	1	1	1	1	2	2	2	2	3	4	1	2	1	4	1	3	1	2	1	2	2
SLOVENIA	3	4	5	3	4	5	5	4	4	4	4	3	4	5	4	3	3	3	3	5	4
SPAIN	4	4	4	4	4	4	4	4	5	5	4	4	4	5	4	4	4	4	4	4	4
UNITED KINGDOM	3	2	5	4	2	3	2	2	3	4	4	1	2	3	3	3	3	3	2	5	5

Table 4.2. Evaluation on "needs" of Topic 7 – 11

TOPICS	7.1	7.2	7.3	8.1	8.2	8.3	8.4	9.1	9.2	9.3	10.1	10.2	11.1	11.2
BELGIUM	3	3	3	2	2	2	2	2	2	2	4	4	2	2
BULGARIA	4	2	4	4	3	5	5	4	2	4	2	3	4	2
FRANCE	5	5	5	3	2	5	3	3	2	2	4	3	4	5
GERMANY	2	2	3	2	3	3	3	3	2	2	3	2	2	2
GREECE	5	5	5	5	5	5	5	5	5	5	-	4	4	2
ISLAND	3	4	4	3	2	4	2	3	3	4	4	4	4	4
ITALY	4	4	4	4	4	4	4	4	3	4	4	3	3	3
LATVIA	4	4	4	4	4	4	4	4	4	4	5	5	4	3
MALTA	5	5	3	5	4	3	3	2	3	3	4	2	3	3
POLAND	5	1	1	5	2	5	1	1	1	1	3	1	1	1
ROMANIA	2	2	1	2	1	1	1	1	1	1	1	1	1	1
SLOVENIA	5	4	4	3	3	3	4	5	3	5	5	4	5	4
SPAIN	4	4	4	4	4	4	4	4	3	4	5	4	4	4
UNITED KINGDOM	3	3	3	1	2	2	2	4	4	4	4	4	3	2

4.2 Common strengths considered in terms of research capacity within its own country on the specific sub topic.

Table 4.3. Evaluation on "strengths" of Topic 1 – 6

TOPICS	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2
BELGIUM	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
BULGARIA	1	3	1	1	2	3	1	1	4	4	2	1	2	1	1	2	1	1	1	3	1
FRANCE	3	4	4	4	3	4	5	3	4	4	3	1	3	2	1	4	2	5	3	1	5
GERMANY	3	3	3	3	3	3	3	3	4	4	3	3	3	3	3	3	4	3	3	3	3
GREECE	5	5	4	5	2	4	5	2	4	5	2	2	4	4	5	-	-	-	-	2	2
ISLAND	3	3	3	3	4	2	2	3	4	3	3	3	3	2	1	3	3	3	4	3	3
ITALY	4	4	5	4	5	4	5	3	5	4	4	3	4	4	3	5	4	3	3	4	4
LATVIA	3	3	3	3	4	3	3	3	3	3	2	2	4	3	3	3	3	3	3	2	3
MALTA	2	1	3	1	3	3	4	2	3	3	2	3	4	3	2	2	2	1	2	2	1
POLAND	1	1	1	5	5	5	1	1	3	5	1	1	-	3	1	5	5	1	1	5	5
ROMANIA	3	1	1	1	2	3	5	1	5	5	1	1	1	5	1	3	3	2	1	2	2
SLOVENIA	3	5	4	4	4	3	3	2	3	3	3	3	4	3	4	3	3	3	3	4	4
SPAIN	4	3	4	3	4	4	4	4	5	4	4	4	4	4	4	5	4	4	4	4	4
UNITED KINGDOM	4	3	4	3	2	4	4	4	4	4	3	3	3	4	3	3	3	3	3	4	4

Table 4.4. Evaluation on "strengths" of Topic 7-11

TOPICS	7.1	7.2	7.3	8.1	8.2	8.3	8.4	9.1	9.2	9.3	10.1	10.2	11.1	11.2
BELGIUM	3	3	3	2	2	2	2	2	2	2	2	2	2	2
BULGARIA	4	1	3	3	3	4	4	4	2	4	1	3	3	2
FRANCE	4	5	5	2	2	3	3	3	4	2	4	2	4	4
GERMANY	3	3	3	3	3	3	3	3	3	3	3	3	3	3
GREECE	2	3	2	-	-	5	5	5	5	5	-	5	2	2
ISLAND	2	2	2	3	4	2	4	3	2	1	3	3	3	3
ITALY	5	4	4	5	4	4	4	4	4	4	4	3	3	3
LATVIA	3	2	2	2	2	2	3	3	3	3	4	4	3	3
MALTA	1	1	3	1	2	3	3	3	2	3	2	5	2	3
POLAND	5	1	1	5	2	5	1	1	1	1	3	1	1	1
ROMANIA	2	2	1	2	1	1	1	1	1	1	1	1	1	1
SLOVENIA	4	3	2	3	3	3	3	5	2	3	4	4	3	4
SPAIN	4	3	4	4	4	4	4	4	3	3	4	4	4	4
UNITED KINGDOM	5	5	4	3	4	4	4	4	4	4	5	5	4	4

4.3 Common Priorities considered in terms of research priority in its own country on the specific sub topic.

Table 4.5 Evaluation on "Scientific Priorities" of Topic 1 – 6

TOPICS	1.1	1.2	1.3	1.4	2.1	2.2	2.3	2.4	3.1	3.2	3.3	3.4	4.1	4.2	4.3	5.1	5.2	5.3	5.4	6.1	6.2
BELGIUM	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
BULGARIA	1	3	1	2	3	3	3	1	5	5	2	1	2	2	1	2	2	2	2	4	2
FRANCE	4	5	4	4	5	4	5	4	4	5	4	5	5	5	3	4	5	4	2	5	5
GERMANY	4	4	4	3	5	4	3	3	4	4	3	3	4	4	4	5	4	4	4	4	4
GREECE	5	5	3	5	2	5	5	2	5	5	3	3	5	5	5	5	5	4	5	2	2
ISLAND	3	5	5	4	4	3	3	4	4	4	4	2	5	2	1	3	3	3	4	5	4
ITALY	5	5	4	3	5	5	5	3	5	5	4	4	5	5	4	4	4	4	3	4	4
LATVIA	4	3	4	4	4	5	4	4	3	4	4	3	5	5	3	4	4	3	4	4	4
MALTA	4	3	3	3	4	4	5	4	4	4	4	3	4	4	4	4	4	4	4	5	4
POLAND	1	1	1	5	5	5	1	1	3	5	1	1	1	3	1	5	5	1	1	5	5
ROMANIA	1	1	1	1	4	3	1	1	3	4	1	2	1	4	1	1	3	2	1	2	2
SLOVENIA	3	4	5	3	4	4	4	2	4	4	3	2	4	5	3	3	3	3	3	5	4
SPAIN	4	4	4	4	5	4	4	4	5	5	4	4	4	5	5	3	4	4	4	4	4
UNITED KINGDOM	4	3	5	5	3	3	3	2	3	4	4	1	3	4	3	4	5	3	2	5	5

Table 4.6. Evaluation on "Scientific Priorities" of Topic 7 – 11

TOPICS	7.1	7.2	7.3	8.1	8.2	8.3	8.4	9.1	9.2	9.3	10.1	10.2	11.1	11.2	
BELGIUM	3	3	3	1	1	1	1	3	3	3	4	4	2	2	118
BULGARIA	4	2	4	4	3	5	5	4	2	5	2	3	4	2	98
FRANCE	5	5	5	2	2	5	3	3	3	2	4	4	4	4	142
GERMANY	4	3	3	4	4	3	3	3	3	3	4	3	3	3	127
GREECE	5	5	5	-	-	5	5	5	5	5	-	5	4	4	139
ISLAND	4	4	5	1	5	2	4	5	4	4	4	4	4	3	128
ITALY	4	4	4	4	4	4	4	4	3	4	4	3	3	3	142
LATVIA	3	2	4	3	3	3	4	4	3	4	5	4	3	2	129
MALTA	4	4	5	5	4	3	5	4	3	5	4	5	5	4	142
POLAND	5	1	1	5	2	5	1	1	1	1	3	1	1	1	86
ROMANIA	2	2	1	2	1	1	1	1	1	1	1	1	1	1	57
SLOVENIA	5	3	4	3	4	4	4	5	3	4	5	4	5	4	132
SPAIN	4	4	4	3	4	4	4	4	3	4	4	4	4	4	142
UNITED KINGDOM	3	4	4	2	2	2	2	4	4	5	5	5	3	2	121

5. CRITERIA FOR IDENTIFICATION OF COMMON RESEARCH GAPS AND PRIORITIES

Following the criteria that is the identification of common RTD strategies to be conducted on sub-topics with scores from 4 to 5 (that is with only one score ≤ 3 the sub topics are excluded), there is only 1 sub topic that fulfills this criteria which is subtopic:

3.2 Non invasive instruments and methodologies for diagnosis and monitoring.

One sub-topic which received scores 4 or 5 by 12 countries out of 14, that is

6.1 Development of strategies and procedures for storage and preservation of multi media supports and readability of the stored content.

There are 3 sub-topics which have received score 4 or 5 by 11 countries out of 14, that are:

2.1 Multidisciplinary approach to synergic interactions between environment and materials.
4.2 Development or improvement of restoration and conservation products with low impact on the historical content of artefacts.
6.2 Innovative proposals for the conservation and durability of contemporary art materials (i.e. plastics, ceramics, new alloys, glasses, new dyes, concrete, mortars).

There are additional 7 sub-topics which have received score 4 or 5 by 10 countries out of 14, that are:

2.2 Interactions between specific environmental factors (temperature, humidity, etc.) and complex artefacts made in different materials.
3.1 Portable instruments for in situ measurements.
4.1 Development of new and appropriate materials and technologies for the upgrading or construction of conservation buildings
5.2 Innovative solutions for compatibility, durability and reversibility of new materials and treatments
7.1 Development of management systems for quality and sustainability of indoor/outdoor cultural heritage environments.
7.3 Development of scientific criteria and tools to measure and regulate tourists' impact on cultural heritage sites.
10.1 Preservation of industrial heritage: objects, buildings and landscapes.

There are additional 6 sub-topics which have received score 4 or 5 by 9 countries out of 14, that are:

1.1 Critical levels of synergic pollutants in a context of environmental conditions (indoor/outdoor).
1.3 Impact of climate change on materials and structures and adaptation of technologies to mitigate negative effects.
5.1 New solutions for development, assessment and reporting of analysis protocol for the time effects evaluation of treatments (e.g. cleaning, biocides…) and materials.
9.1 Web mapping and Web GIS innovative tools for the tele-monitoring and remote control of archaeological sites and cultural landscapes.
9.3 Development of advanced systems for the tele-survey and remote fruition of underwater cultural heritage.
10.2 Preservation of 20th-century military heritage: objects, buildings and landscapes.

There are additional 5 sub-topics which have received score 4 or 5 by 8 countries out of 14, that are:

1.2 Preventive approach against extreme natural events (seismic events, flooding, storms, landslides, fire), and first aid measures
1.4 Changes in hydrogeological conditions in the ground : technologies for stabilising the historic structures.

2.3 Best conservation practices against specific attacks (physical, chemical, biological, ..) to prevent damage on specific materials.

3.3 Intelligent multi-sensor systems for early warning (modelling, local network for monitoring systems), including telediagnosis.

8.4 Techniques for inventory, cataloguing and traceability of cultural heritage objects.

The evaluation is highly variable among countries: some countries have indentified a limited number of scientific priorities comparing with others. Table 4.6 reports the Total country score which varies from 57 to 142

The present report summarises the evaluation emerged by the consultation of the countries participating to net-heritage on research gaps and priorities.

Deliverable 3.2 will elaborate the scientific priorities data in view of identifying complementarities and the potential networking among national research programmes

6. List of Experts Panels

France

Ludovic Belot-Gurlet: **CNRS, LADIR, UMR 7075**

Anne Cartier-Bresson- **Atelier de Restauration et de Conservation des Photographies de la Ville de Paris (ARCP)**

Nelly Cauliez- **Archives Nationales, département de la conservation**

Thomas Calligaro, Etienne Feau, Maria Guerra Maria: **C2RMF**

Pierre Cazenave: **DRAC Charente Poitou**

Anne Chabas: **Paris XII, LISA**

Cécile Cren, Martine Regert: **CNRS**

Laurence Galoisy: **Laboratoire de Minéralogie-Cristallographie LMCP, UMR 7590**

Jean-Michel Geneste: **Centre National de La Préhistoire**

Géraldine Guillaume- Chavannes **: MNAM-CCI Centre Pompidou, Service de restauration des œuvres**

Thierry Lalot: **Université Paris1 Sorbonne UFR03 histoire de l'art et archéologie**

Stéphane Lequien: **Nanostructures and Magnetism Laboratory (NM), INAC / SP2M**

Emmanuel Maurin, François Mirambet: **LRMH**

Marie-Christine Papillon: **INP Laboratoire**

Jacques Philippon: **DRAC nord Pas de Calais**

Guirec Querre: **UMR6566 Centre de Recherche en Archéologie, Archéosciences, Histoire (CREAAH)**

Malalanirina Rakotonirainy, Françoise Vienot: **CRCC**

Sandrine Therias-Morlat**: Laboratoire de Photochimie Moléculaire et Macromoléculaire UMR6505**

Sophia Antipolis : **CEPAM - Centre d'Etudes Préhistoire, Antiquité, Moyen-Age UMR 6130 Université de Nice**

Beatrice de Pastre, Nicolas Ricordel: **CNC /Centre national de la cinématographie et du film français**

Germany

Johanna Leissner: **Fraunhofer Gesellschaft Brüssel**

Lutz Töpfer: **Deutsche Bundesstiftung Umwelt**

Michael Auras: **Institut für Steinkonservierung**

Paul Bellendorf: **Fraunhofer Institut für Silicatfotschung ISC**

Stefan Brüggerhoff: **Deutsches Bergbau-Museum**

Rainer Drewello: **Universität Bamberg, Restaurierungswissenschaften in der Baudenkmalpflege**

Karin Drda-Kühn: **Kultur und Arbeit e.V., media k GmbH**

Gerhard Eggert: **Staatliche Akademie der Bildenden Künste, Stuttgart, Prof. für Restaurierung**

Christoph Franzen: **Institut für Diagnostik und Konservierung an Denkmalen, Sachsen und Sachsen-Anhalt**

Robert Fuchs: **CICS Cologne Institute for Conservation Sciences, Restaurierung und Konservierung von Schriftgut, Graphik und Buchmalerei**

Wolfgang Karl Göhner: **Deutsches Nationalkomitee für Denkmalschutz (DNK)**

Gabriele Hochschule für Technik: **Hochschule für Technik Stuttgart**

Georg Haber: **Haber & Brandner GmbH**

Oliver Hahn: **BAM - Bundesanstalt für Materialforschung und -prüfung**

Martin Hoernes: **Kulturstiftung der Länder**

Wolf Ibach: **Ibach Steinkonservierung GmbH**

Erich Jelen: **Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik UMSICHT**

Herbert Juling: **Institut für Werkstofftechnik/Amtliche Materialprüfungsanstalt**

Roswitha Kaiser: **LWL-Amt für Denkmalpflege in Westfalen**

Ruth Keller-Kempas: **Fachhochschule für Technik und Wirtschaft Berlin**

Werner Koch: **Fachhochschule Potsdam, Studiengang Restaurierung**

Robert Krah: **Krah & Grote Messtechnik**

Steffen Laue: **Fachhochschule Potsdam, Studiengang Restaurierung**

Roland Lenz: **Staatliche Akademie der Bildenden Künste, Stuttgart, Prof. für Restaurierung**

Hans Lochmann: **Deutscher Museumsbund (DMB), Museumsverband für Niedersachsen und Bremen e.V.**

Martin Mach: **Bayerisches Landesamt für Denkmalpflege**

Wolfgang Nedon: **Fraunnhofer-Institut für Elektronenstrahl- und Plasmatechnik, FEP**

Ernst Pernicka: **Eberhard Karls Universität Tübingen, Institut für Ur- und Früh-geschichte und Archäologie des Mitttelalters**

Karin Petersen: **HAWK Hochschule für Angewandte Wissenschaft und Kunst**

Mr Martin Pracher: **Consolidas Kunst & Kultur GmbH**

Holger Reinhardt: **Thüringisches Landesamt für Denkmalpflege und Archäologie Bau- und Kunstdenkmalpflege**

Sabrina Rota: **Fraunhofer-Institut für Silicatforschung, Außenstelle Bronnbach**

Hans-Ewald Schneider: **Hasenkamp Holding GmbH**

Michael Sietz: **Deutsches Schiffahrtsmuseum, DSM**

Stefan Simon: **Rathgen-Forschungslabor Staatliche Museen zu Berlin**

Manfred Torge: **BAM- Bundesanstalt für Materialforschung und -prüfung**

Ursula Warnke: **Deutsches Schiffahrtsmuseum, DSM**

Angela Weyer: **Hornemann Institut FH Hildesheim/Holzminden/Göttingen, Fakultät Erhaltung von Kulturgut**

Greece

Elena Korka, Aspasia Gioka, Glykeria Gkika, Sophia Chatzidi, Nikos Minos, Kiriaki S.

Polykreti, Maria Krini, Gregory Tsokas- **Hellenic Ministry of Culture**

Yannis Maniatis- **Institute of Materials Science, National Centre for Scientific Research "Demokritos"**

Island

Kristin Huld Sigurdardottir- **Archaeological Heritage Agency of Iceland**

Nikulás Úlfar Másson- **Architectural Heritage Board**

Ragnheiður H Þórarinsdottir- **Ministry of Education and Culture**

Agnes Stefánsdóttir - **Archaeological Heritage Agency of Iceland**

Italy

***Consultation Panel*:**

Antonia Recchia, Rosanna Binacchi, Gisella Capponi, Isabella Lapi, Armida Batori, Patrizia Bianconi, Stefania Celentino, Mariateresa Di Dedda - **MIBAC- Ministero dei Beni e delle Attività Culturali**

Maria Uccellatore, Aldo Covello, Cristina Sabbioni, Laura Tinelli - **MIUR- Ministero dell'Istruzione, Università e Ricerca**

Maria Mautone, Giuseppe Cavarretta, Massimo Inguscio, Claudio Bertoli, Francesco Beltrame - **CNR- Consiglio Nazionale delle Ricerche**

Antonio Di Lorenzo - **ENEA- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile**

***Technical Panel*:**

Marina Bicchieri, Annamaria Giovagnoli, Patrizia Bianconi, Stefania Celentino, Mariateresa Di Dedda - **MIBAC- Ministero dei Beni e delle Attività Culturali**

Cristina Sabbioni, Aldo Covello, Laura Tinelli - **MIUR- Ministero dell'Istruzione, Università e Ricerca**

Roberto Vinci, Adriana Bernardi, Laura Moltedo, Paola Moscati, Mauro Bacci - **CNR- Consiglio Nazionale delle Ricerche**

Antonio Di Lorenzo - **ENEA- Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile**

Latvia

Janis Krastins, Janis Lejnieks, Inta Vitina - **Riga Technical University**

Ojars Sparitis - **Art Academy of Latvia**

Andris Sne - **University of Latvia**

Ruta Kaminska - **State Inspection for heritage protection of Latvia**

Malta

Claire Baluci, Ray Bondin, Raymond Jones: **Heritage Malta**

Martina Caurana, Luciano Mule Stagno: **Other contributors to the evaluation**

Poland

Małgorzata Bociąga, Piotr Majewski, Zbigniew Maj- **Ministry of Culture and**

National Heritage

Pawel Karaszkiewicz, Jadwiga Łukaszewicz, Bogumiła Rouba,

Iwona Szmelter- **Higher Education Institutions educating conservators**

Łukasz Bratasz , Roman Kozłowsky, Tomasz Łojewski, Gerard, Śliwiński- **Other scientific institutions**

Dorota Ignatowicz-Woźniakowska, Katarzyna Ślaska, Janusz Trupinda- **End-users**

Włodzimierz Gajewsky, Marcin Kozarzewski- **Companies of the heritage protection sector**

Spain

Researchers National Research Council

Felipe Criado-Boado, Rafael Fort, Adolfo C. Iñigo Iñigo: **(CSIC)**

Researchers from Universities

Pedro Arias Sánchez - **Universidad de Vigo**

Isabel Baez - **Universidad Complutense de Madrid**

Joaquín Barrio- **Universidad Autónoma de Madrid**

Gema Campo- **Universidad de Barcelona**

Josep Gisbert Aguilar- **Universidad de Zaragoza**

Teresa Espejo Arias- **Universidad de Granada**

José Francisco García Martínez- **Universidad de Barcelona**

Antonio Herranz Gismero- **UNED**

Sergio Ruiz Moreno- **Universidad Politécnica de Cataluña**

Margarita San Andrés- **Universidad Complutense de Madrid**

Santiago Sánchez Beitia- **Universidad del País Vasco**

Miguel A. Respaldiza- **Universidad de Sevilla**

Stakeholders

Marian del Egido- **Instituto del Patrimonio Cultural de España, IPCE**

Jorge García Tejedor- **Museo Nacional Centro de Arte Reina Sofía**

Emilio Cano Díaz, Blanca Ramírez Barat - **Ministry of Science and Innovation (MICINN)**

United Kingdom

May Cassar- **University College London**

Peter Brimblecombe- **University East Anglia**

Members of the Science and Heritage Advisory Board:

Heather Viles - **Oxford University**

Nigel Llewellyn - **Tate**

Chris Scull- **English Heritage**

Dana Arnold- **University of Southampton**

Nancy Bell- **The National Archives**

Simon Cane- **Birmingham Museums and Art Gallery**

Ingval Maxwell OBE- **Historic Scotland**

Tadj Oreszczyn- **University College London**

David Saunders- **The British Museum**

Norman Tennent**- Fyne Conservation Services**