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

NET-HERITAGE

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

Deliverable 3.2.

Report on the possible convergence of RTD programmes and planning of common national research strategies in this domain.

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Start date of project: October 2008 Duration: 3 Years

Ministry of Cultural Heritage and Activities (Italy)

Project coordinator: Antonia Pasqua Recchia

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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)	

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1. **Executive summary**

In Task 3.2 the results obtained in the deliverable 3.1 were elaborated in order to give evidence to the national distribution of needs and competence and to identify convergence on common priorities.
Starting from the working key words (needs, strengths, scientific priorities) given by the net-heritage partnership different criteria were defined to identify the results of the evaluation provided by the member states' experts involved in NET-HERITAGE.
A great attention was given to find the best and simple way to express transferable synthesis of the expression of interest, either from each of the identified criteria, either comparing each other. In detail it was represented:

- the cumulative scores for each subtopic of needs, strength and priority (see section 3)
- the relation between needs and strengths evidencing differences and convergences (sections 4 and 5)

Finally, three thresholds for common priority identification were agreed, as high, medium and low priorities.
Focusing on the highest scores and levels, twelve subtopics were identified as scientific main priorities.
This list of subtopics will be considered a part of the starting framework to develop decisions and research actions. It could be noted that the majority of these subtopic assess a high concentration of interest and competencies among the European countries. This process will assure in advance successful outcome of the future research common initiatives.

2. **Process description**

Within Task 3.1 of WP3 on Strategic Activities, the research topics and subtopics were identified by Partners and they were evaluated with 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*

In the following tables topics and subtopics as well as the results of the evaluation process are summarized following Deliverable 3.1 "Report on common research gaps and priorities".

In Task 3.2 the results were elaborated in order to give evidence to the geographic distribution of needs and competence and to identify convergence on common priorities.

Section 3 shows the cumulative scores for each subtopic of needs, strength and priority.

Sections 4 and 5 report the relation between needs and strength evidencing differences and convergences among NET HERITAGE Partners.

In section 6 three thresholds for common priority identification are proposed, as high, medium and low priorities.

LIST of TOPIC and 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 artefacts.
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.		

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

Table 2.1 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 2.2 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

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2.2 Strengths considered in terms of research capacity within its own country on the specific sub topic.

Table 2.3 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 2.4 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

2.3 Priorities considered in terms of research priority in its own country on the specific sub topic

Table 2.5 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 2.6 Evaluation on "Scientific Priorities" of Topic 7 – 11

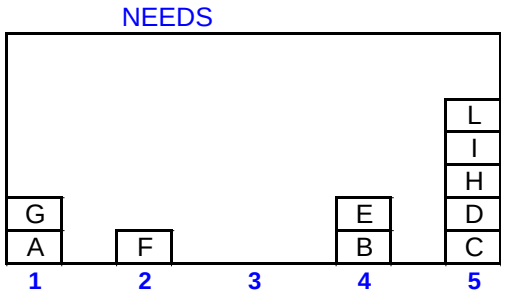
TOPICS	7.1	7.2	7.3	8.1	8.2	8.3	8.4	9.1	9.2	9.3	10.1	10.2	11.1	11.2	
BELGIUM	3	3	3	1	1	1	1	3	3	3	4	4	2	2	118
BULGARIA	4	2	4	4	3	5	5	4	2	5	2	3	4	2	98
FRANCE	5	5	5	2	2	5	3	3	3	2	4	4	4	4	142
GERMANY	4	3	3	4	4	3	3	3	3	3	4	3	3	3	127
GREECE	5	5	5	-	-	5	5	5	5	5	-	5	4	4	139
ISLAND	4	4	5	1	5	2	4	5	4	4	4	4	4	3	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

3. Cumulative Histogram of needs, strengths and priorities:

The cumulative histogram of needs, strengths and priorities shows in abscissa the 1-5 scores for each defined subtopic and in correspondence of each score there is the country that assigned its specific score.

For examples if the countries A,B,C,D,E,F,G and H gave the following scores:

country	Score needs
A	1
B	4
C	5
D	5
E	4
F	2
G	1
H	5
I	5
L	5

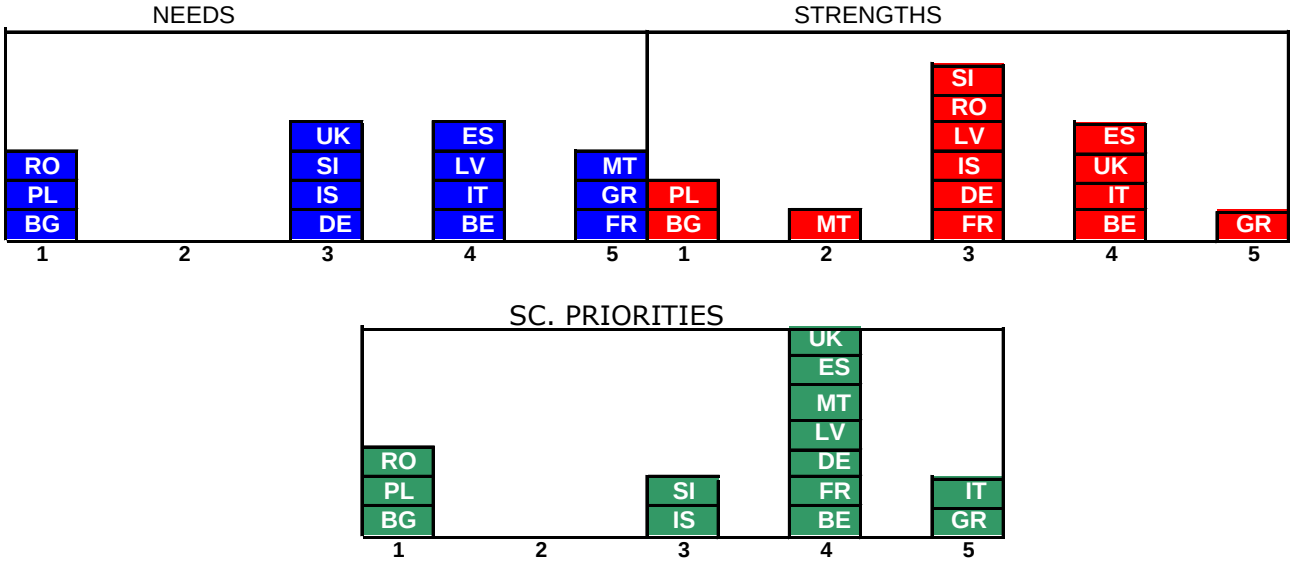


It results that: countries A and G gave score 1, the county F the score 2, the countries Band E score 4 and C, D, H, I and L score 5. This example show that the countries C,D and H have big needs, A and G less needs in the specific subtopic.

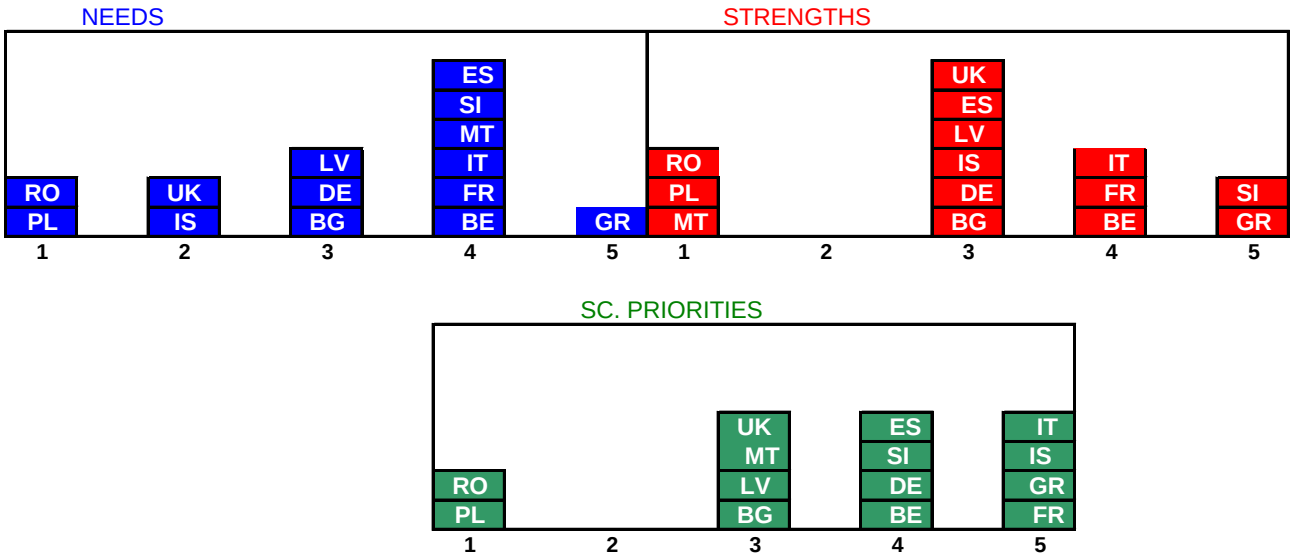
For the three categories, needs, strengths or priorities this permits to identify in the specific sub-topics:

- the countries with the higher needs
- the strongest countries for each scientific field
- the geographical distribution of the priorities
- the identification of coupling of the countries with high needs with countries with high strengths.

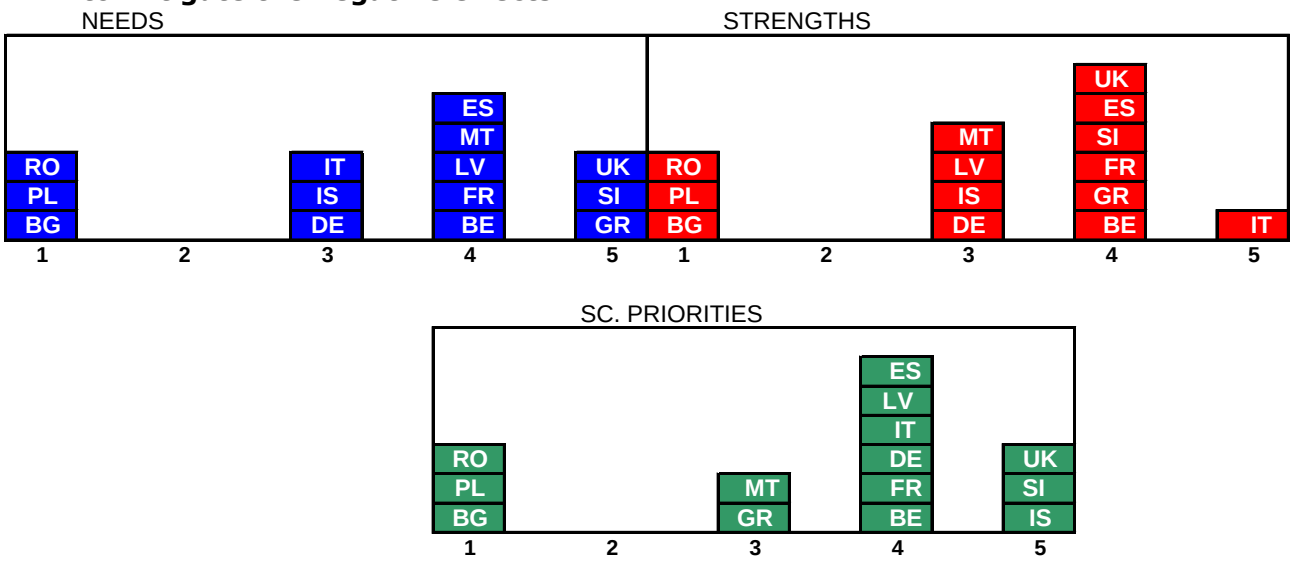
1.1 Critical levels of synergic pollutants in a context of environmental condition (indoor/outdoor).



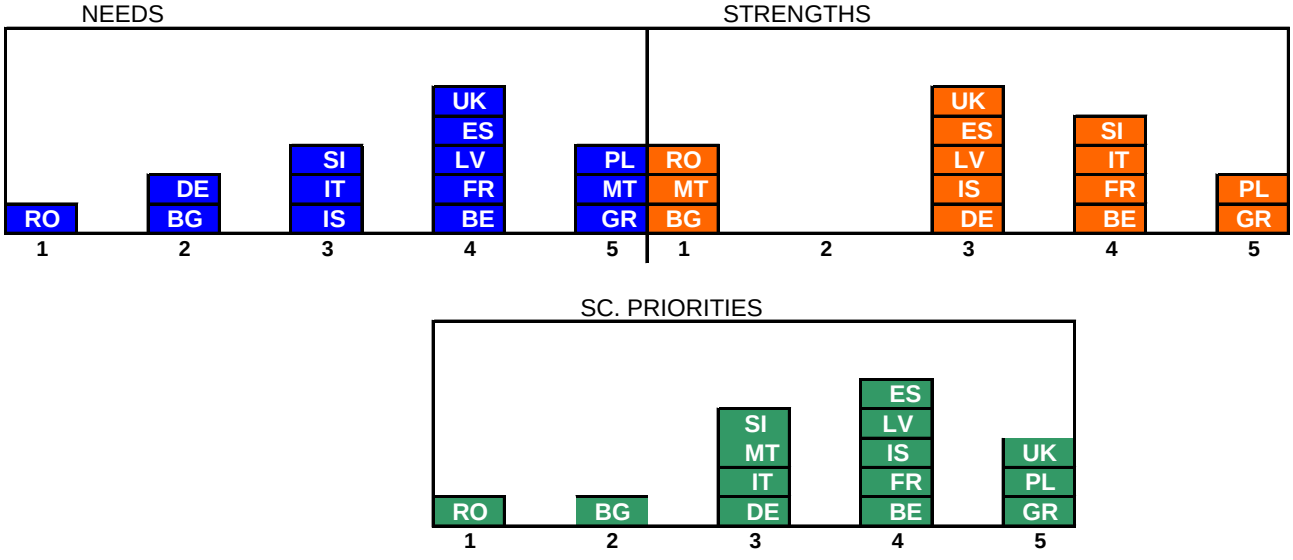
1.2 Preventive approach against extreme natural events (seismic events, flooding, storms, landslides, fire) and first aid measures.



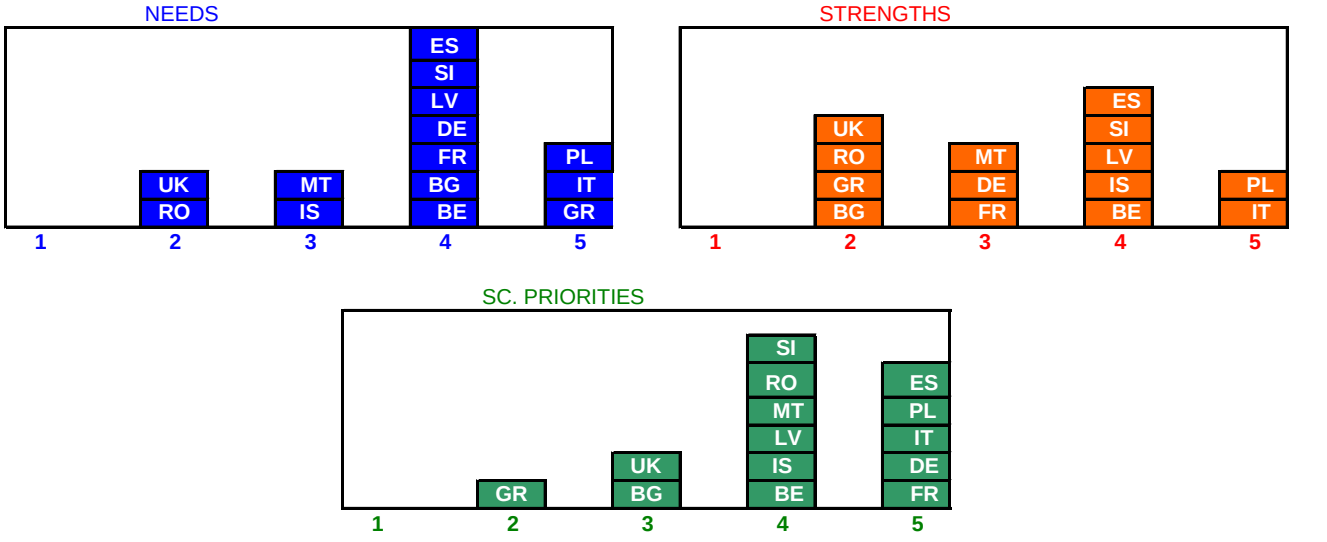
1.3 Impact of climate change on materials and structures and adaptation of technologies to mitigate the negative effects.



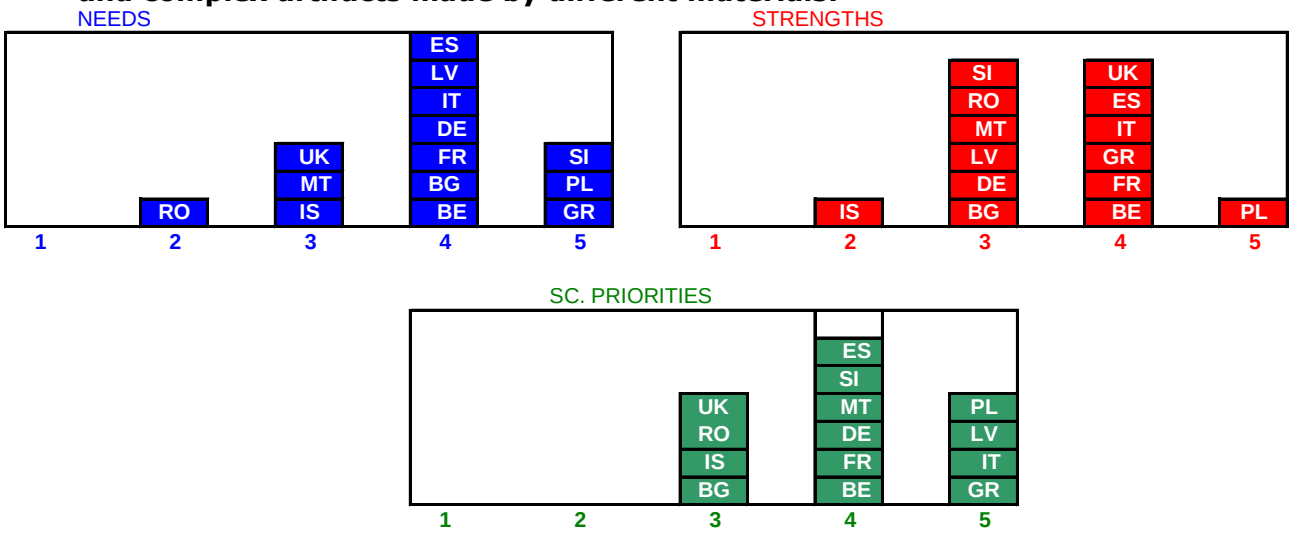
1.4 Changes in hydrogeological conditions in the ground : technologies for stabilising the historic structures.



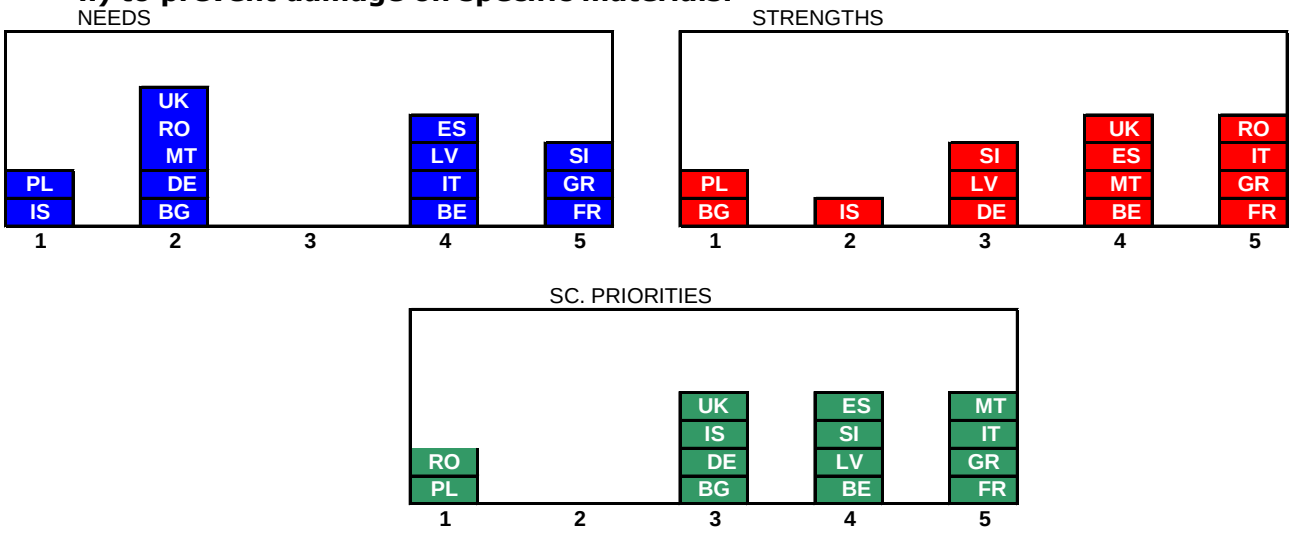
2.1 **Multidisciplinary approach on the synergic interactions between environment and materials.**



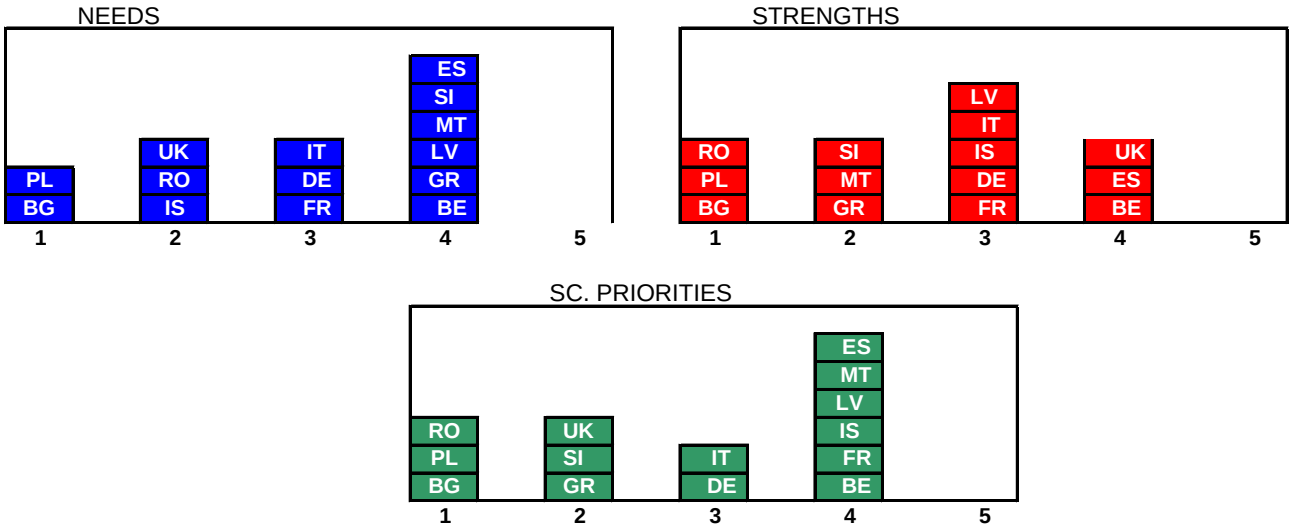
2. 2 Interactions between specific environmental factors (temperature, humidity, ...) and complex artifacts made by different materials.



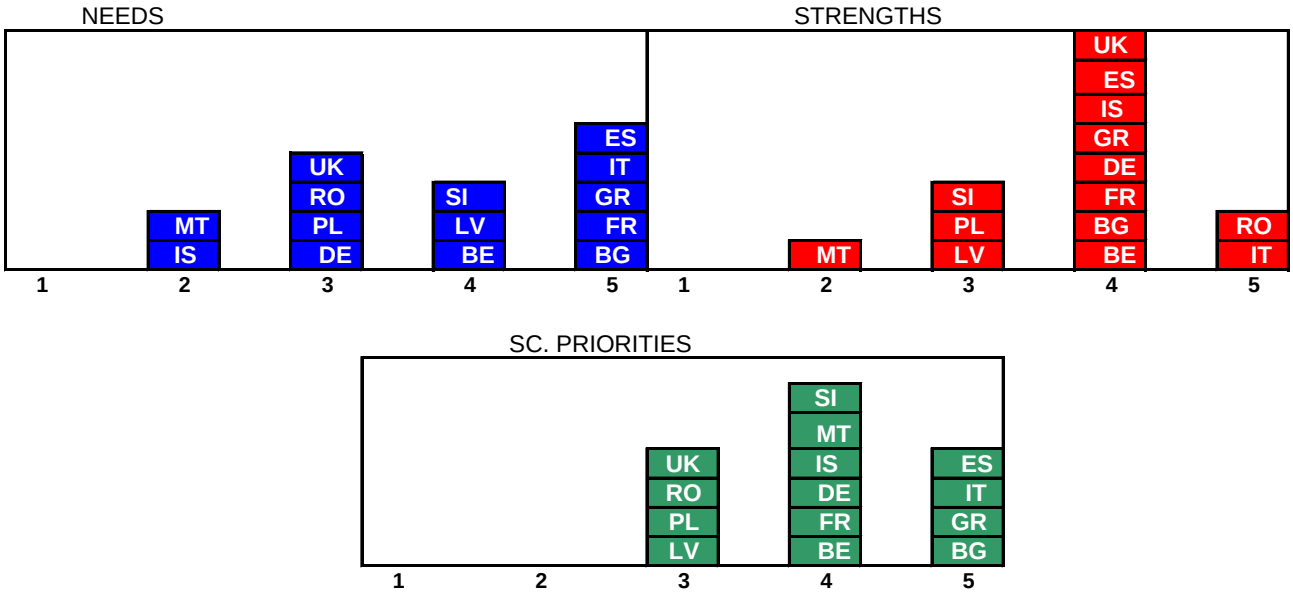
2.3 Best conservation practices against specific attacks (physical, chemical, biological, ..) to prevent damage on specific materials.



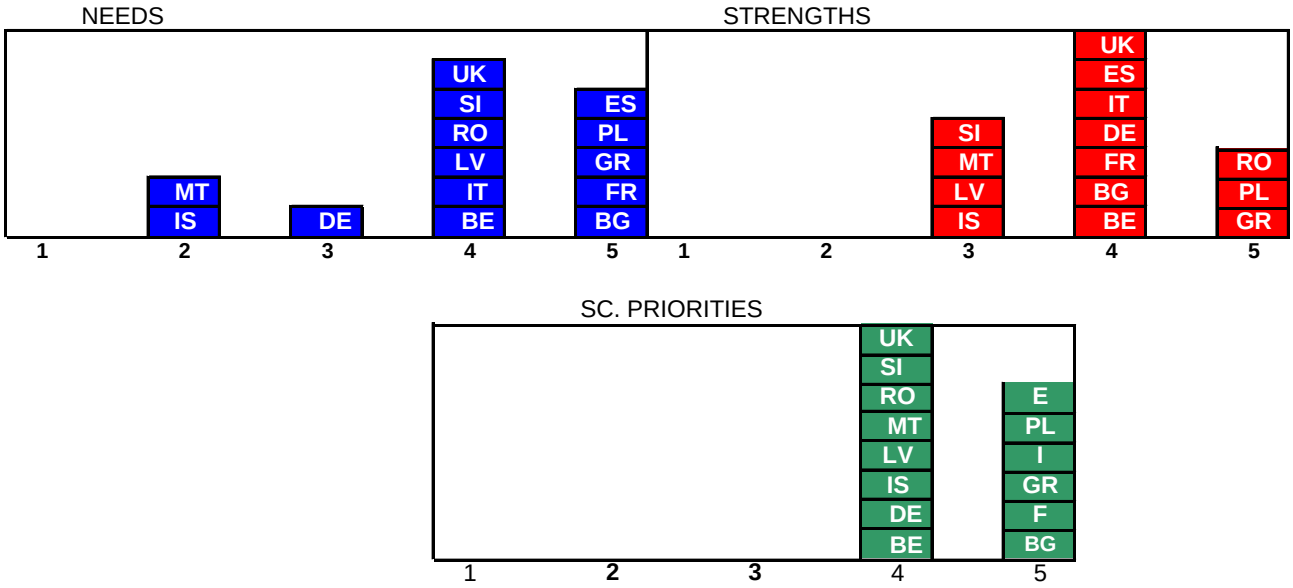
2.4 Damage mitigation - to include salvage, recovery, recycling and reuse of materials.



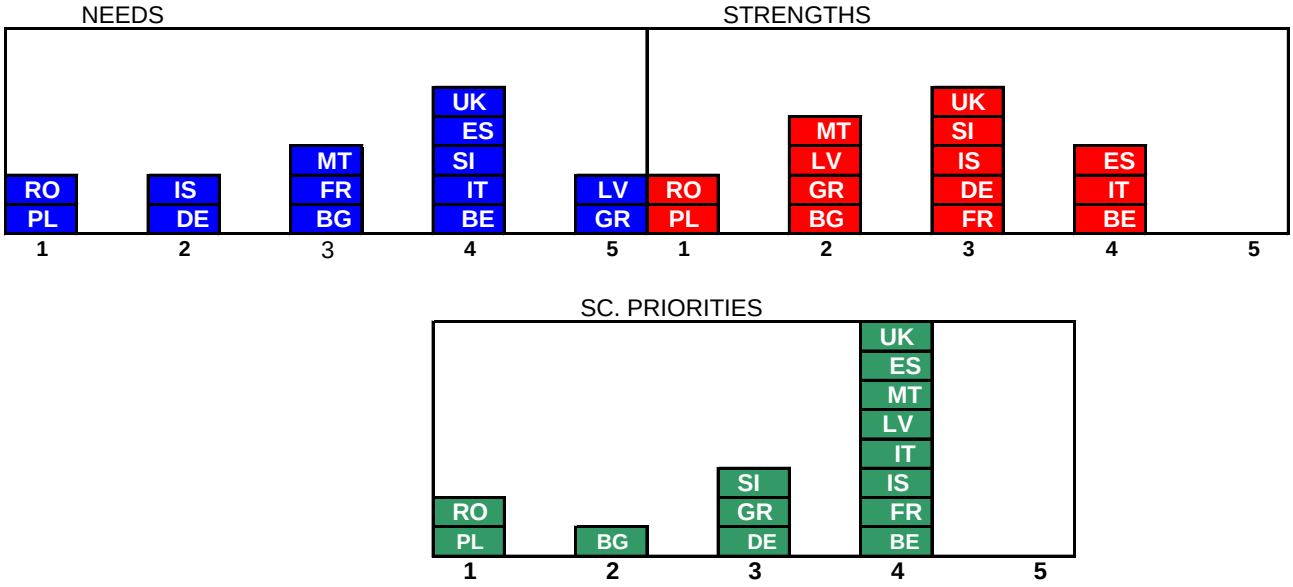
3.1 Portable instruments for in situ measurements.



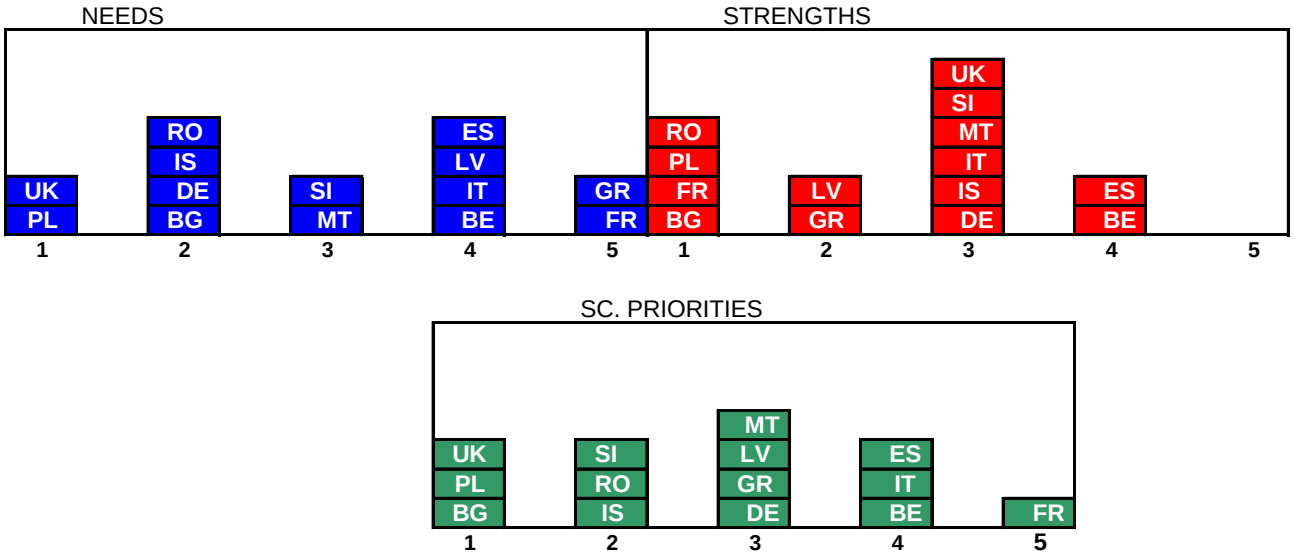
3.2 Non invasive instruments and methodologies for diagnosis and monitoring.



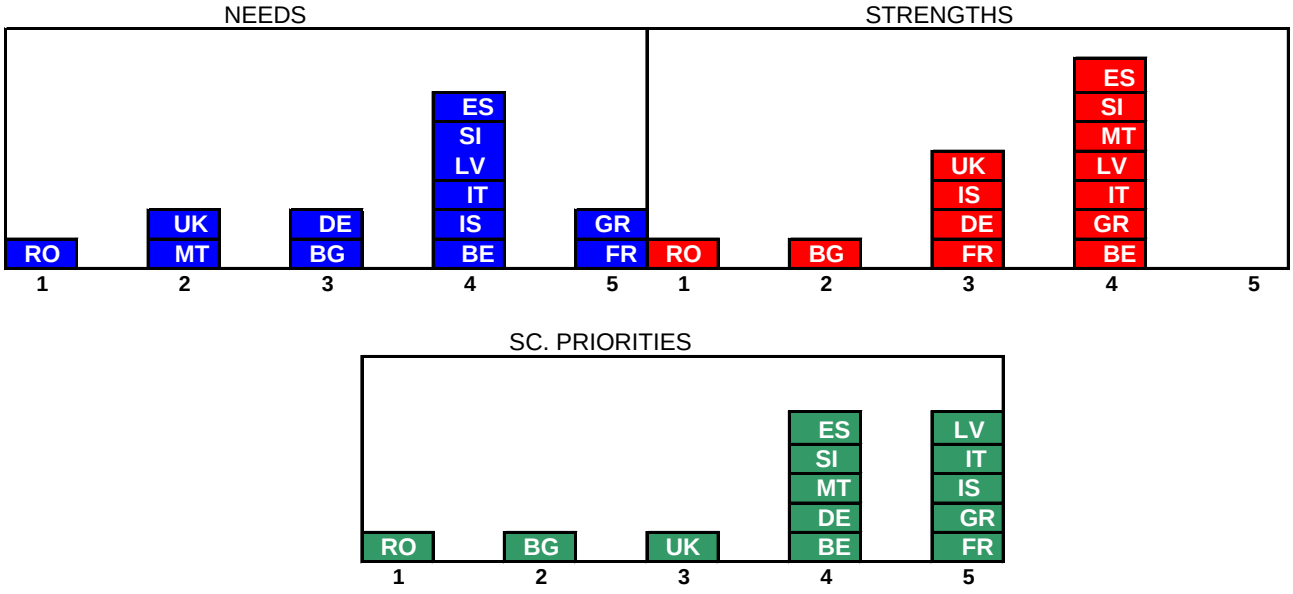
3.3 Intelligent multi-sensor systems for early warning (modeling, local network for monitoring systems), including telediagnosis.



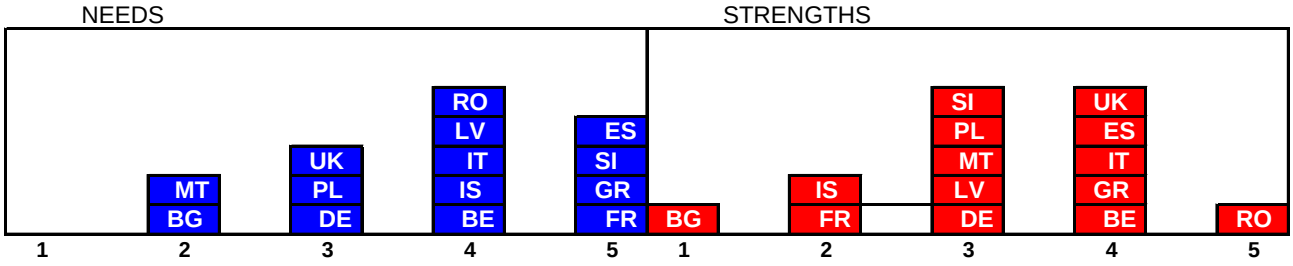
3.4 Re-engineering of instruments and techniques to simplify and to adapt their use.

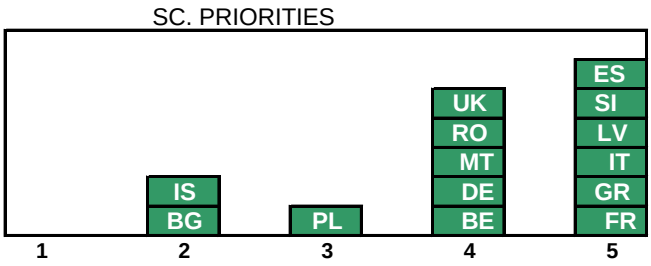


4.1 Development of new and appropriate materials and technologies for the upgrading of the construction of conservation buildings/rooms.

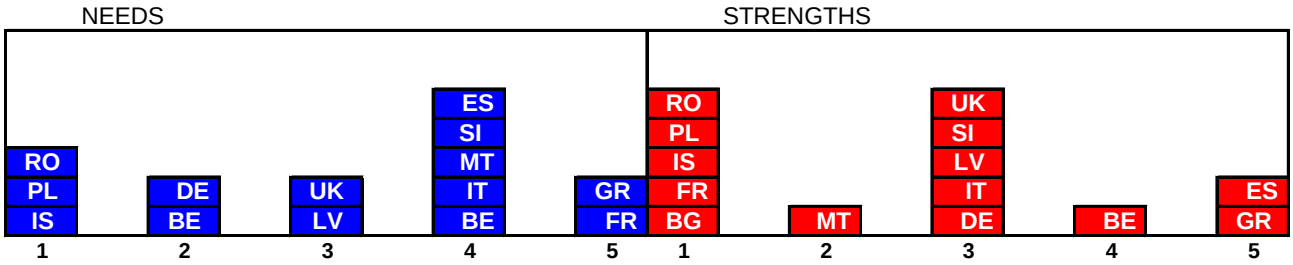


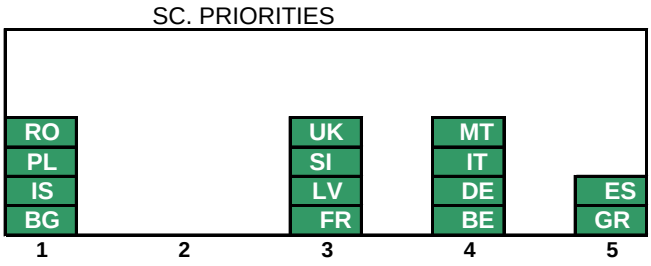
4.2 Development or improvement of products for restoration and conservation with low impact on the historical content of artifacts



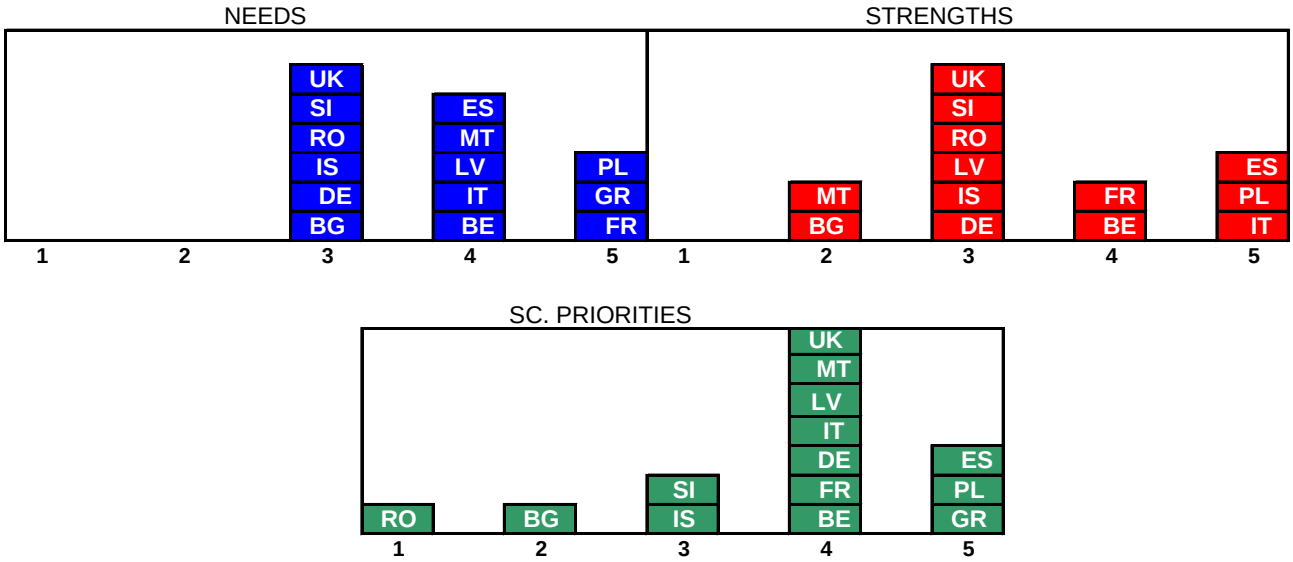


4.3 Identification and assessment procedures to evaluate the fitness for use of new and goal oriented products to define common guidelines and pre-standards.

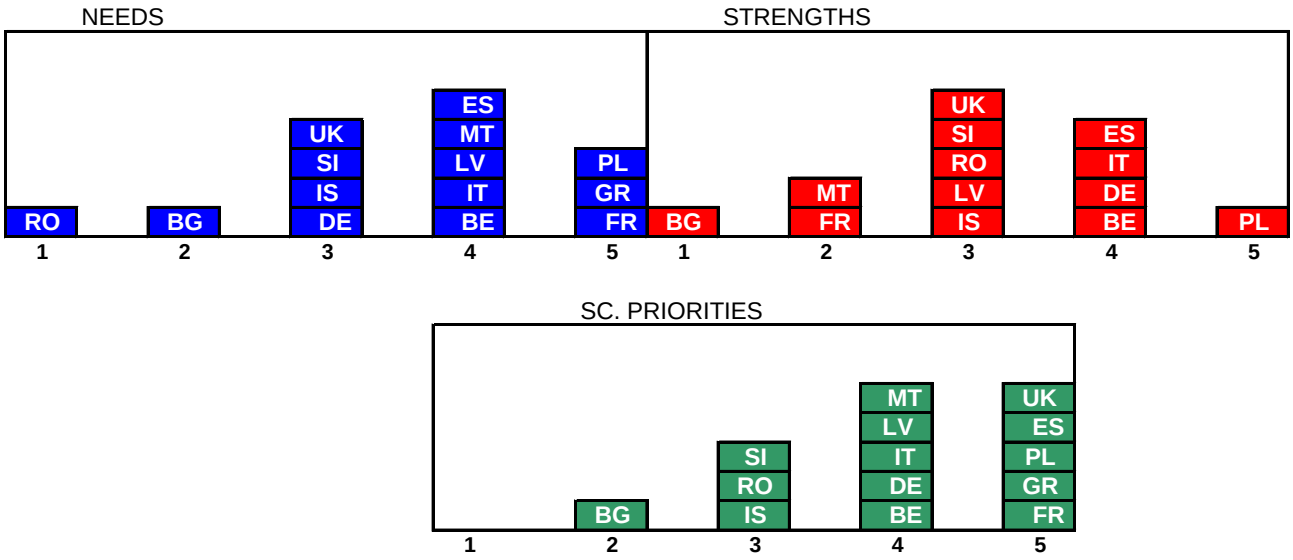




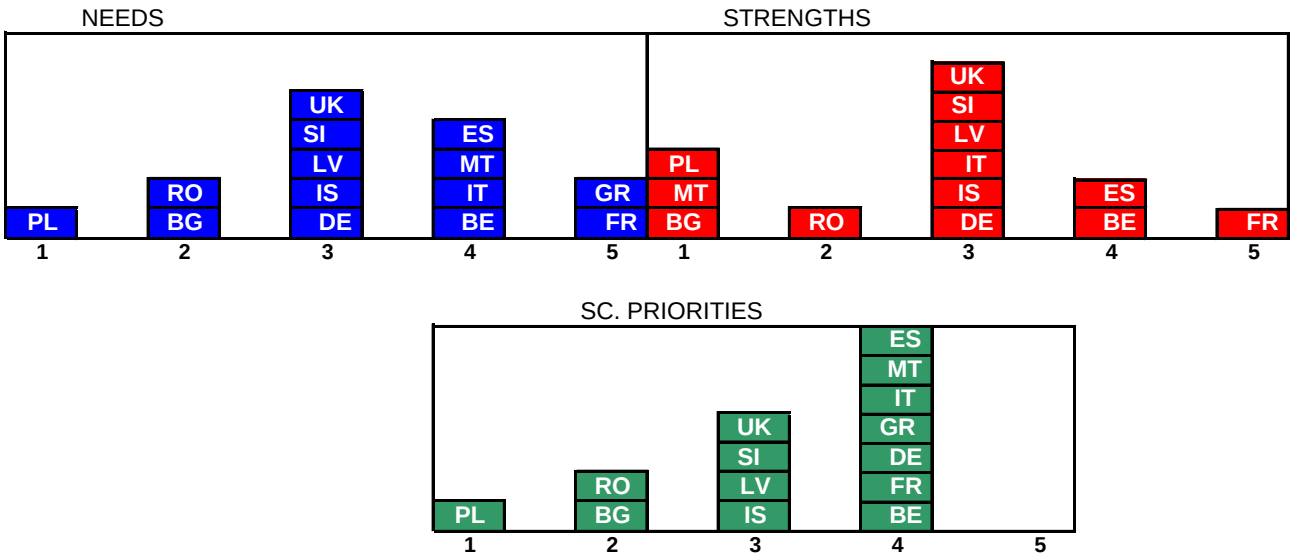
5.1 New solutions for development, assessment and reporting of analysis protocol for the time effects evaluation of treatments (e.g. cleaning, biocides…) and materials.



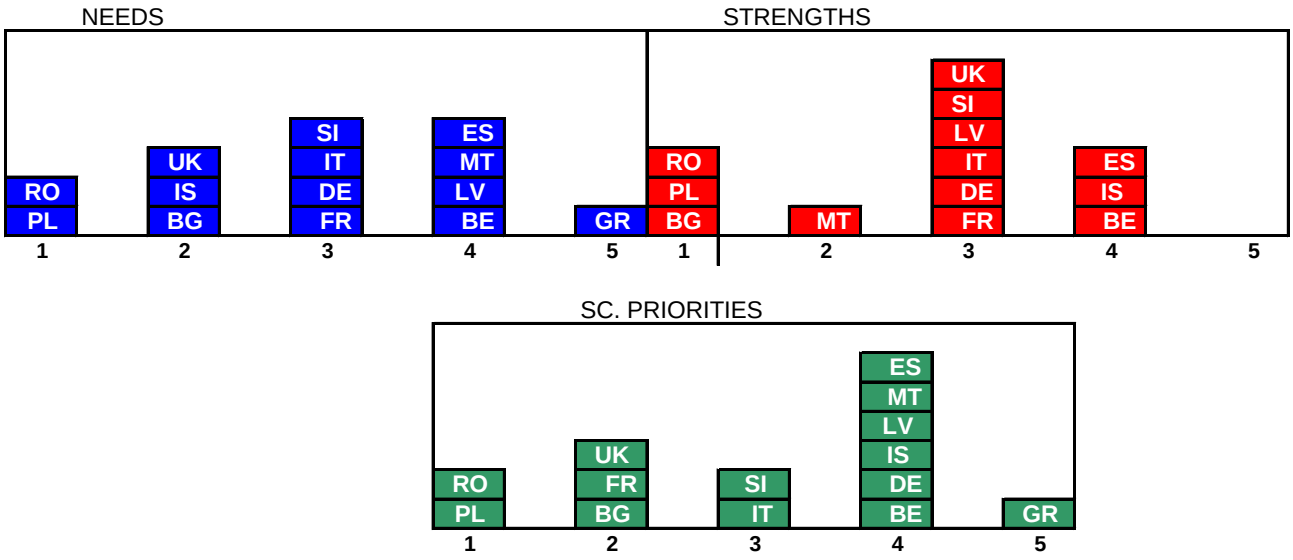
5.2 Innovative solutions for compatibility, durability and reversibility of new materials and treatments.



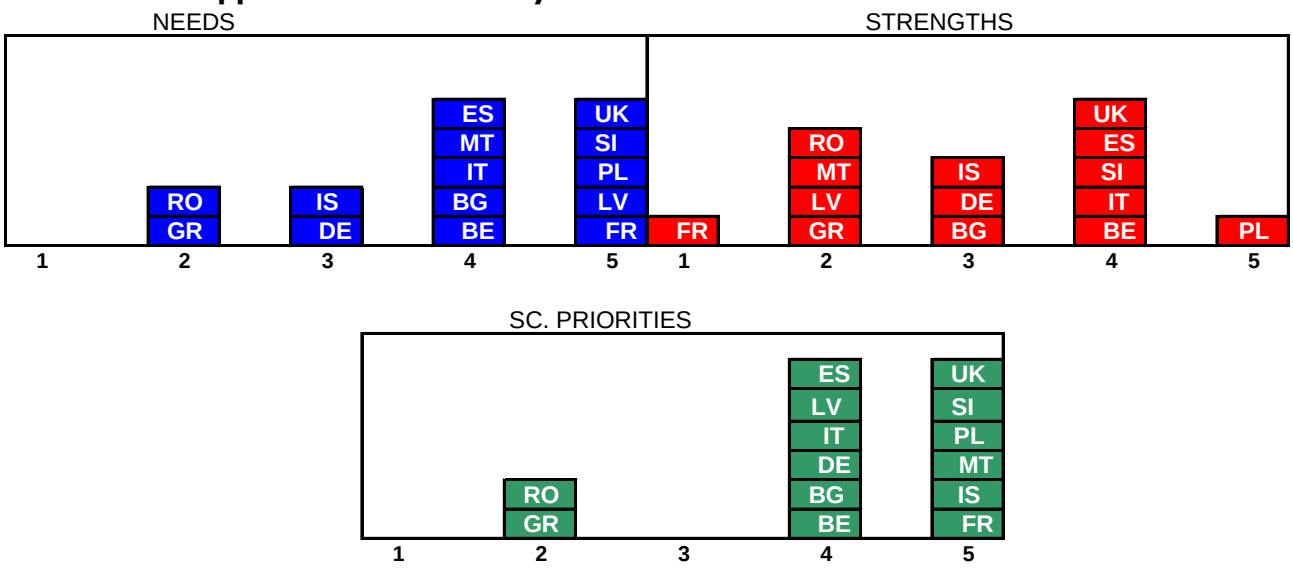
5.3 Modelling and simulation for predictive evaluation and validation of materials and treatments.



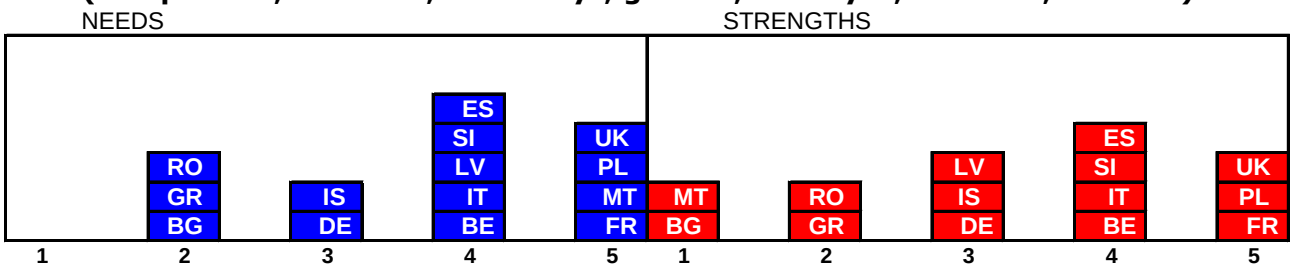
5.4 Impact of modern finishing materials and techniques on historic structures.

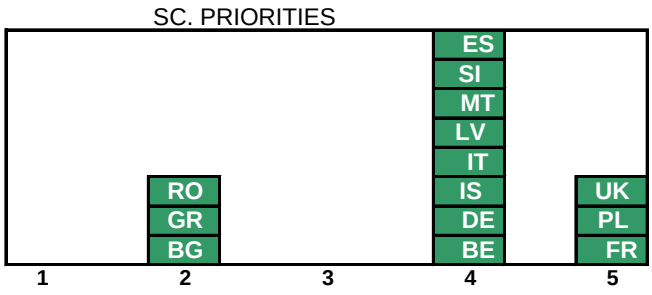


6.1 Development of strategies and procedures for storage and preservation of multi media supports and readability of the stored content.

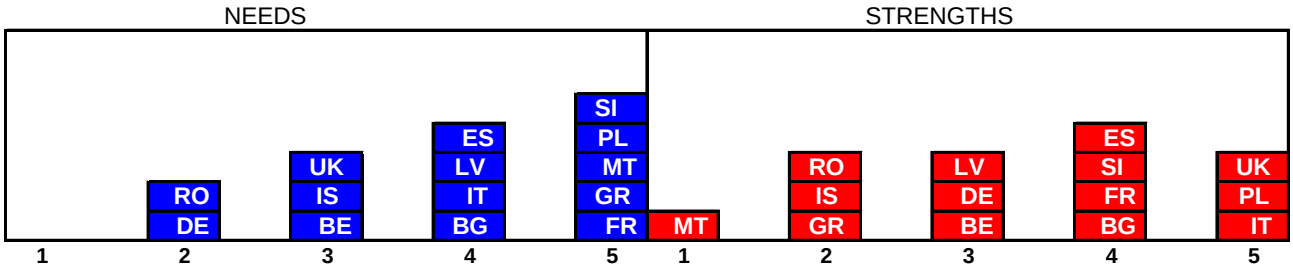


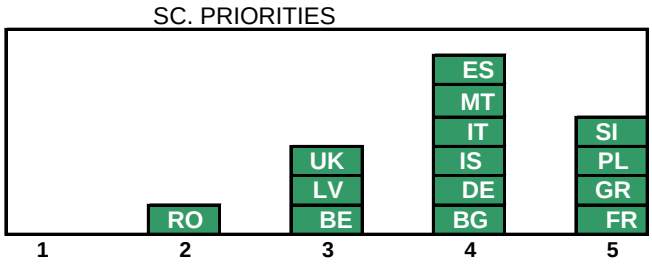
6.2 Innovative proposals for conservation and durability of contemporary art materials (i. e. plastics, ceramics, new alloys, glasses, new dyes, concrete, mortars).



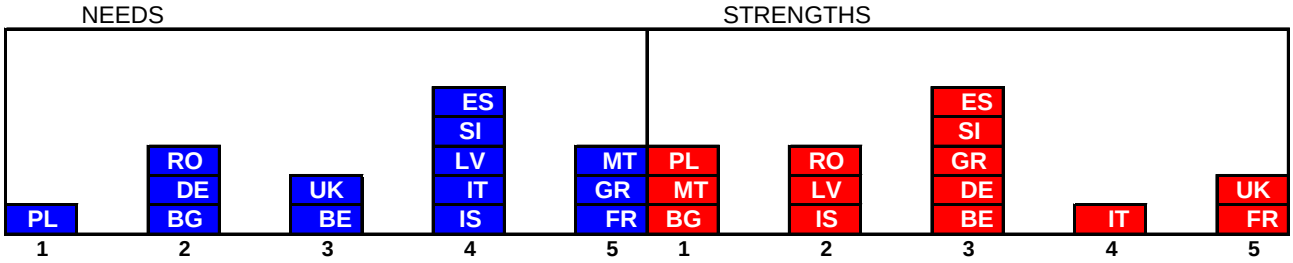


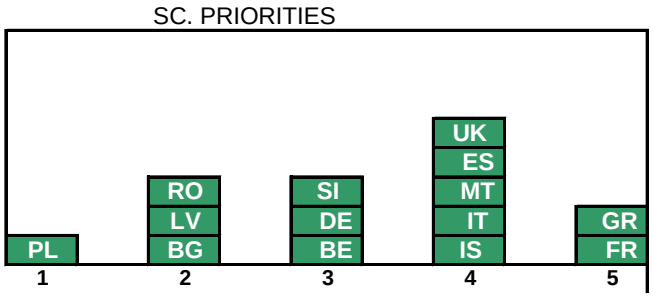
7.1 Development of management systems on quality and sustainability of indoor/ autdoor cultural heritage environments.



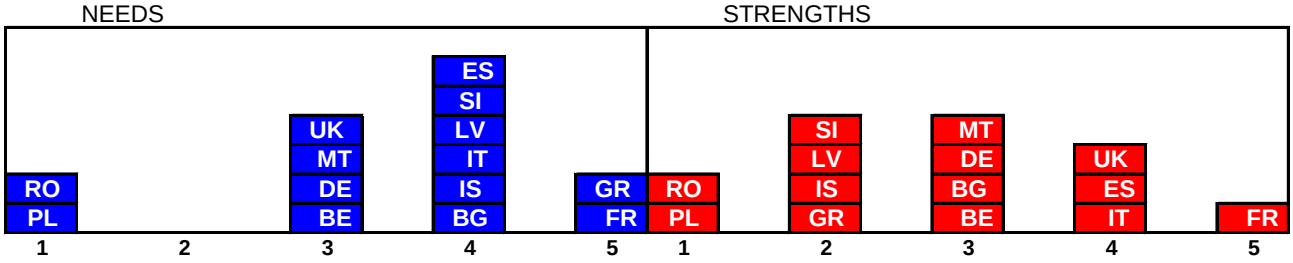


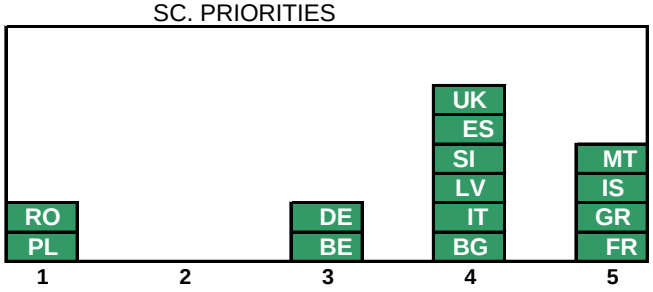
7.2 Development, testing and validation of mobility models to reduce environmental impacts to unmovable cultural heritage (emission, vibration..).



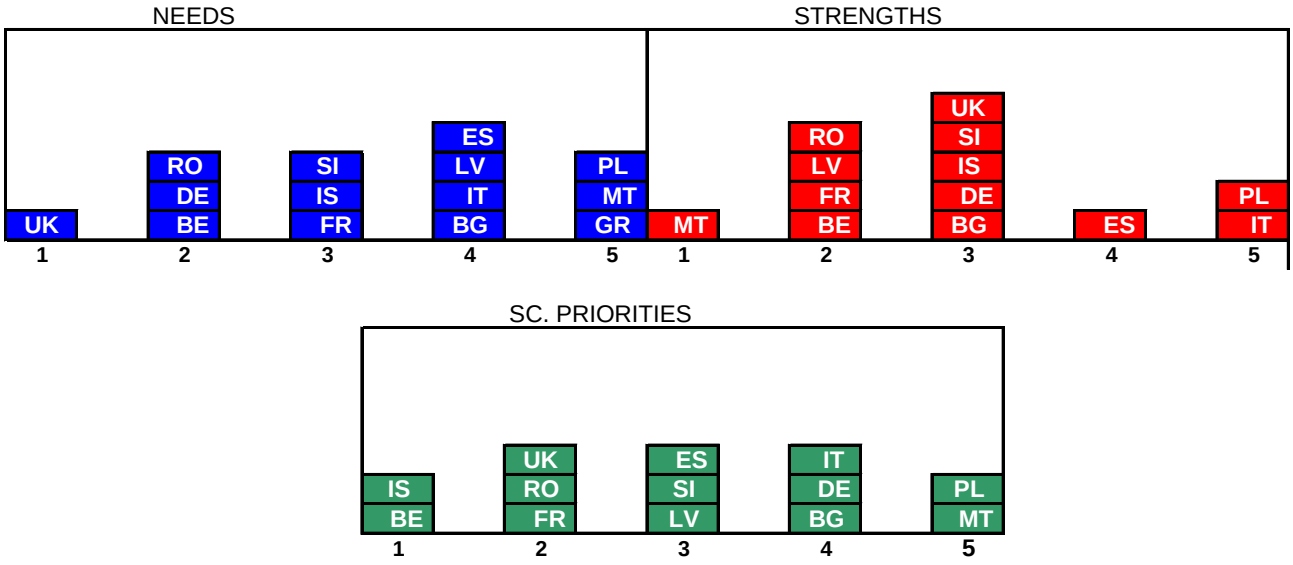


7.3 Development of scientific criteria and tools to measure and regulate tourist impacts on cultural heritage sites.

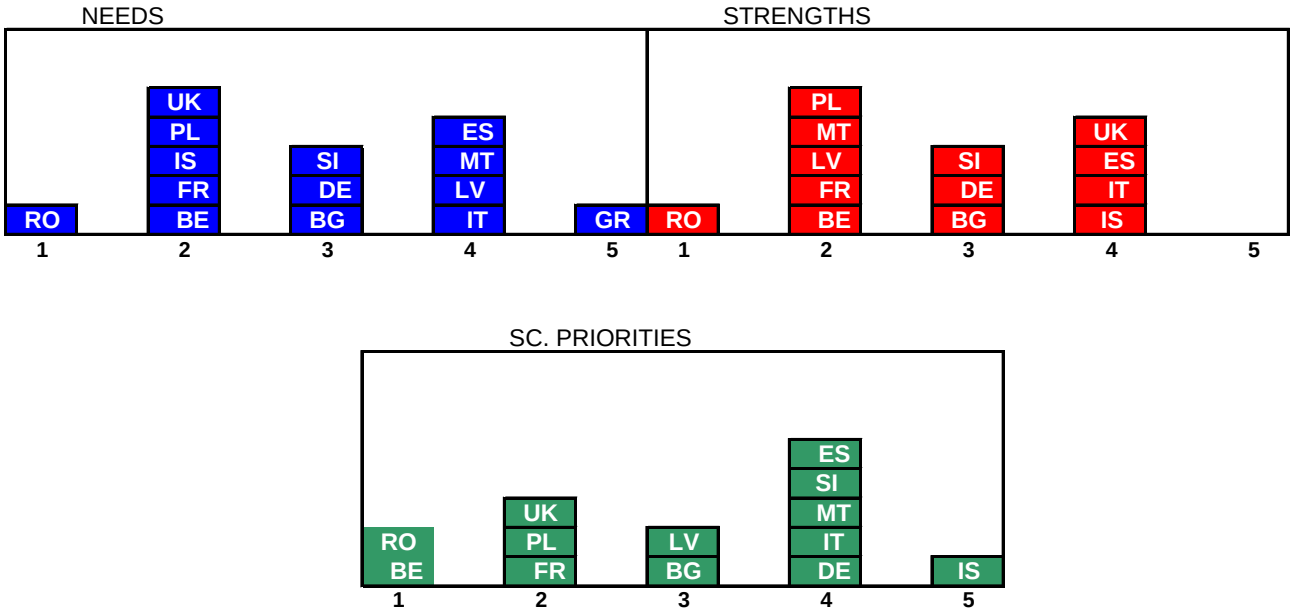




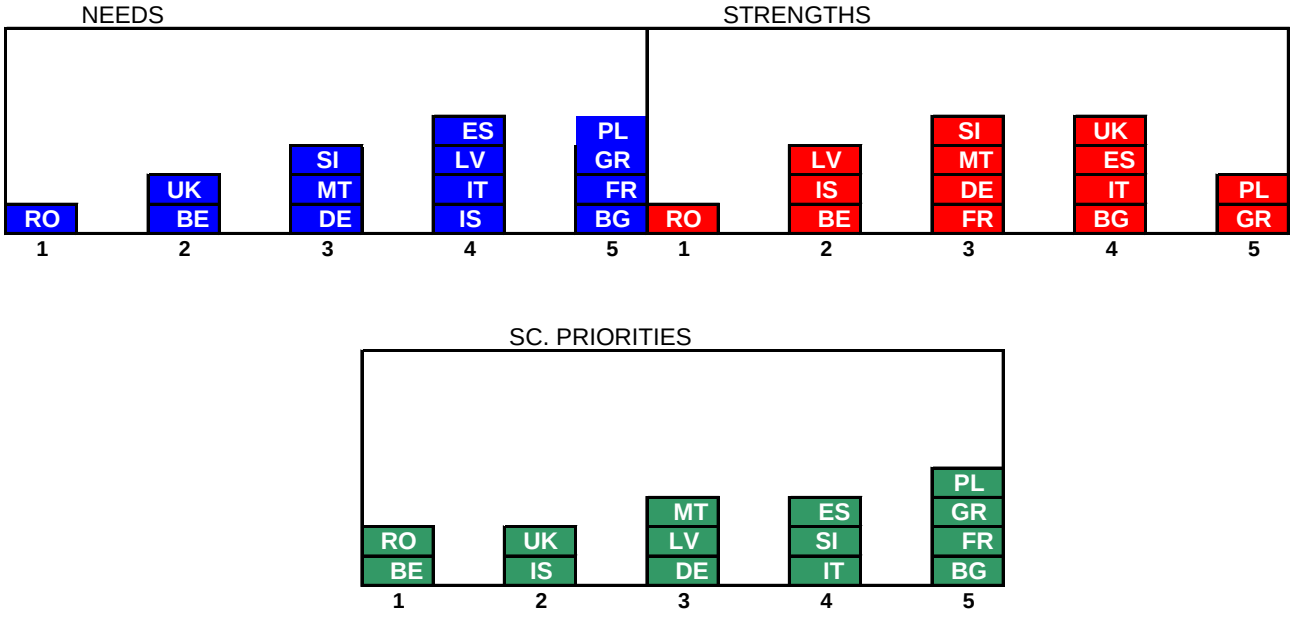
8.1 Development of sensors and devices for a safe handling, movement, transport and exhibition of artefacts and related guidelines.



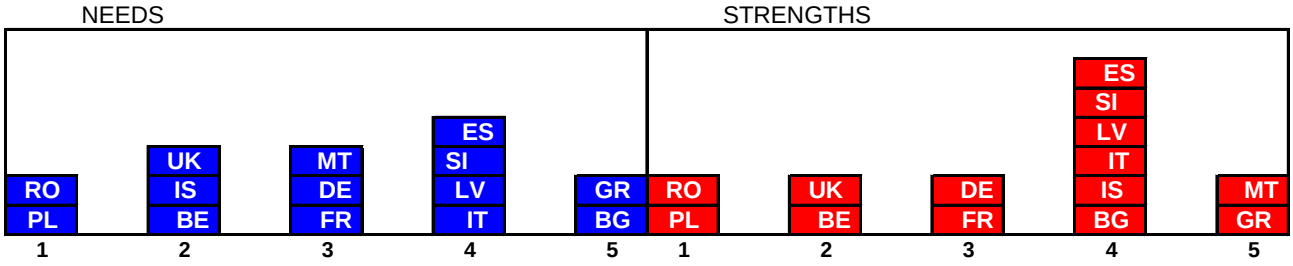
8.2 Development of integrated systems for effective prevention, detection and reaction to risk situations at different scale (e.g.: fire, theft, vandal attacks, etc).

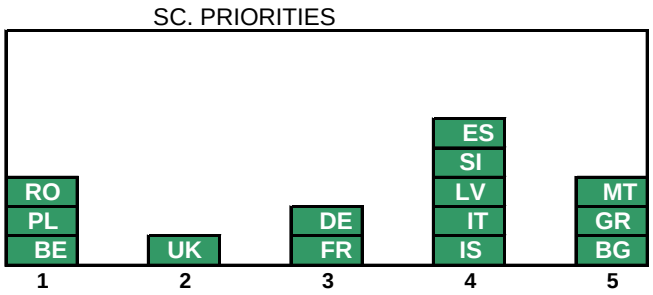


8.3 Development of techniques to support the identification of fakes or stolen artefacts with special reference to the insurance issues

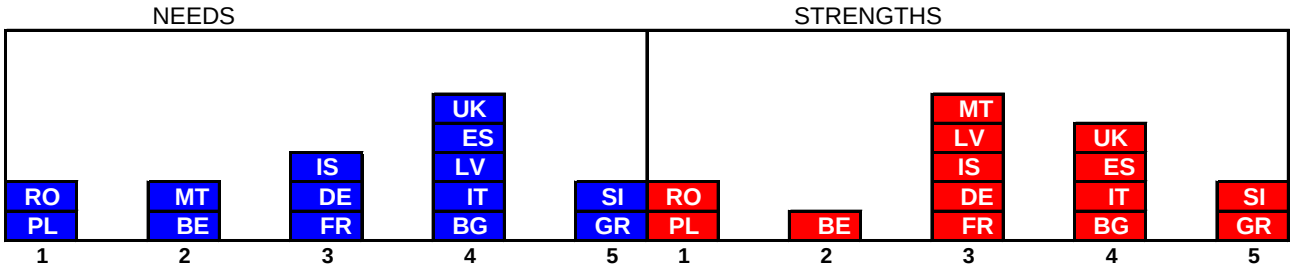


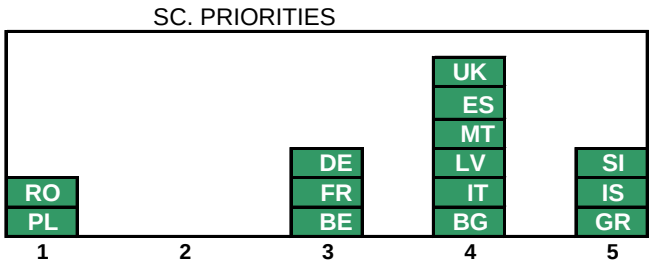
8.4 Techniques for inventory, cataloguing and traceability of cultural heritage objects.



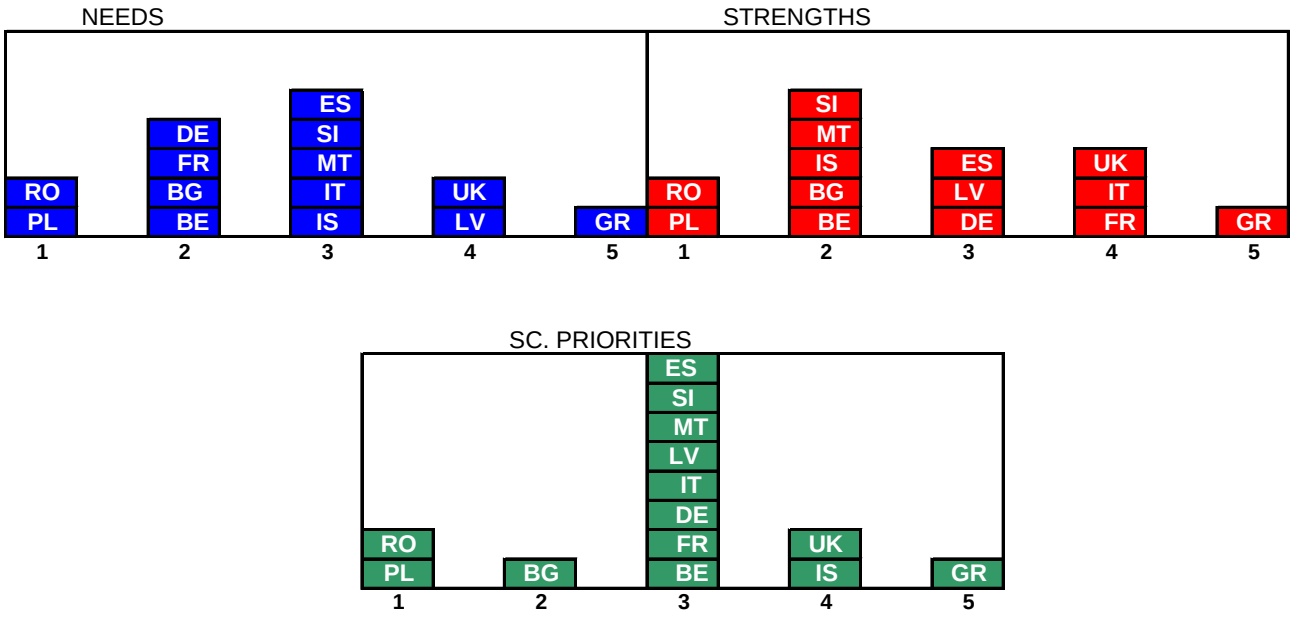


9.1 Web mapping and Web GIS innovative tools for the tele-monitoring and remote control of the archaeological sites and cultural landscapes.

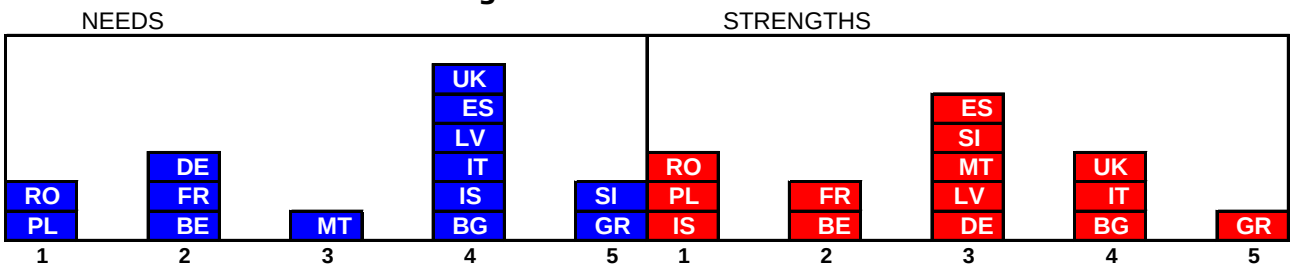


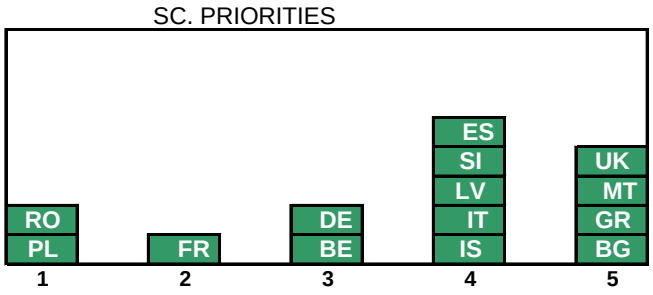


9.2 Development of innovative and aesthetically acceptable devices for the tele-survey of movable artefacts.

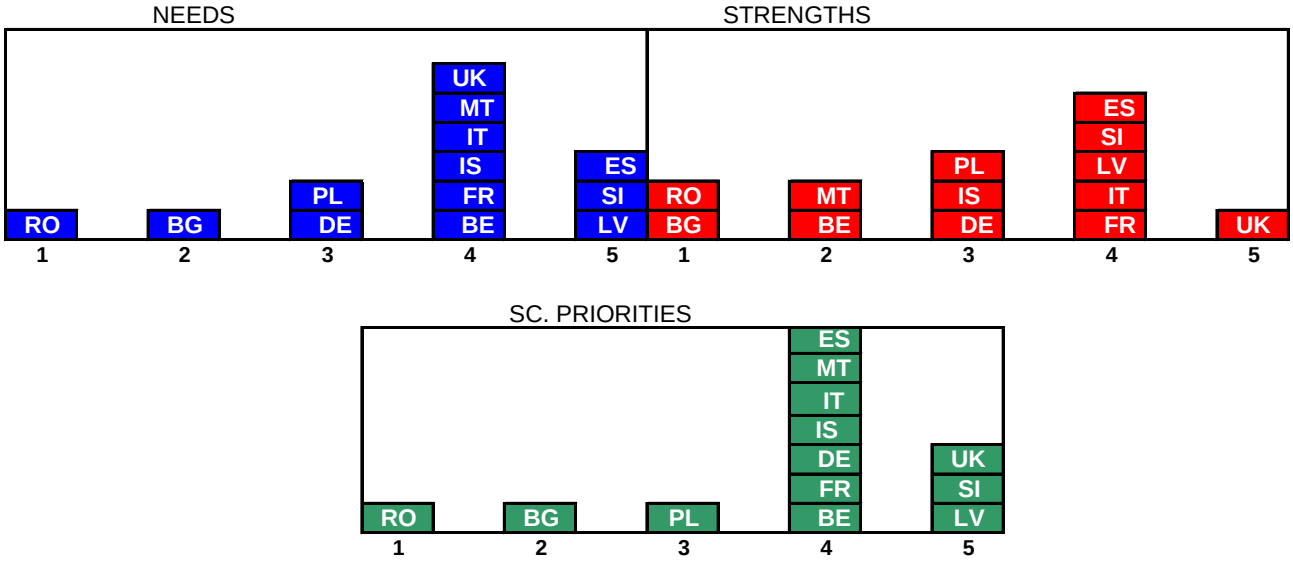


9.3 Development of advanced systems for the tele-survey and remote fruition of underwater cultural heritage.

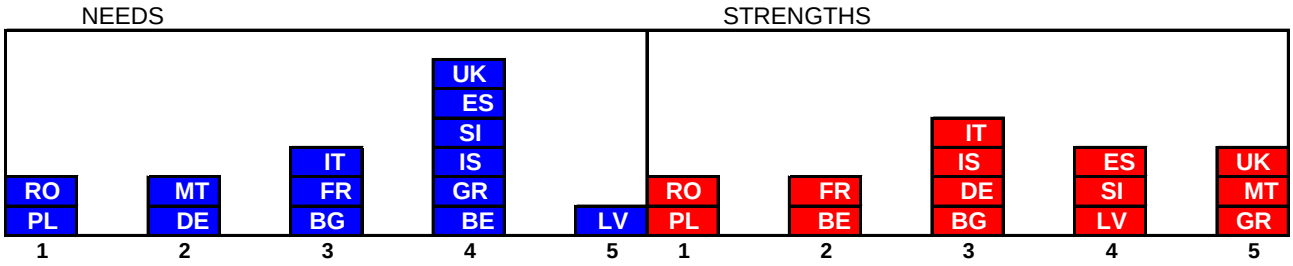


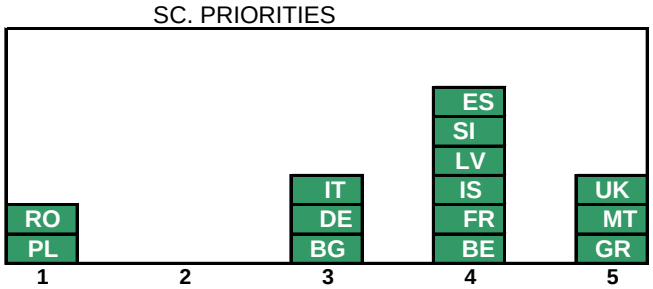


10.1 Preservation of industrial heritage : objects, buildings and landscape.

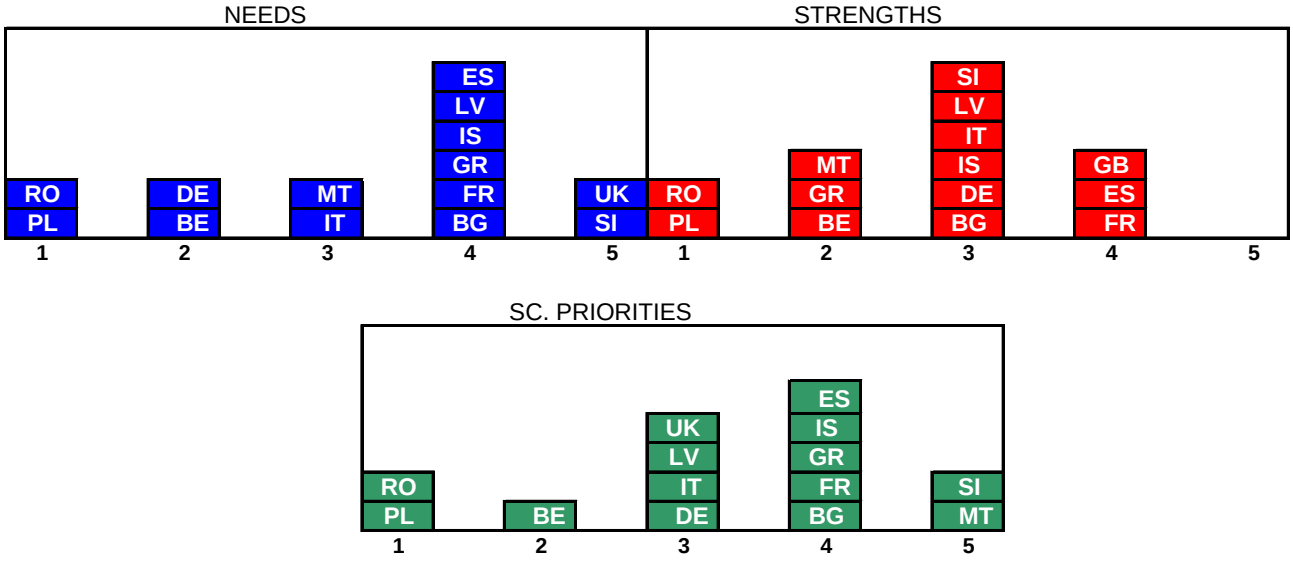


10.2 Preservation of 20th century military heritage: objects, buildings, landscapes.

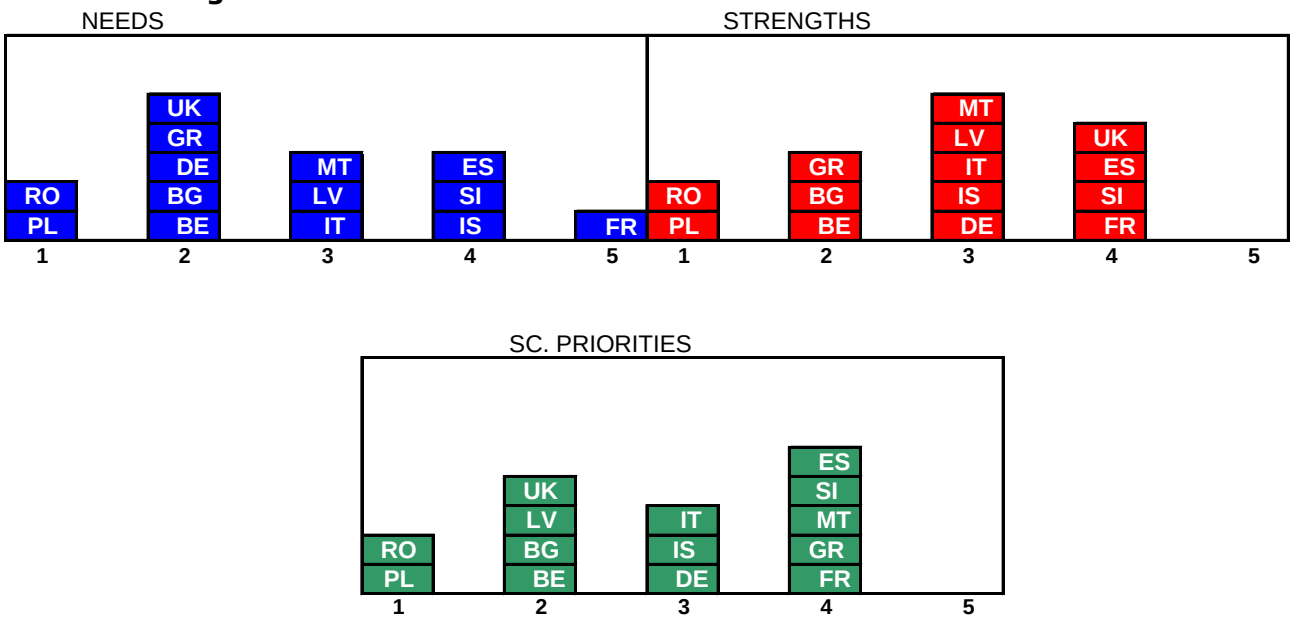




11.1 Development of Quality Management Systems (planning, implementation, assessment reporting and quality improvement) addressed to the process of conservation of cultural heritage.



11.2 Prenormative activities goal-oriented to improve the reproducibility and repeatability of testing results.



4.- Relation needs vs strengths

This table shows the score given to needs and strengths by each country for each subtopic. (See picture below)

SUBTOPIC 1.1	Needs	Strengths
COUNTRY 1	1	1
COUNTRY 2	1	1
COUNTRY 3	2	2
COUNTRY 4	5	3
COUNTRY 5	1	4
COUNTRY 6	5	5

The above mentioned data are shown in the table of relationship here below.

SUBTOPIC 1.1

Needs						
	5			Country 5		Country 4
	4					
	3					
	2		Country 3			
	1	Country 1, Country 2			Country 6	
		1	2	3	4	5
		Strengths				

In particular the table shows the following:

- **Country** 1 and **County 2** share the same position: needs=1 strengths=1.
- **Country 1**, **Country 2**, **Country 3**, **Country 4** share the same score given to needs and strengths and they are set on the diagonal of the table.
- **Country 5**, which shows a higher score given to needs than the one given to strength is set in the upper section of the table, in the "needs" area (needs=5, strengths=3).
- **Country 6**, which shows a lower score give to needs than the one given to strengths is set in the lower section of the table, in the "strengths" area (needs=1, strengths=4).

This table of relationship allows an immediate visualisation of the following conditions:

- The balance between needs and strengths is represented by the white area on the diagonal of the table.
- The positioning in the table in the upper area (blue/ needs) shows a needs value higher than the strengths value.
- The positioning in the table in the lower area (red/strengths) shows on the contrary that the score given by the country to a strength is higher than the score given to a need.

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

Needs						
	5		Malta	France		Greece
	4			Latvia	Belgium Italy Spain	
	3			Germany Island Slovenia	United Kingdom	
	2					
	1	Bulgaria Poland		Romania		
		1	2	3	4	5
		Strengths				

1.2 Preventive approach against extreme natural events (seismic events, flooding, storms, landslides, fi and first aid measures.

Needs						
	5			France		Greece
	4	Malta		Latvia	Belgium France Italy Spain	Slovenia
	3		United Kingdom	Bulgaria Germany Latvia		
	2			Island		
	1	Poland Romania		Romania		
		1	2	3	4	5
		Strengths				

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

Needs						
	5	Malta		France		Greece Poland
	4			Latvia Spain United Kingdom	Belgium France	Slovenia
	3			Island	Italy Slovenia	
	2	Bulgaria		Germany		
	1	Poland Romania		Romania		
		1	2	3	4	5
		Strengths				

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

Needs						
	5	Malta				Greece, Poland
	4			Latvia, Spain, United Kingdom	Belgium, France	
	3			Island	Italy, Slovenia	
	2	Bulgaria		Germany		
	1	Romania				
		1	2	3	4	5
		Strengths				

2.1 Multidisciplinary approach on the synergic interactions between environment and materials.

Needs						
	5		Greece			Italy, Poland
	4		Bulgaria	France, Germany	Belgium, Latvia, Slovenia, Spain	
	3			Malta	Island	
	2		Romania, United Kingdom			
	1					
		1	2	3	4	5
		Strengths				

2.2 Interactions between specific environmental factors (temperature, humidity,..) and complex artifacts made by different materials.

Needs						
	5			Slovenia	Greece	Poland
	4			Bulgaria, Germany,Latvia	Belgium, France, Italy, Spain	
	3		Island	Malta	United Kingdom	
	2			Romania		
	1					
		1	2	3	4	5
		Strengths				

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

Needs						
	5			Slovenia		France, Greece
	4			Latvia	Belgium, Spain	Italy
	3					
	2	Bulgaria		Germany	Malta, United Kingdom	Romania
	1	Poland	Island			
		1	2	3	4	5
		Strengths				

2.4 Damage mitigation - to include salvage, recovery, recycling and reuse of materials.

Needs						
	5					
	4		Greece, Malta, Slovenia	Latvia	Belgium, Spain	
	3			France, Germany, Italy,		
	2	Romania		Island	United Kingdom	
	1	Bulgaria, Poland				
		1	2	3	4	5
		Strengths				

3.1 Portable instruments for in situ measurements.

Needs						
	5				Bulgaria, France, Greece , Spain	Italy
	4			Latvia, Slovenia	Belgium	
	3			Poland	Germany, United Kingdom	Romania
	2		Malta		Island	
	1					
		1	2	3	4	5
		Strengths				

3.2 Non invasive instruments and methodologies for diagnosis and monitoring.

Needs						
	5				Bulgaria, France, Spain	Greece, Poland
	4			Latvia, Slovenia	Belgium, Italy, United Kingdom	Romania
	3				Germany	
	2			Island, Malta		
	1					
		1	2	3	4	5
		Strengths				

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

Needs						
	5		Greece, Latvia			
	4			Slovenia, United Kingdom	Belgium, Italy, Spain	
	3		Bulgaria, Malta	France		
	2			Germany, Island		
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5	France	Greece			
	4		Latvia	Italy	Belgium, Spain	
	3			Malta, Slovenia		
	2	Bulgaria, Romania		Germany, Island		
	1	Poland		United Kingdom		
		1	2	3	4	5
		Strengths				

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

Needs						
	5			France	Greece	
	4			Island	Belgium, Italy, Latvia, Slovenia, Spain	
	3		Bulgaria	Germany		
	2			United Kingdom	Malta	
	1	Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5		France	Slovenia	Greece, Spain	
	4		Island	Latvia	Belgium, Italy	Romania
	3			Germany, Poland	United Kingdom	
	2	Bulgaria		Malta		
	1					
		1	2	3	4	5
		Strengths				

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.

Needs						
	5	France				Greece
	4		Malta	Italy	Belgium, Slovenia, Spain	
	3			Latvia, United kingdom		
	2	Bulgaria		Germany		
	1	Island, Poland, Romania				
		1	2	3	4	5
		Strengths				

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.

Needs						
	5				France	Poland
	4		Malta	Latvia	Belgium	Italy, Spain
	3		Bulgaria	Germany, Island, Romania, Slovenia, United Kingdom		
	2					
	1					
		1	2	3	4	5
		Strengths				

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

Needs						
	5		France			Poland
	4		Malta	Latvia	Belgium, Italy, Spain	
	3			Island, Slovenia, United Kingdom	Germany	
	2	Bulgaria				
	1			Romania		
		1	2	3	4	5
		Strengths				

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

Needs						
	5					France
	4	Malta		Italy	Belgium, Spain	
	3			Germany, Island, Latvia, Slovenia, United Kingdom		
	2	Bulgaria	Romania			
	1	Poland				
		1	2	3	4	5
		Strengths				

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

Needs						
	5					
	4		Malta	Latvia	Belgium, Spain	
	3			France, Germany, Italy, Slovenia		
	2	Bulgaria		United Kingdom	Island	
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5	France	Latvia		Slovenia, United Kingdom	Poland
	4		Malta	Bulgaria	Belgium, Italy, Spain	
	3			Germany, Island		
	2		Greece, Romania			
	1					
		1	2	3	4	5
		Strengths				

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

Needs						
	5	Malta			United Kingdom	France,Poland
	4			Latvia	Belgium, Italy, Slovenia, Spain	
	3			Germany, Island		
	2	Bulgaria	Greece, Romania			
	1					
		1	2	3	4	5
		Strengths				

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

Needs						
	5	Malta	Greece		France, Slovenia	Poland
	4			Latvia	Bulgaria, Spain	Italy
	3		Island	Belgium		United Kingdom
	2		Romania	Germany		
	1					
		1	2	3	4	5
		Strengths				

7.2 Development, testing and validation of mobility models to reduce environmental impacts to unmovable cultural heritage (emission, vibration..)

Needs						
	5	Malta		Greece		France
	4		Island, Latvia	Slovenia, Spain	Italy	
	3			Belgium		United Kingdom
	2	Bulgaria	Romania	Germany		
	1	Poland				
		1	2	3	4	5
		Strengths				

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

Needs						
	5		Greece			France
	4		Island, Latvia Slovenia	Bulgaria	Italy, Spain	
	3			Belgium, Germany, Malta	United Kingdom	
	2					
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5	Malta				Poland
	4		Latvia	Bulgaria	Spain	Italy
	3		France	Island, Slovenia		
	2		Belgium, Romania	Germany		
	1			United Kingdom		
		1	2	3	4	5
		Strengths				

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)

Needs						
	5					
	4		Latvia, Malta		Italy, Spain	
	3			Bulgaria, Germany, Slovenia		
	2		Belgium, France, Poland		Island, United Kingdom	
	1	Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5			France	Bulgaria	Greece, Poland
	4		Island, Latvia		Italy, Spain	
	3			Germany, Malta, Slovenia		
	2		Belgium		United Kingdom	
	1	Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5				Bulgaria	Greece
	4			Latvia Slovenia	Italy, Spain	
	3			France, Germany, Malta		
	2		Belgium		Island, United Kingdom	
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5					Greece, Slovenia
	4			Latvia	Bulgaria, Italy, Spain, United Kingdom	
	3			France, Germany, Island		
	2		Belgium	Malta		
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5					Greece
	4			Latvia	United Kingdom	
	3		Island, Malta, Slovenia	Spain	Italy	
	2		Belgium, Bulgaria	Germany	France	
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5			Slovenia		Greece
	4	Island		Latvia, Spain	Bulgaria, Italy, United Kingdom	
	3			Malta		
	2		Belgium, France	Germany		
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5				Latvia, Slovenia Spain	
	4		Belgium, Malta	Island	France, Italy	United Kingdom
	3			Germany, Poland		
	2	Bulgaria				
	1	Romania				
		1	2	3	4	5
		Strengths				

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

Needs						
	5				Latvia	
	4		Belgium	Island	Slovenia,Spain	Greece, United Kingdom
	3		France	Bulgaria, Italy		
	2			Germany		Malta
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

11.1 Development of Quality Management Systems (planning, implementation, assessment, reporting and quality improvement) addressed to the process of conservation of cultural heritage.

Needs						
	5			Slovenia		
	4		Greece	Bulgaria Island, Latvia	France, Spain	
	3		Malta	Italy	United Kingdom	
	2		Belgium	Germany		
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

11.2 Prenormative activities goal-oriented to improve the reproducibility and repeatability of testing results.

Needs						
	5				France	
	4			Island	Slovenia, Spain	
	3			Italy, Latvia		
	2		Belgium, Bulgaria, Greece	Germany	United Kingdom	
	1	Poland, Romania				
		1	2	3	4	5
		Strengths				

5. Needs vs Strenghts towards a summation analysis

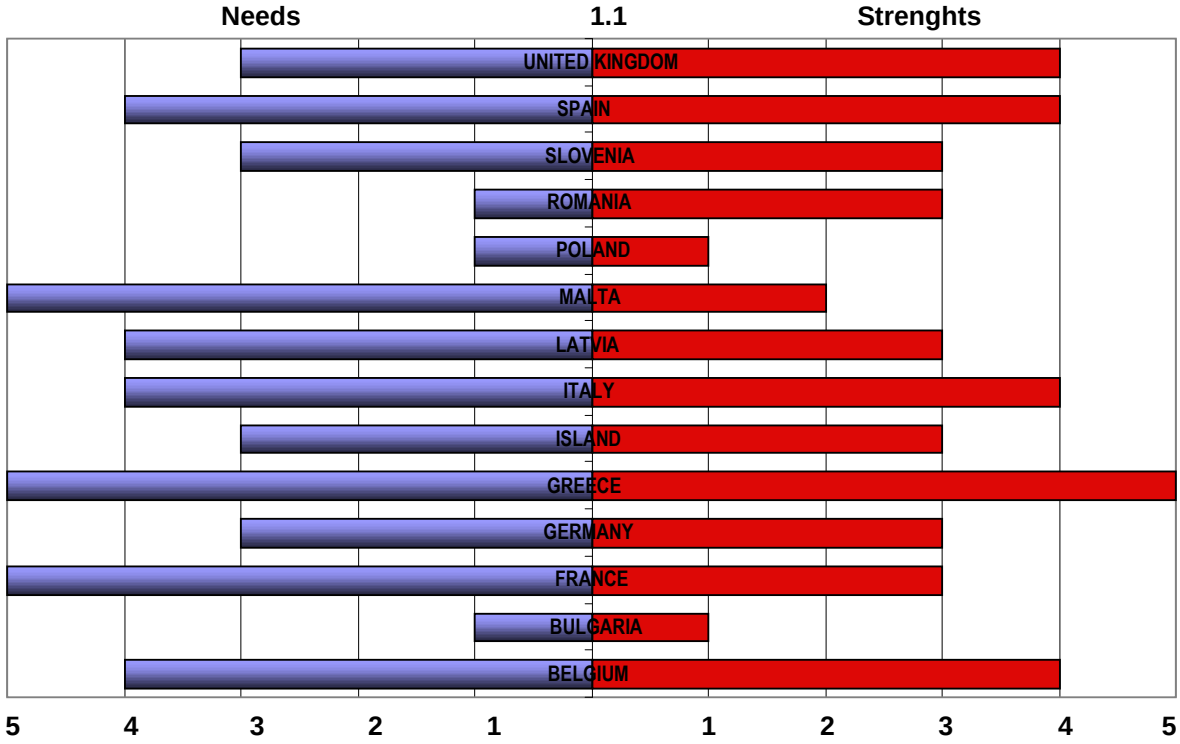
The diagram was set in order to carry out, if the case, a "cold" evaluation through the artificial summation adopted per single *item*, having assumed the *needs* in negative value and the *strengths* in positive value.

Actually, the comparison based on the absolute value of the scores of *needs* and *strengths* raises some interpretation doubts about the consistency of some of the answers.

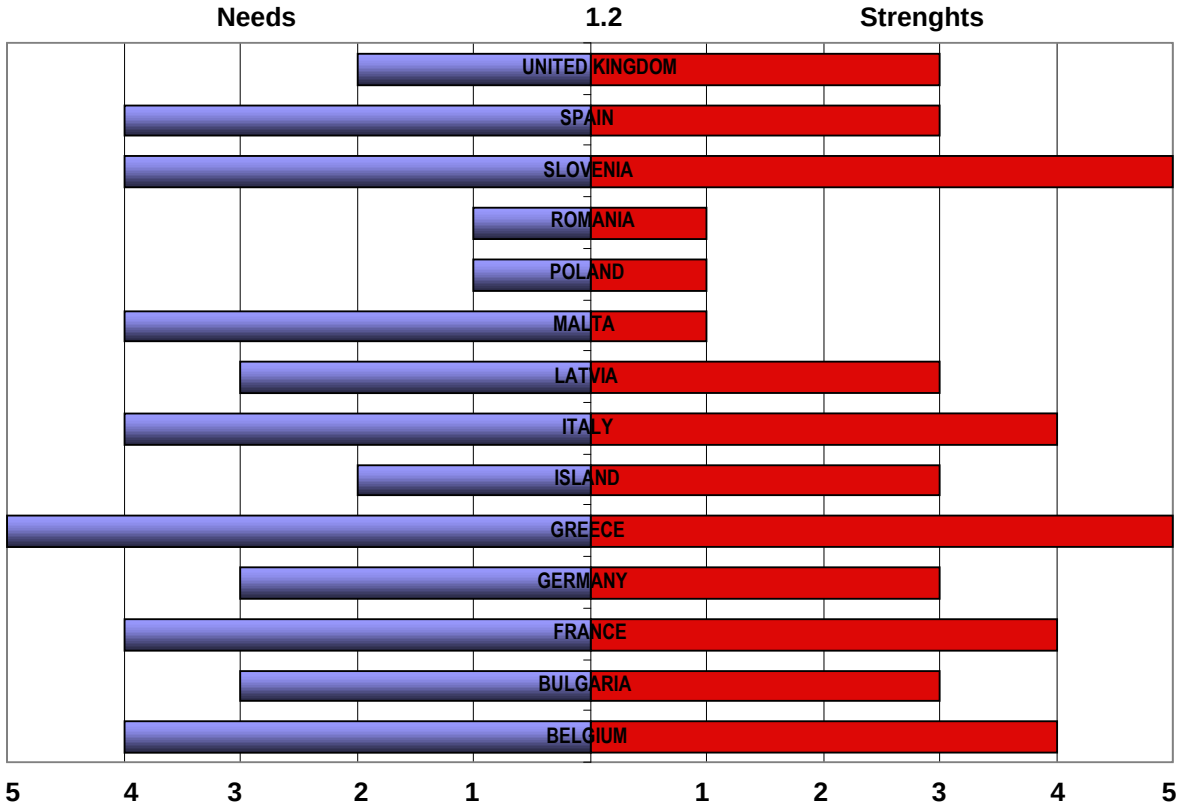
On the contrary, when analysed individually, the two typologies (*needs* and *strengths*) immediately identify the weak points (*needs*) and the strong points (*strengths*) that are duly expressed by the different countries through a score from 1 to 5.

This approach also makes it possible to outline the geographical areas of convergence and agreement, whose benefit, most likely in a complementary regime, might become evident when practically making up the *teams* to take part in projects.

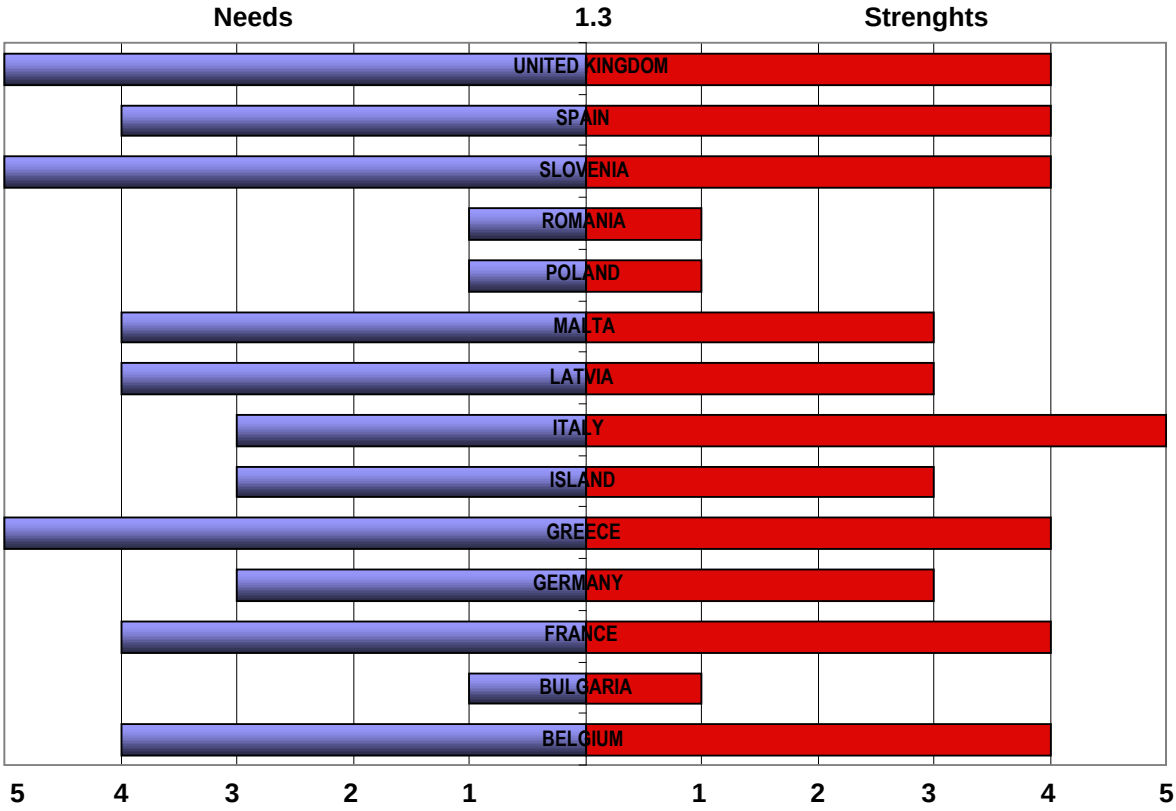
1.1 Critical levels of synergic pollutants in a context of environmental condition (indoor/outdoor).



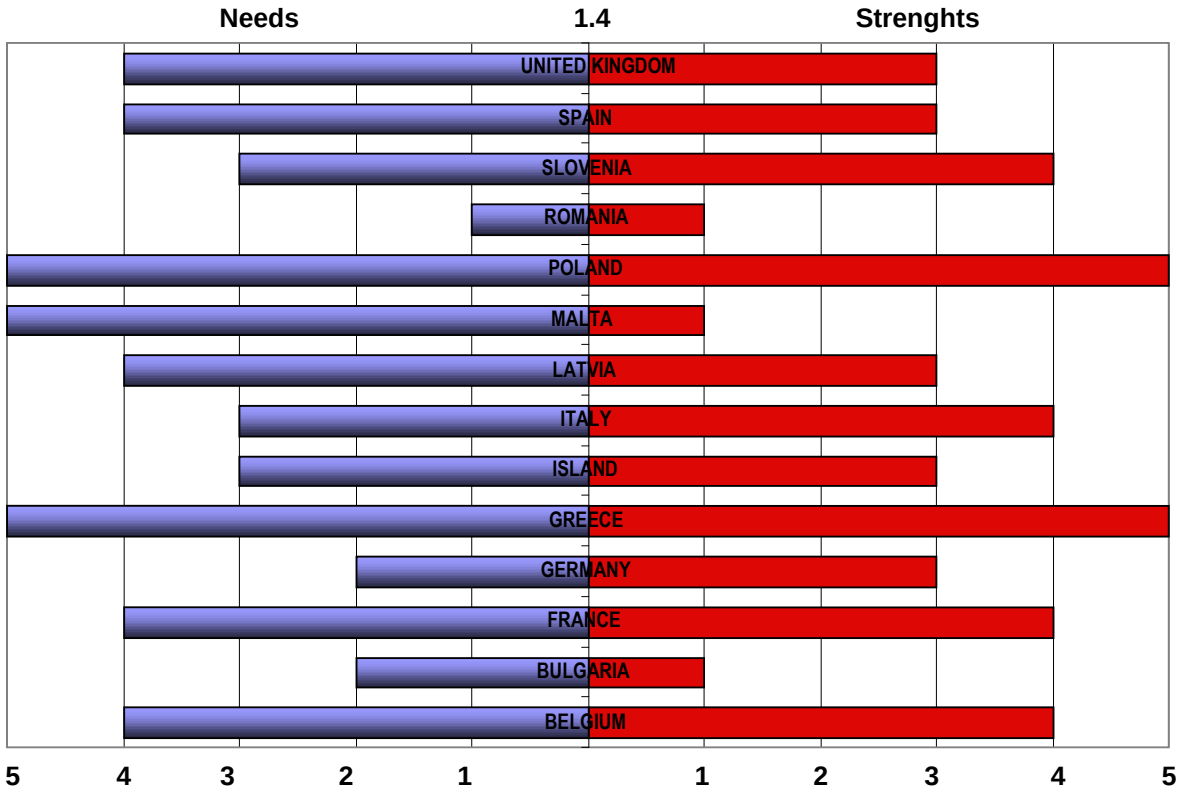
1.2 Preventive approach against extreme natural events (seismic events, flooding, storms, landslides, fire), and first aid measures.



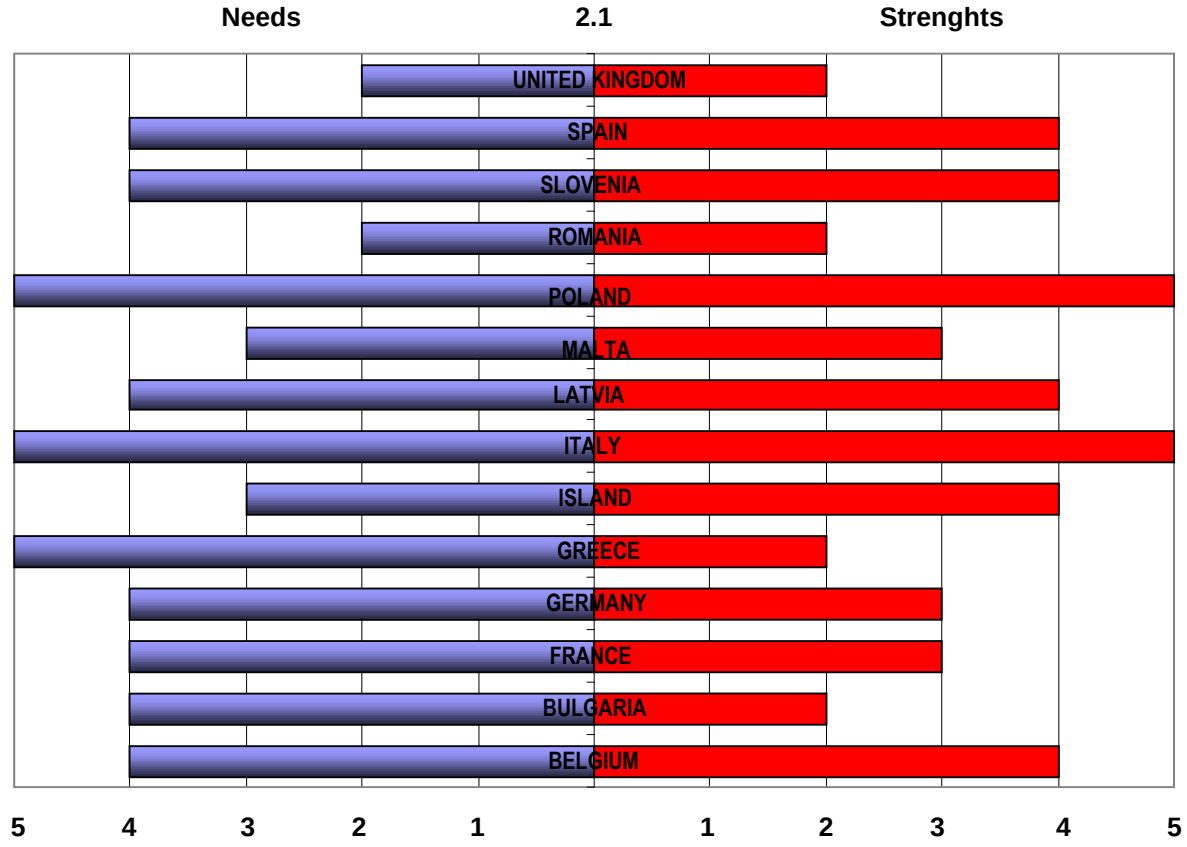
1.3 Impact of climate change on materials and structures and adaptation of technologies to mitigate the negative effects.



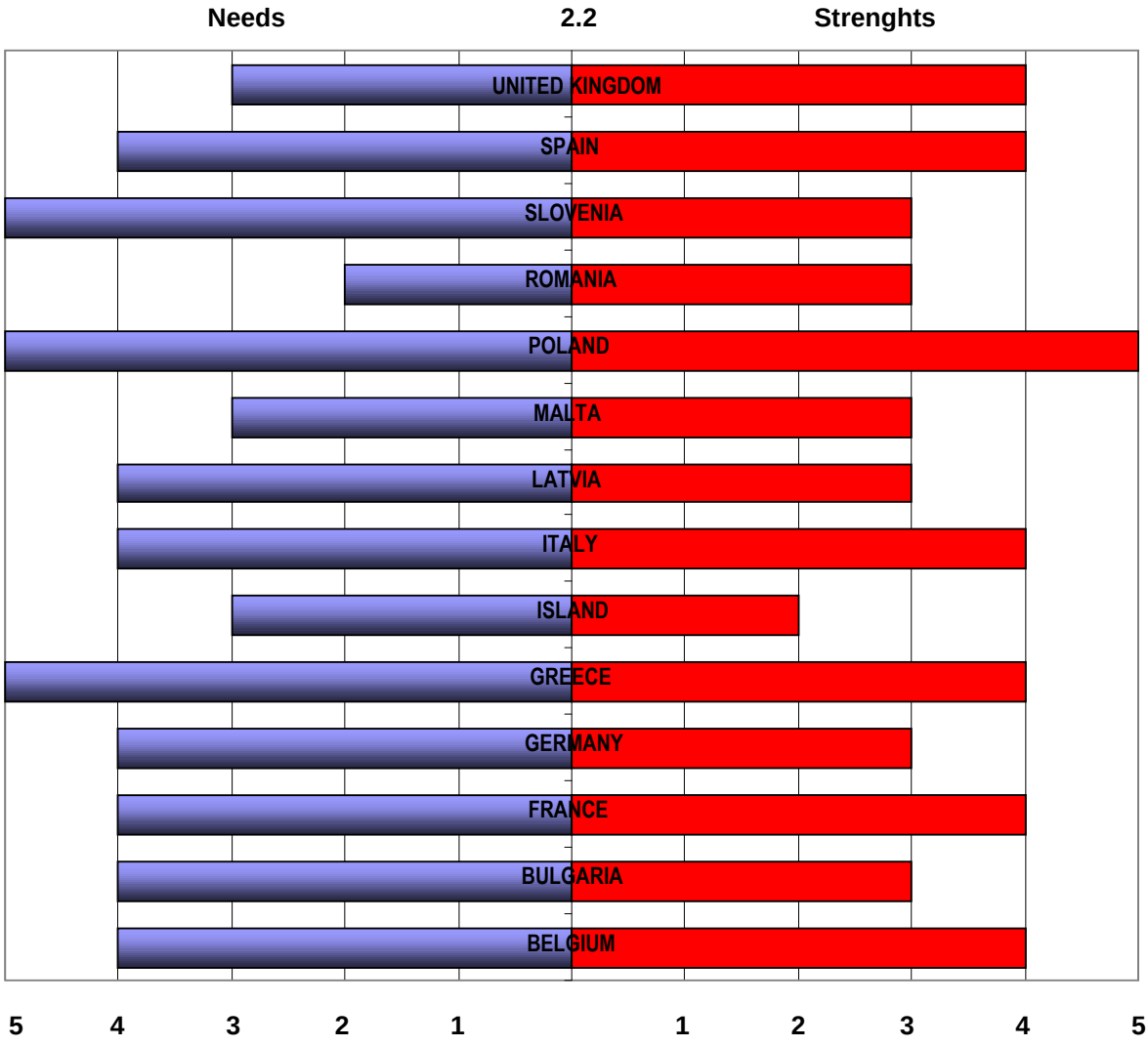
1.4 Changes in hydrogeological conditions in the ground: technologies for stabilising the historic structures.



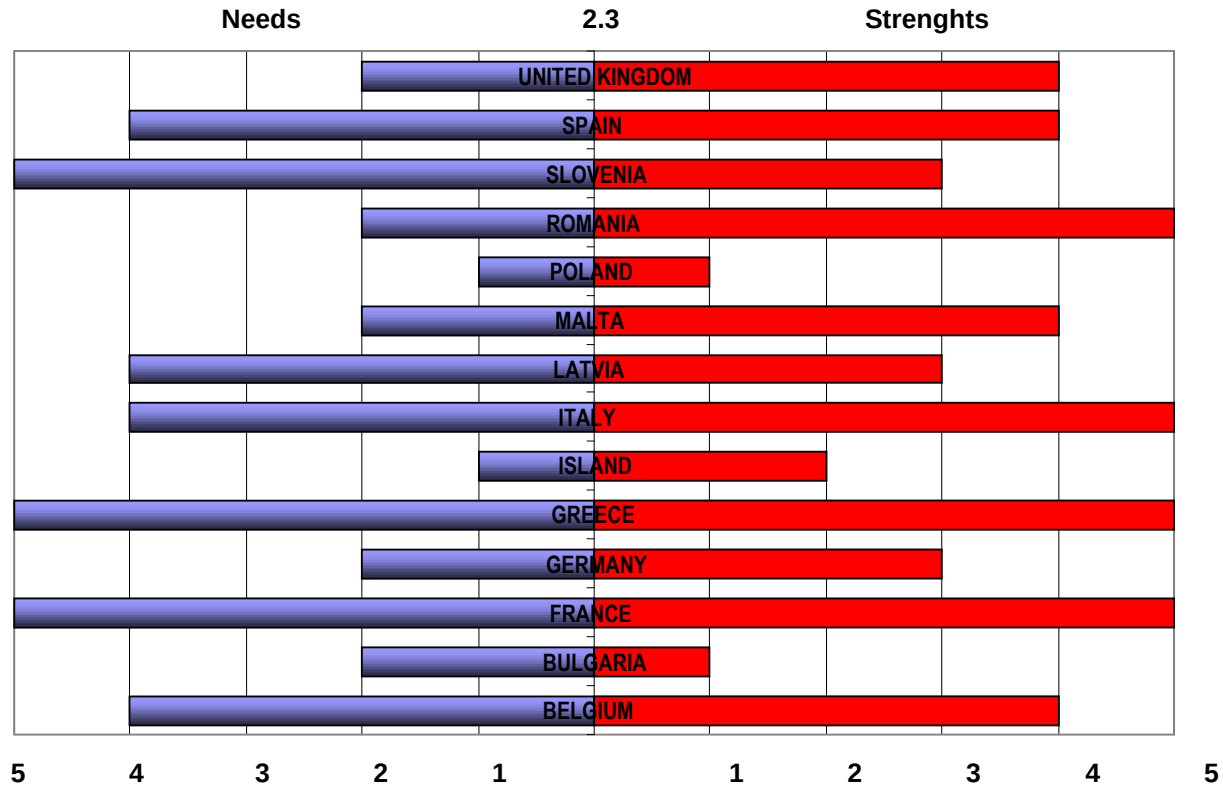
2.1 Multidisciplinary approach on the synergic interactions between environment and materials.



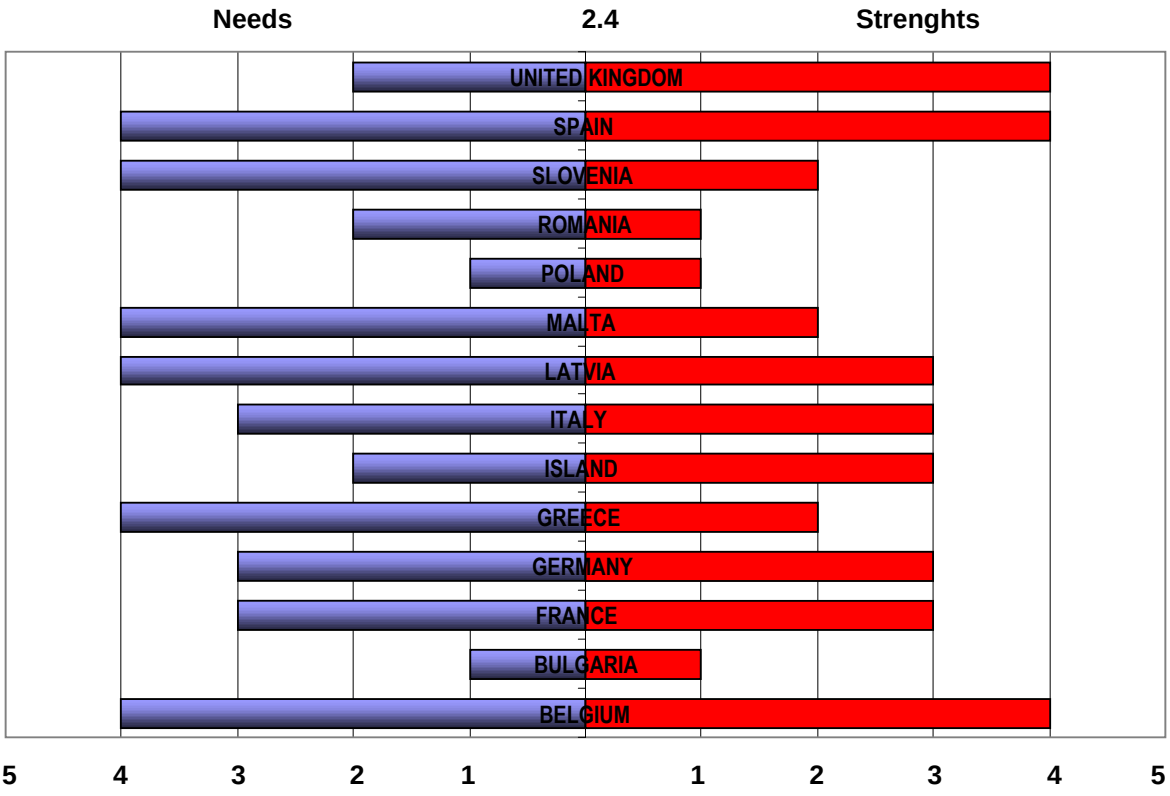
2.2 Interactions between specific environmental factors (temperature, humidity, …) and complex artifacts made by different materials.



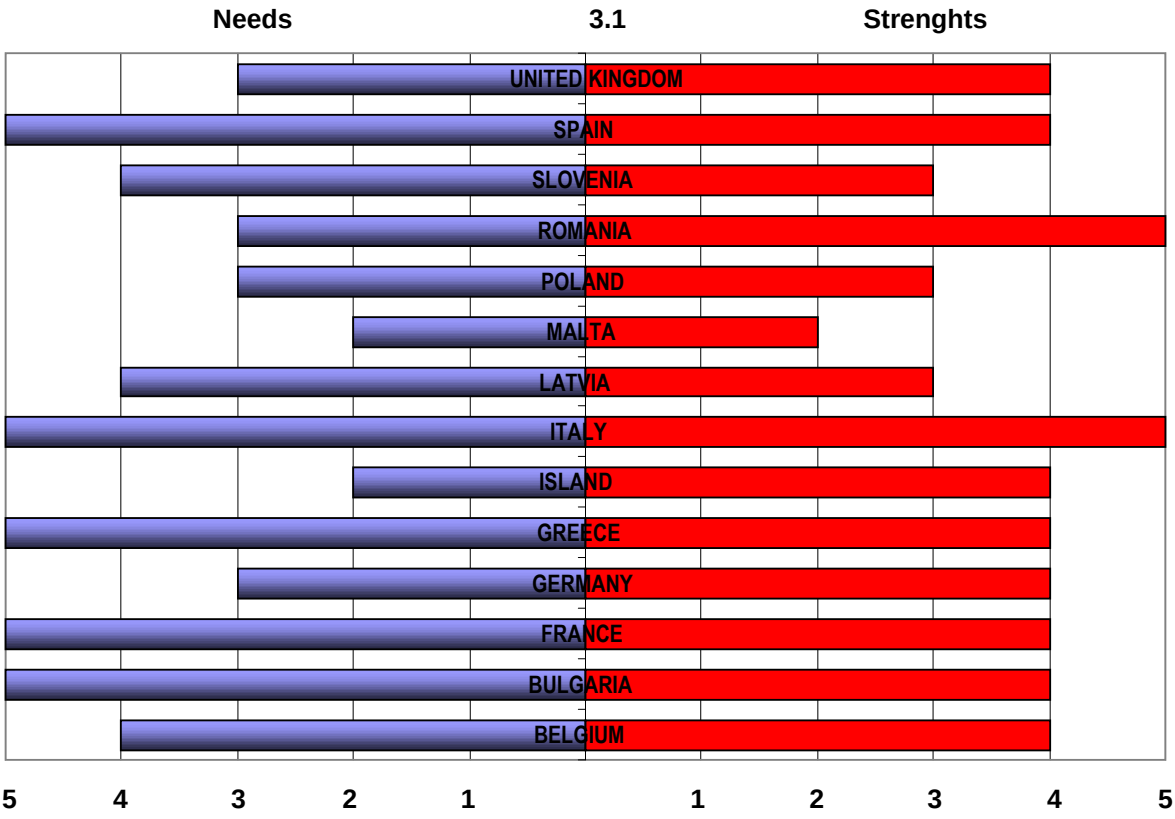
2.3 Best conservation practices against specific attacks (physical, chemical, biological,..) to prevent damage on specific materials.



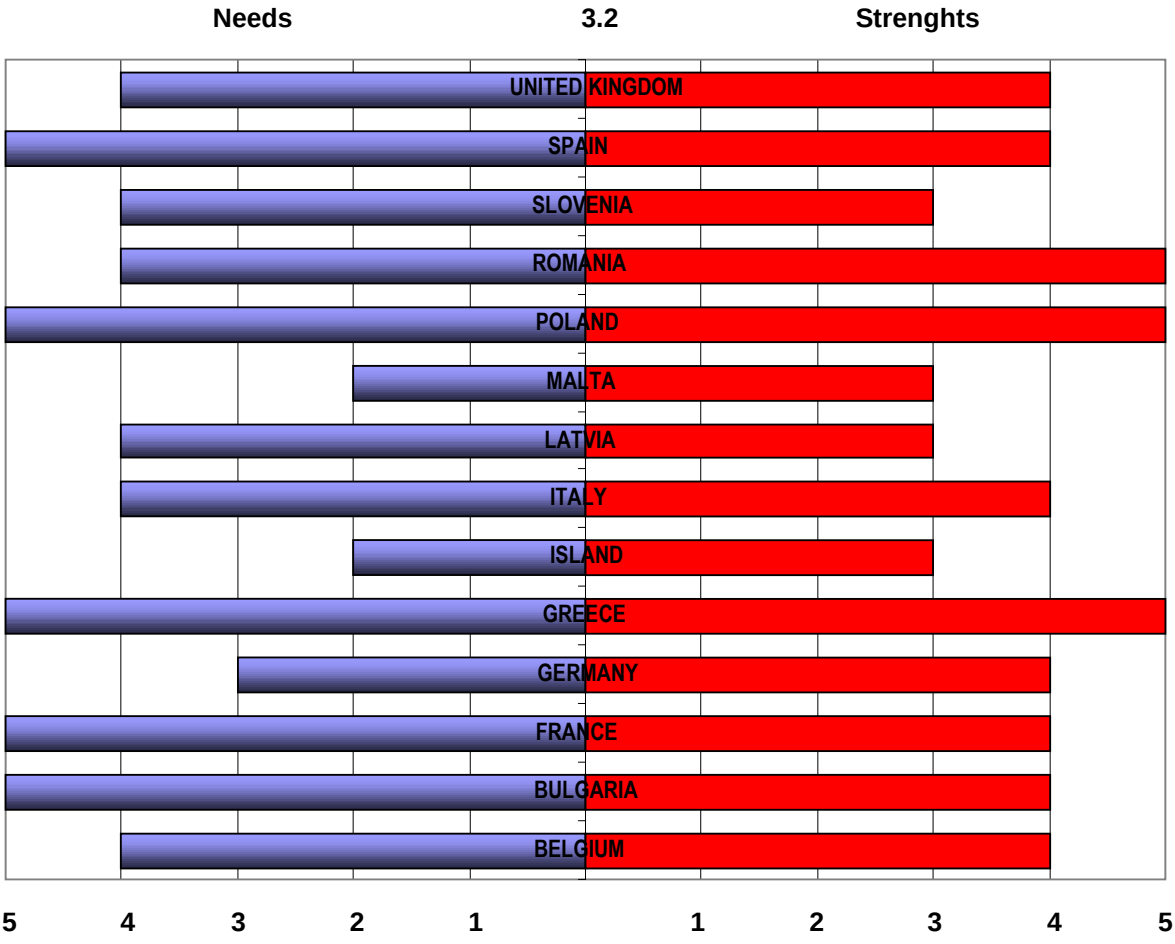
2.4 Damage mitigation - to include salvage, recovery, recycling and reuse of materials.



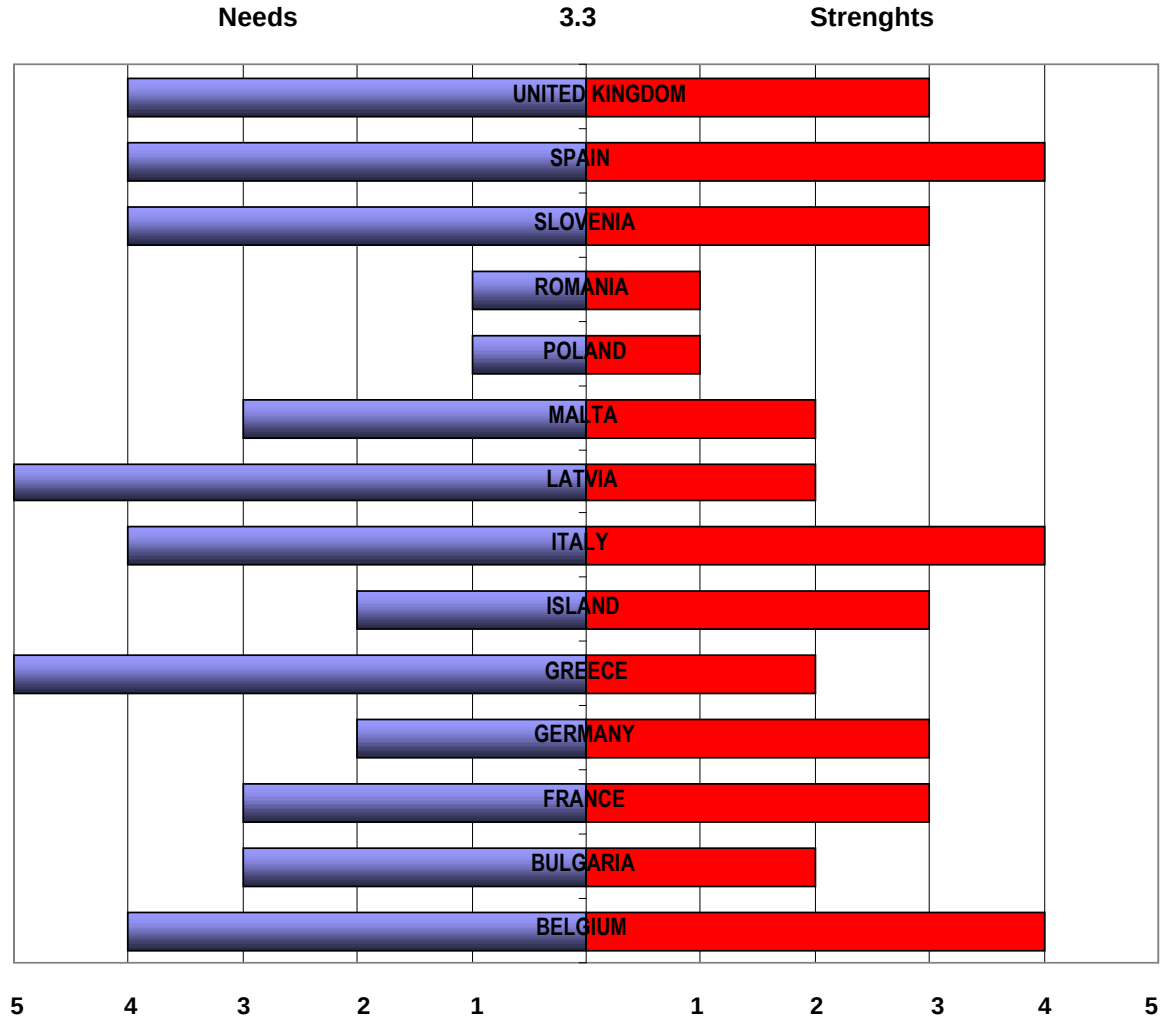
3.1 Portable instruments for in situ measurements.



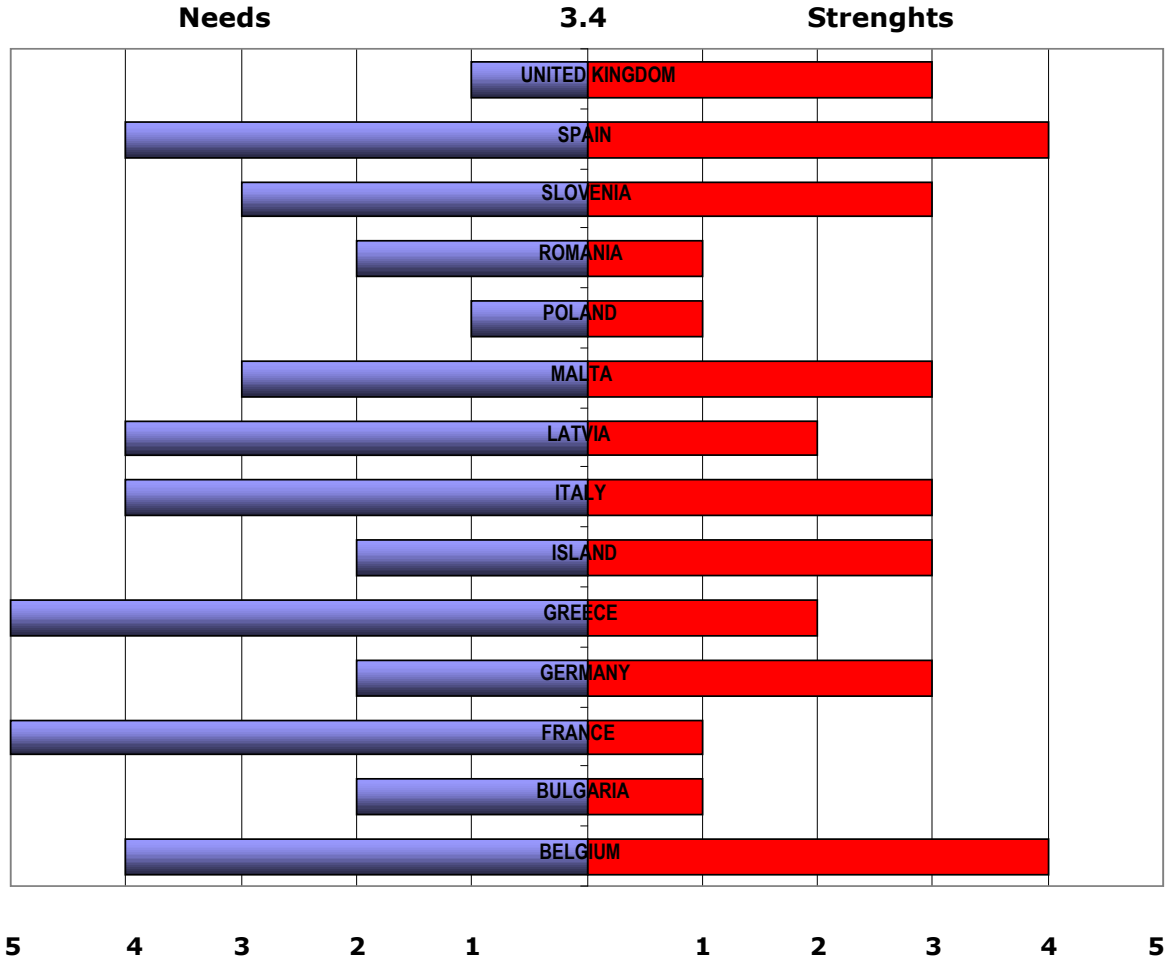
3.2 Non invasive instruments and methodologies for diagnosis and monitoring.



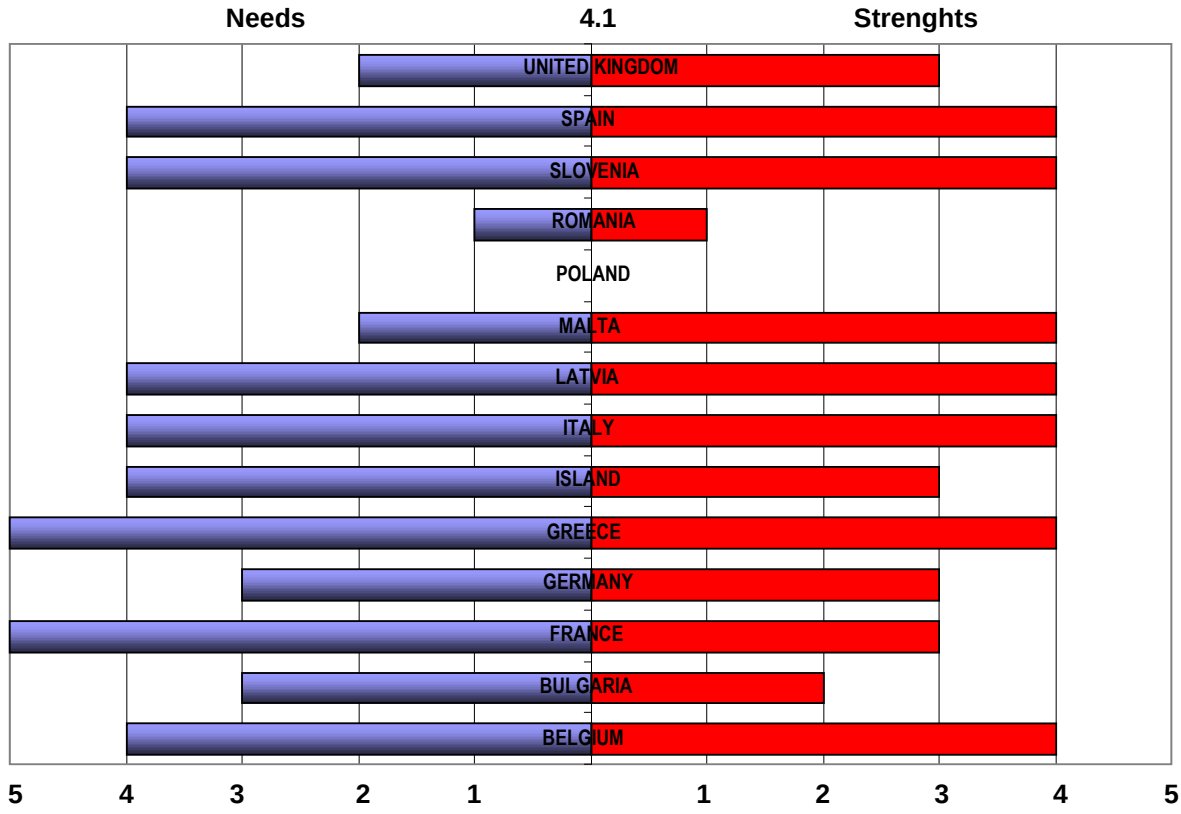
3.3 Intelligent multi-sensor systems for early warning (modeling, local network for monitoring systems), including telediagnosis.



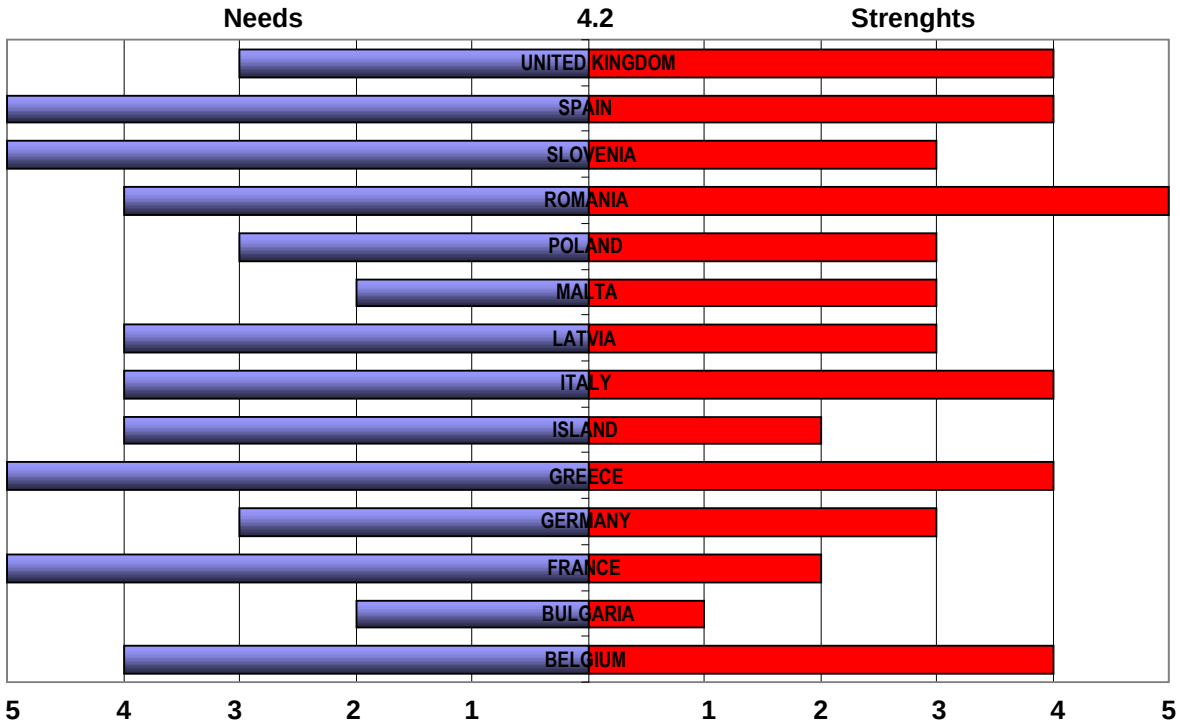
3.4 Re-engineering of instruments and techniques to simplify and to adapt their use.



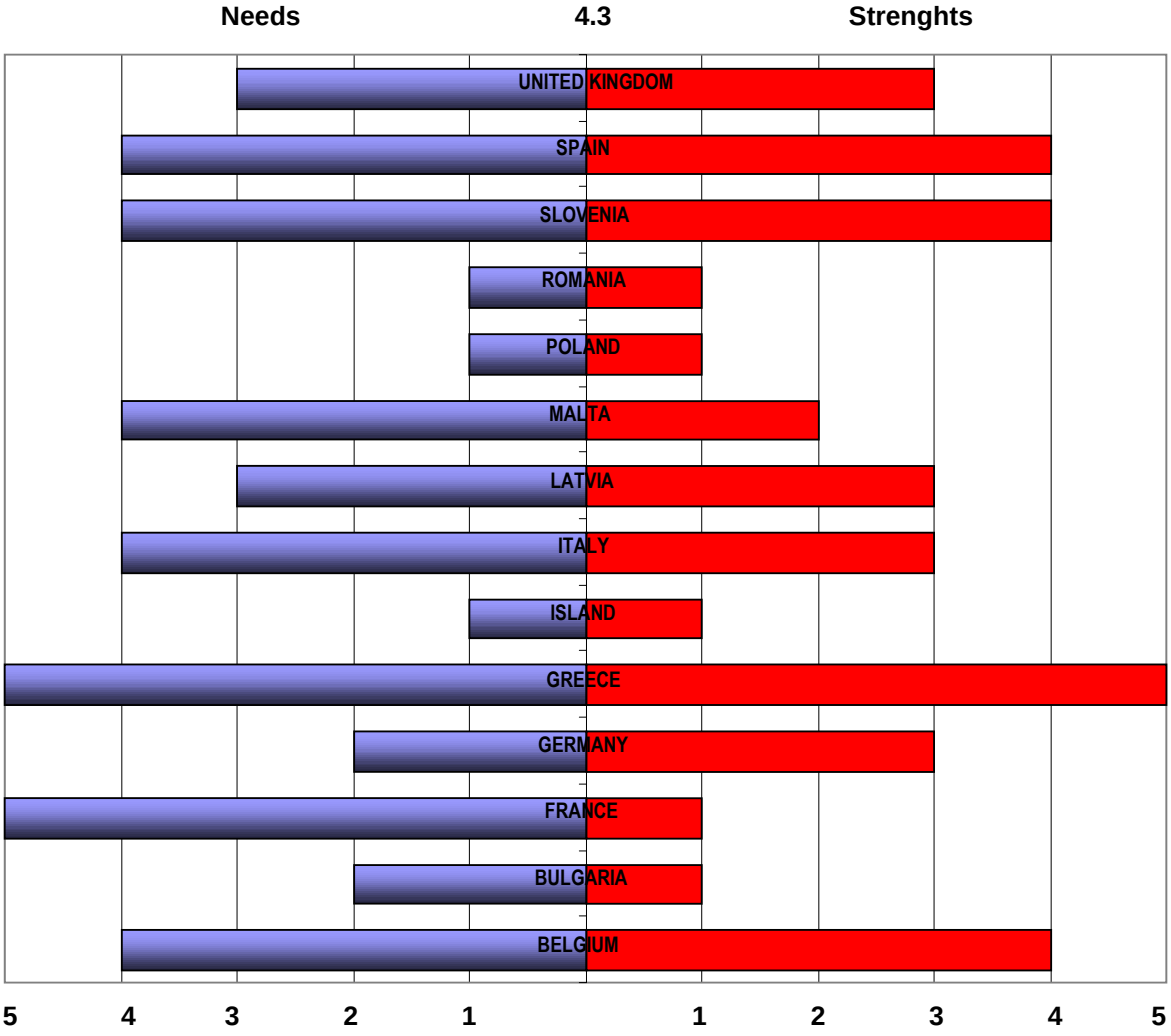
4.1 Development of new and appropriate materials and technologies for the upgrading or the construction of conservation buildings/rooms



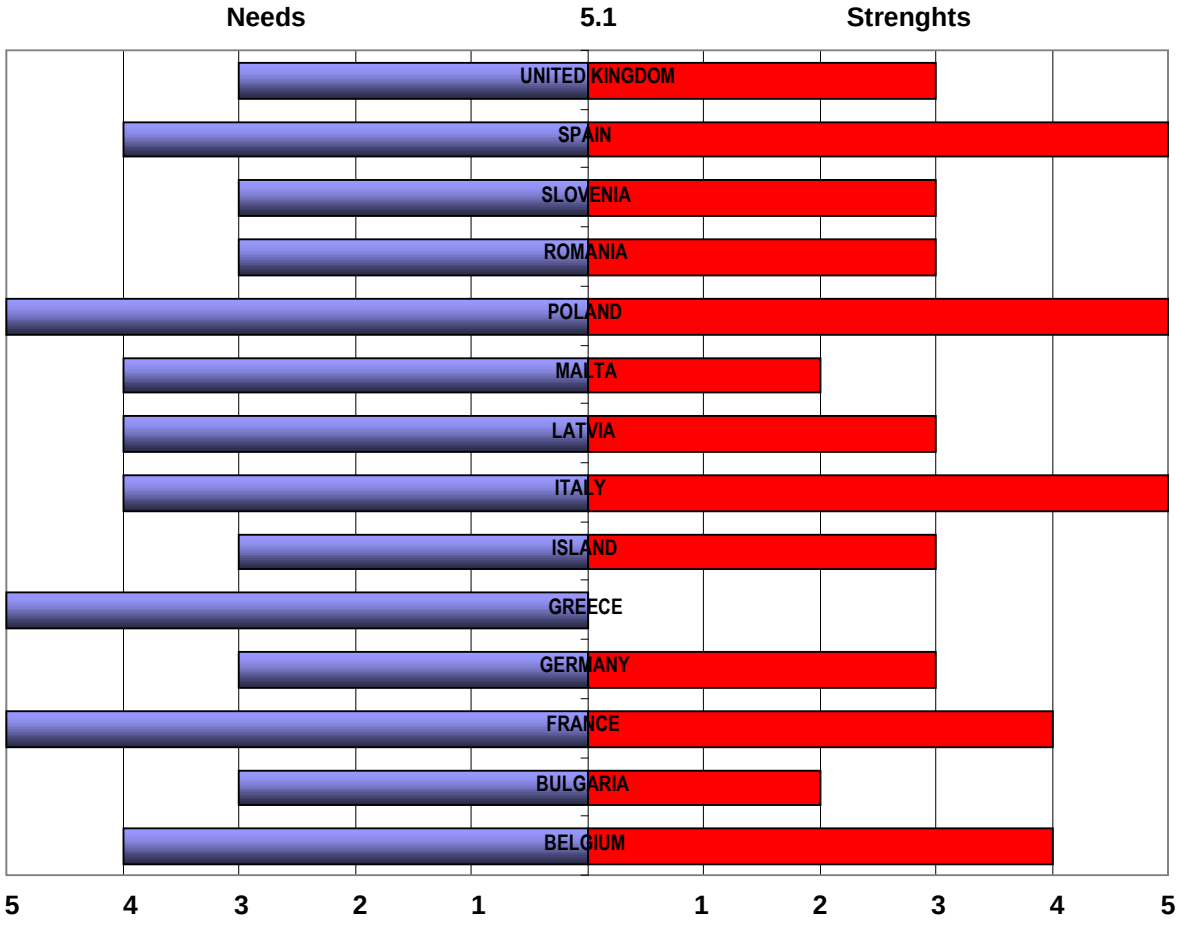
4.2 Development or improvement of products for restoration and conservation with low impact on the historical content of artifacts



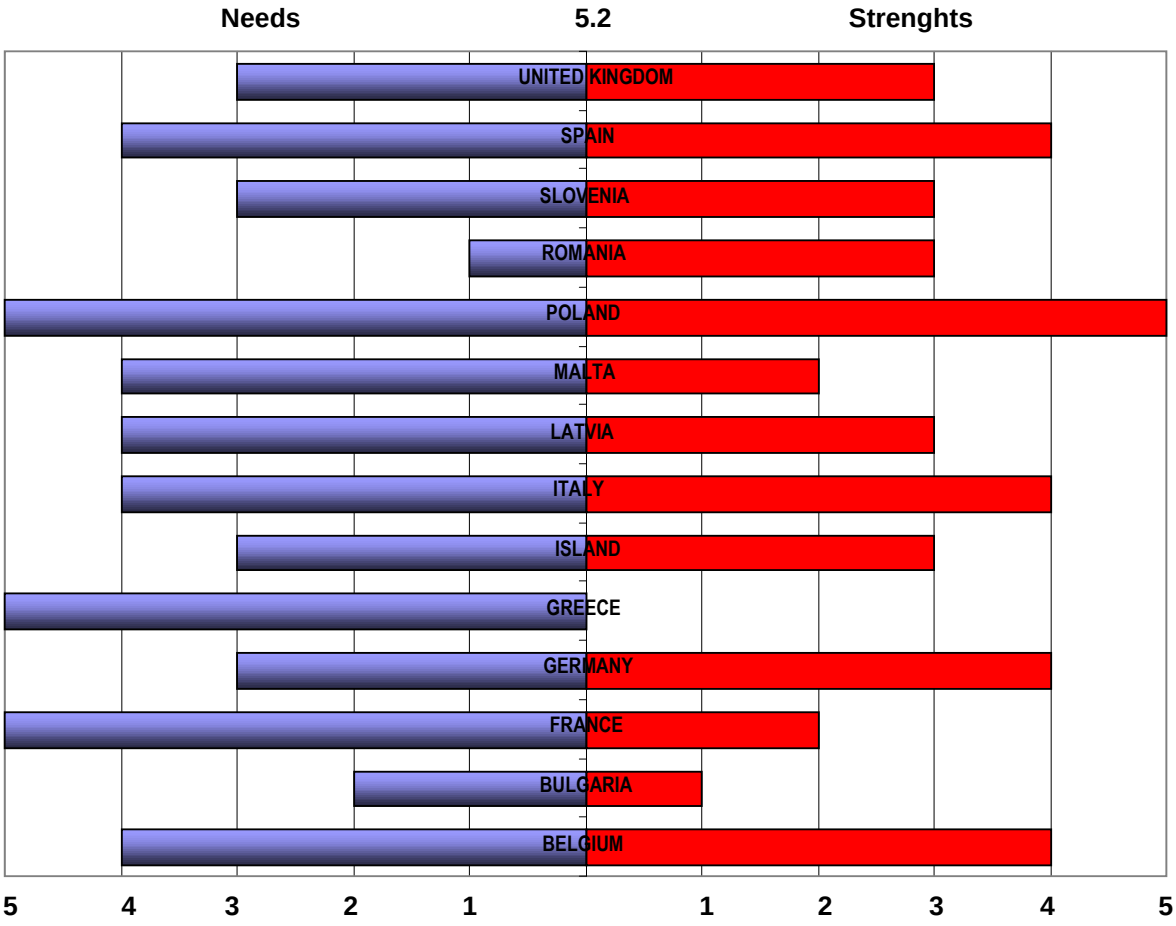
4.3 Identification and assessment procedures to evaluate the fitness for use of new and goal oriented products to define common guidelines and pre-standards.



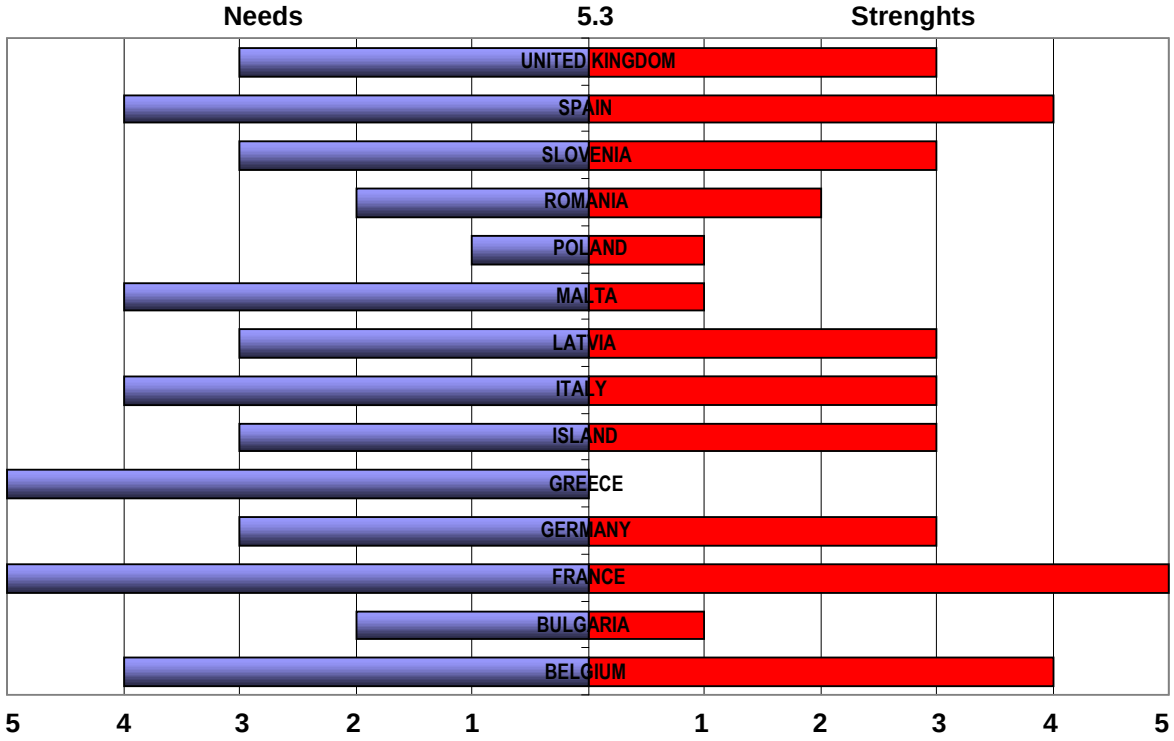
5.1 New solutions for development, assessment and reporting of analysis protocol for the time effects evaluation of treatments (e.g. cleaning, biocides…) and materials.



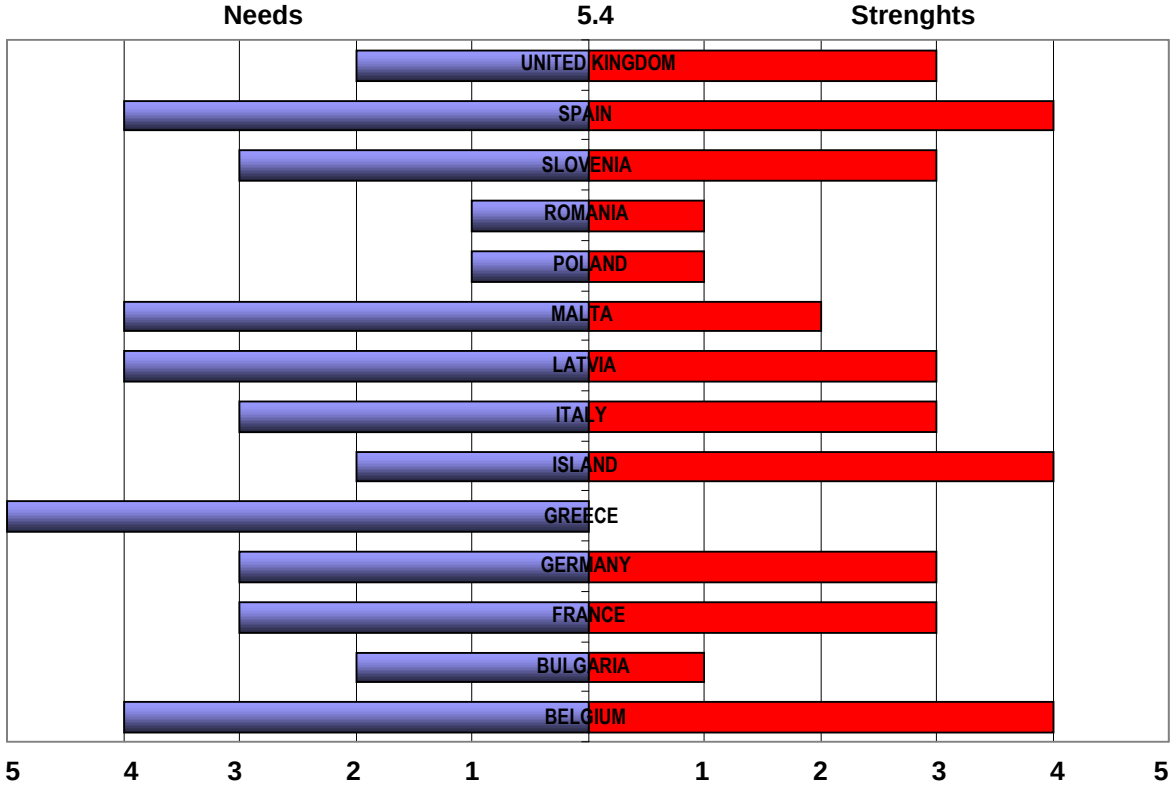
5.2 Innovative solutions for compatibility, durability and reversibility of new materials and treatments.



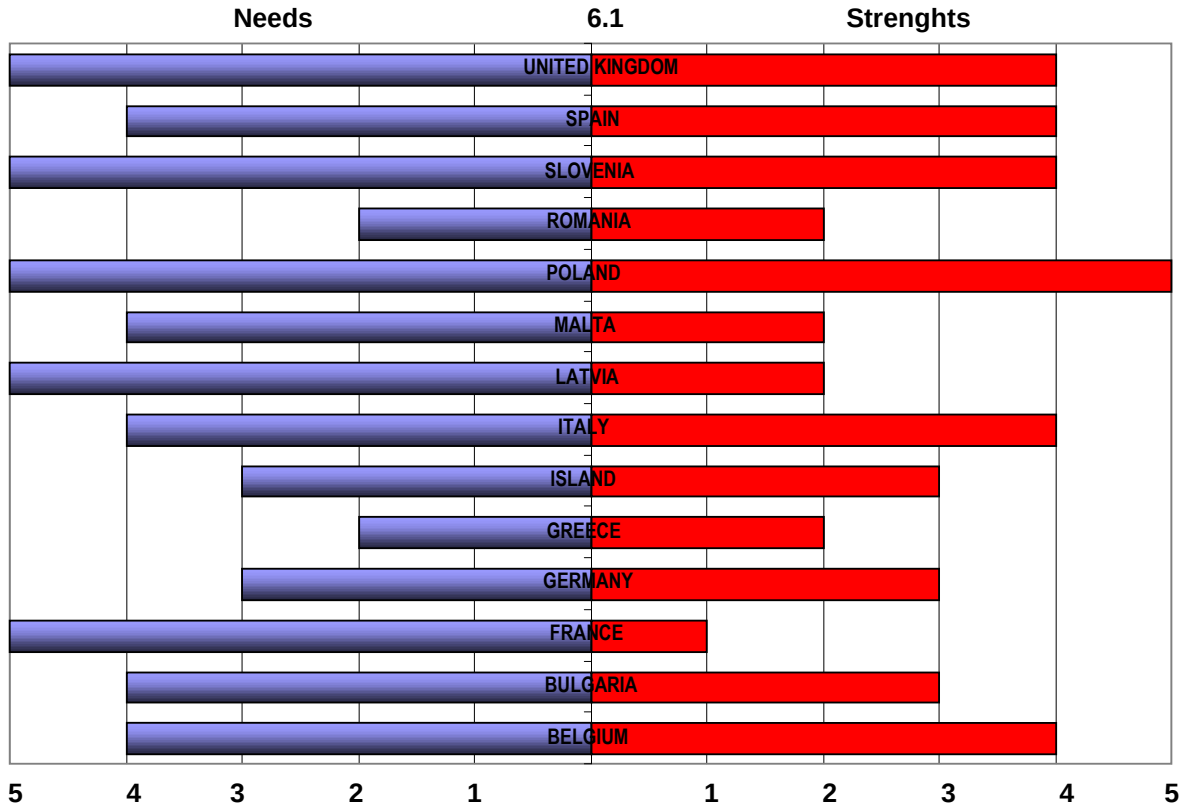
5.3 Modelling and simulation for predictive evaluation and validation of materials and treatments.



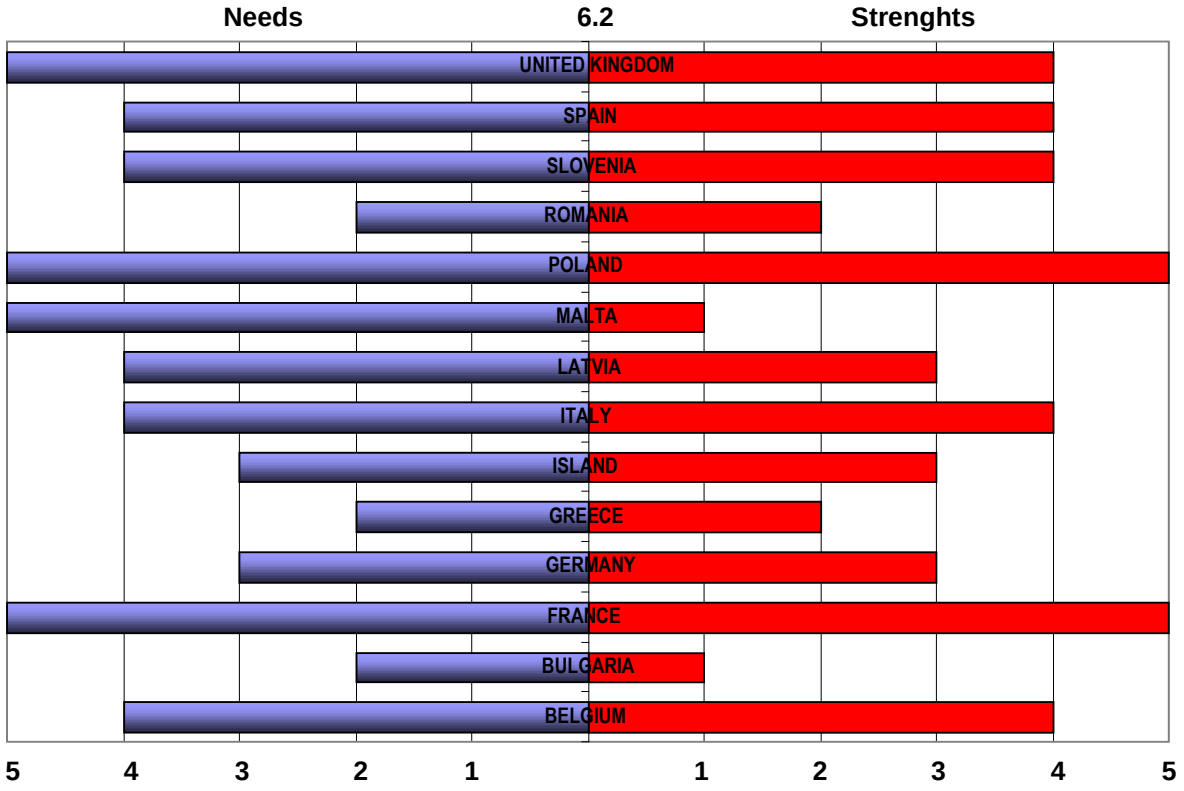
5.4 Impact of modern finishing materials and techniques on historic structures.



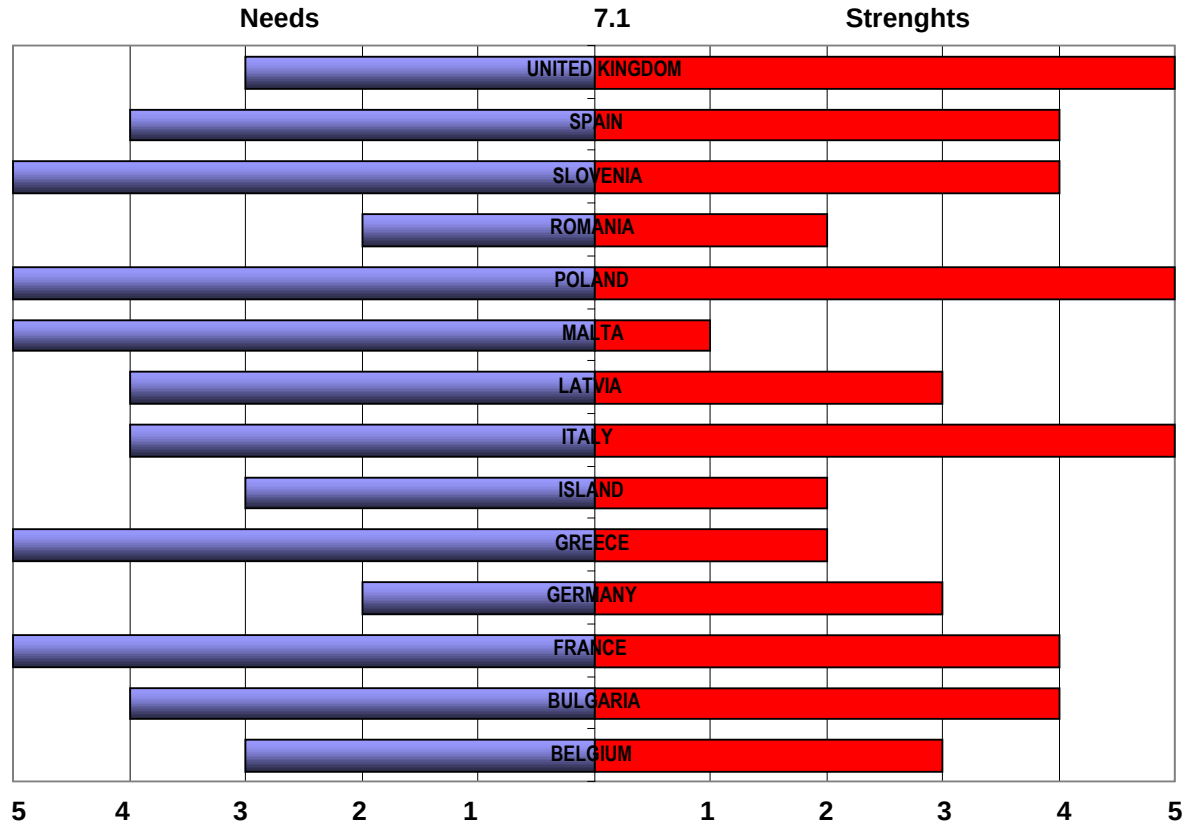
6.1 Development of strategies and procedures for storage and preservation of multi media supports and readability of the stored content.



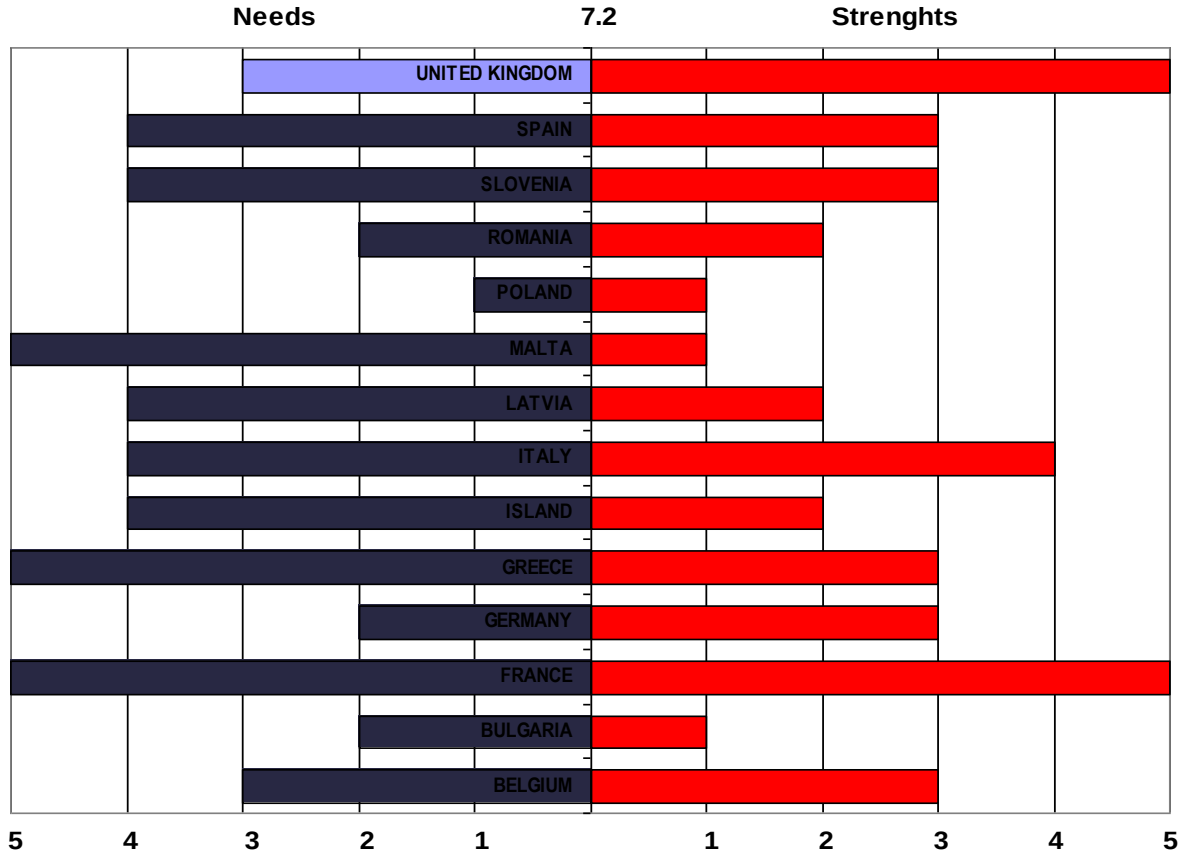
6.2 Innovative proposals for conservation and durability of contemporary art materials (i. e. plastics, ceramics, new alloys, glasses, new dyes, concrete, mortars).



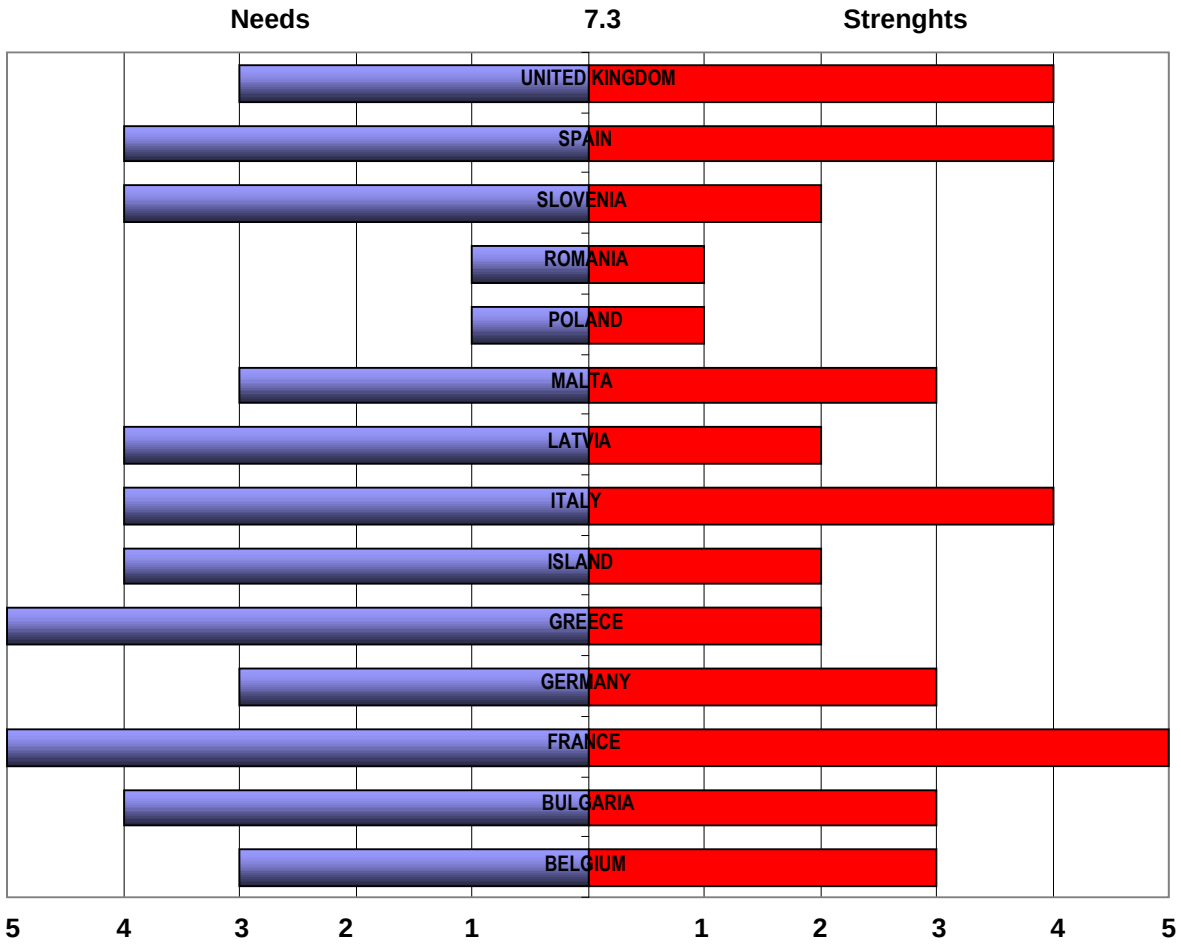
7.1 Development of management systems on quality and sustainability of indoor/outdoor cultural heritage environments.



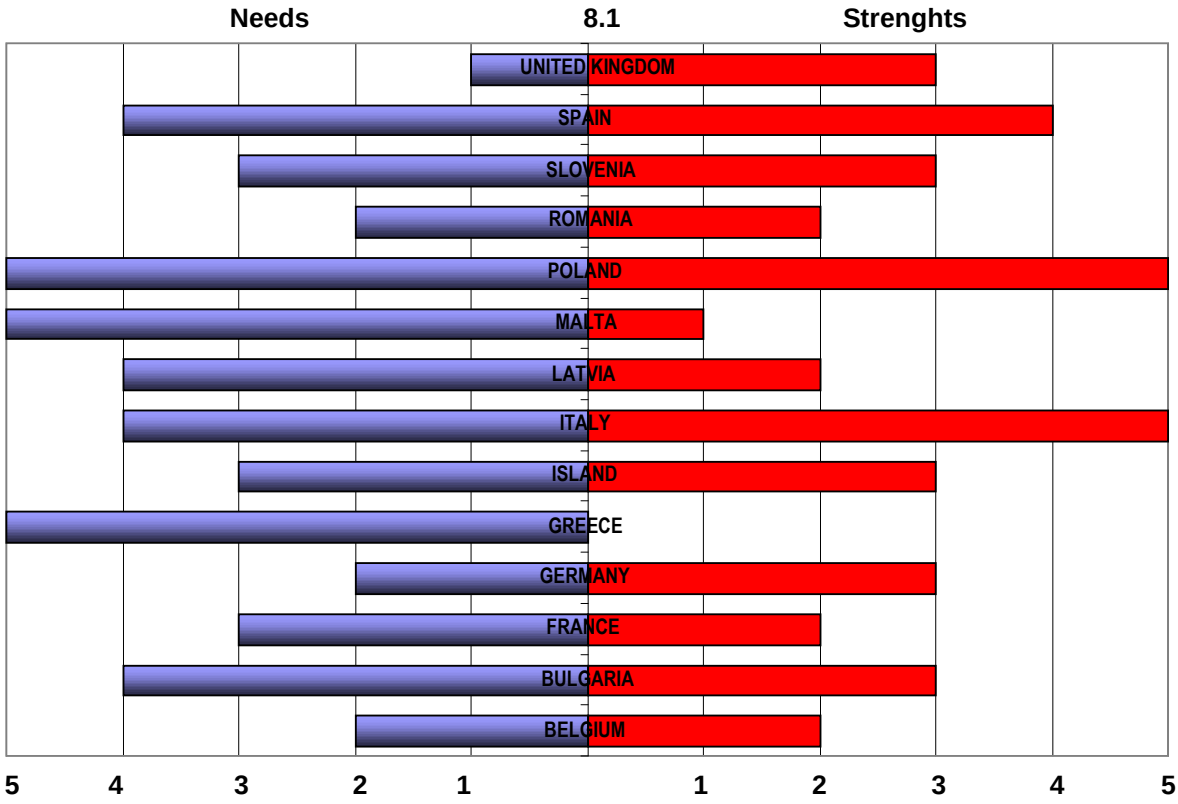
7.2 Development, testing and validation of mobility models to reduce environmental impacts to unmovable cultural heritage (emission, vibration…).



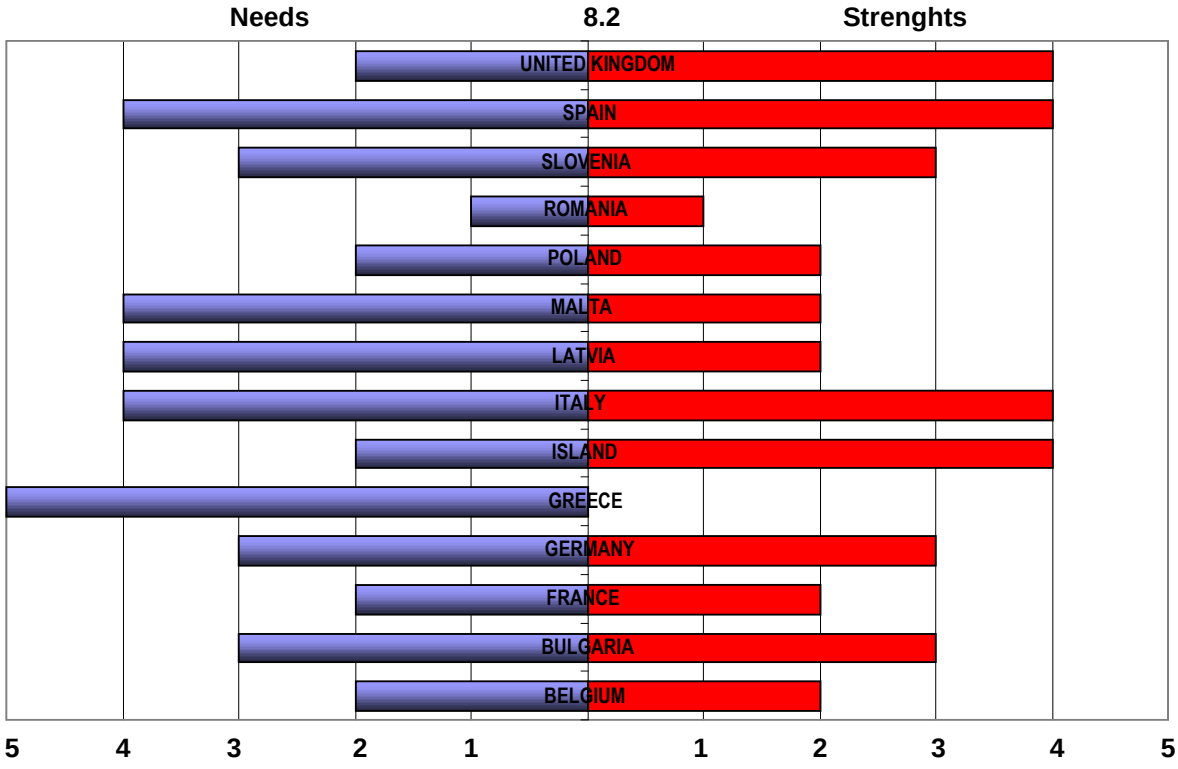
7.3 Development of scientific criteria and tools to measure and regulate tourist impact on cultural heritage sites.



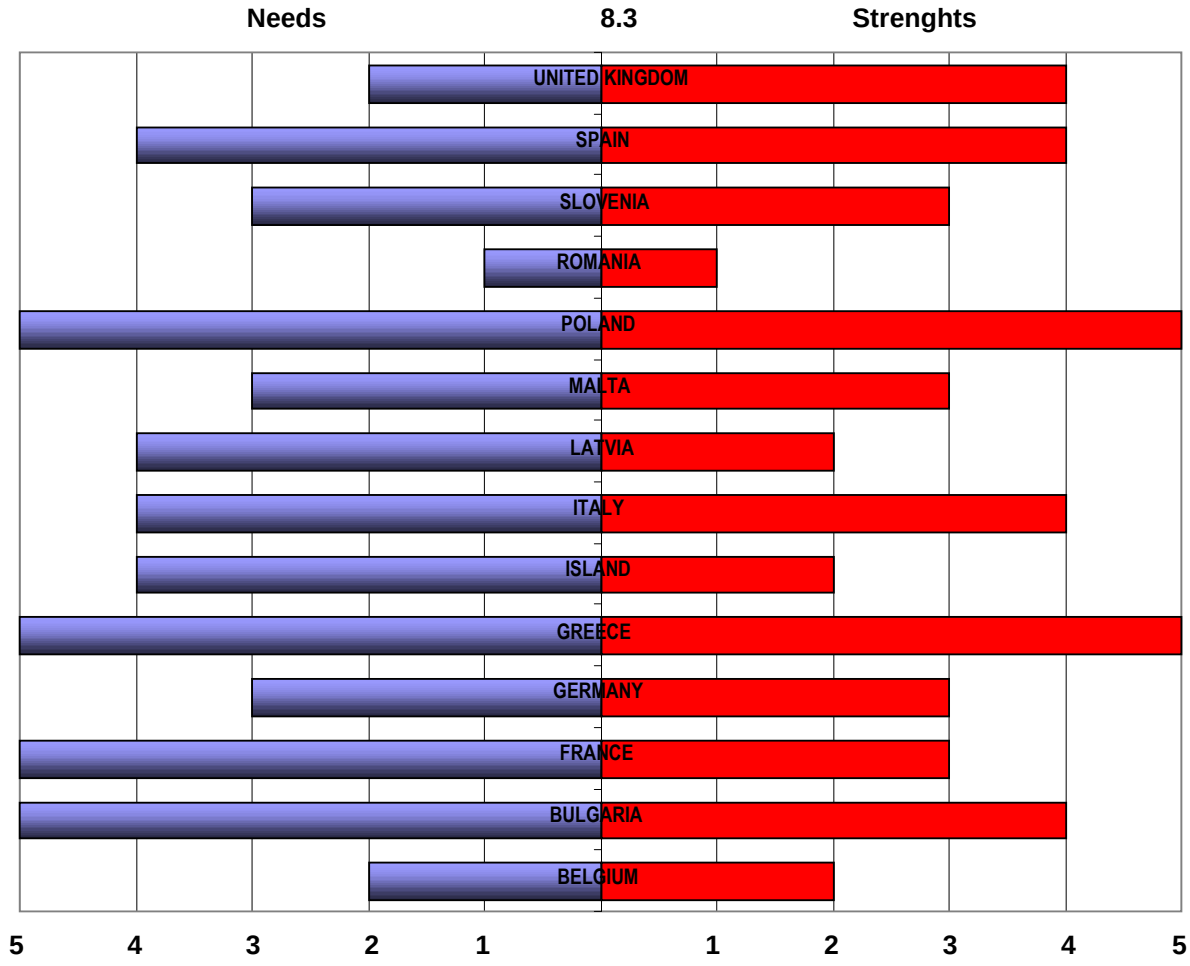
8.1 Development of sensors and devices for a safe handling, movement, transport and exhibition of artefacts and related guidelines.



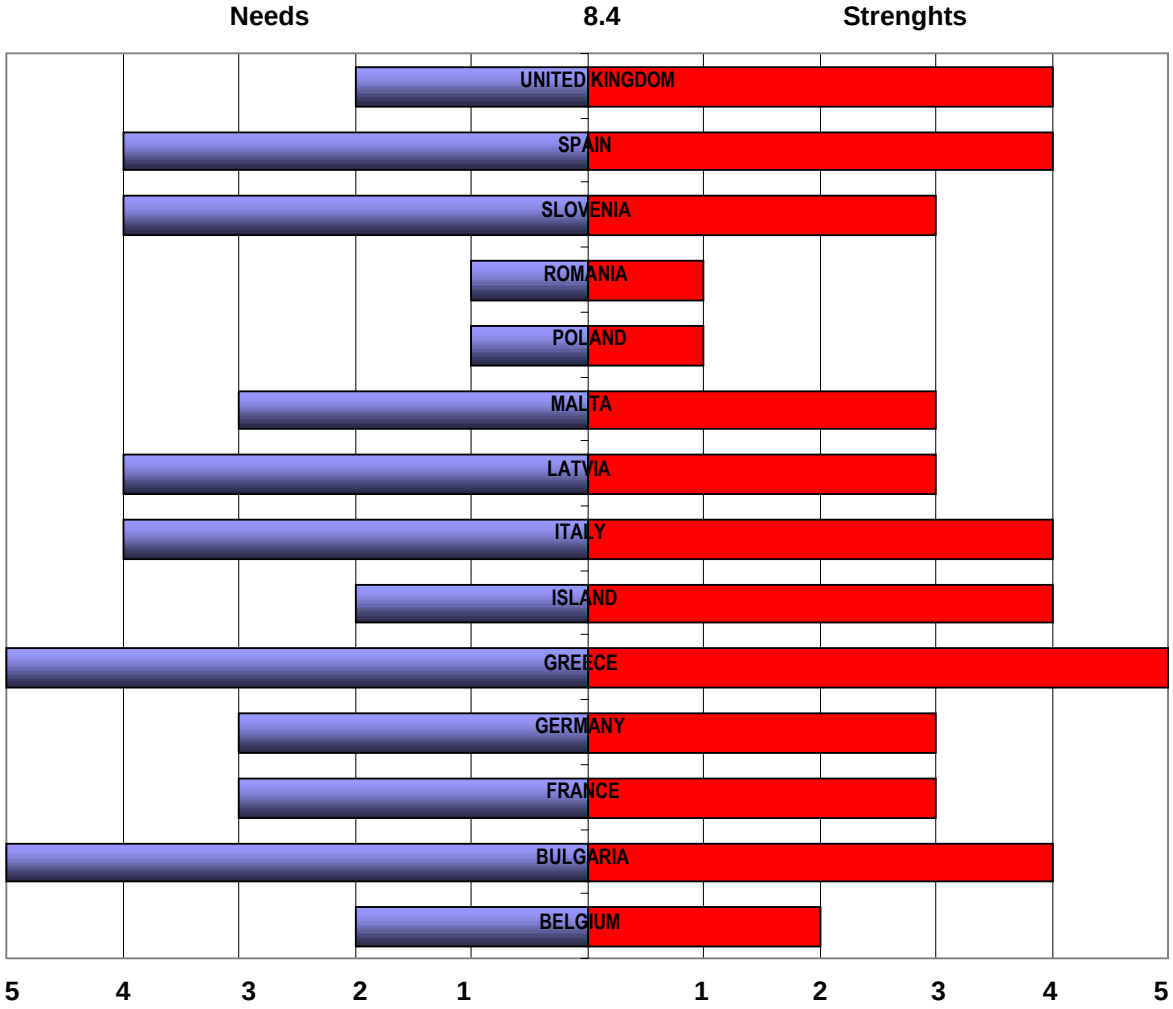
8.2 Development of integrated systems for effective prevention, detection and reaction to risk situations at different scale (e.g.: fire, theft, vandal attacks, etc).



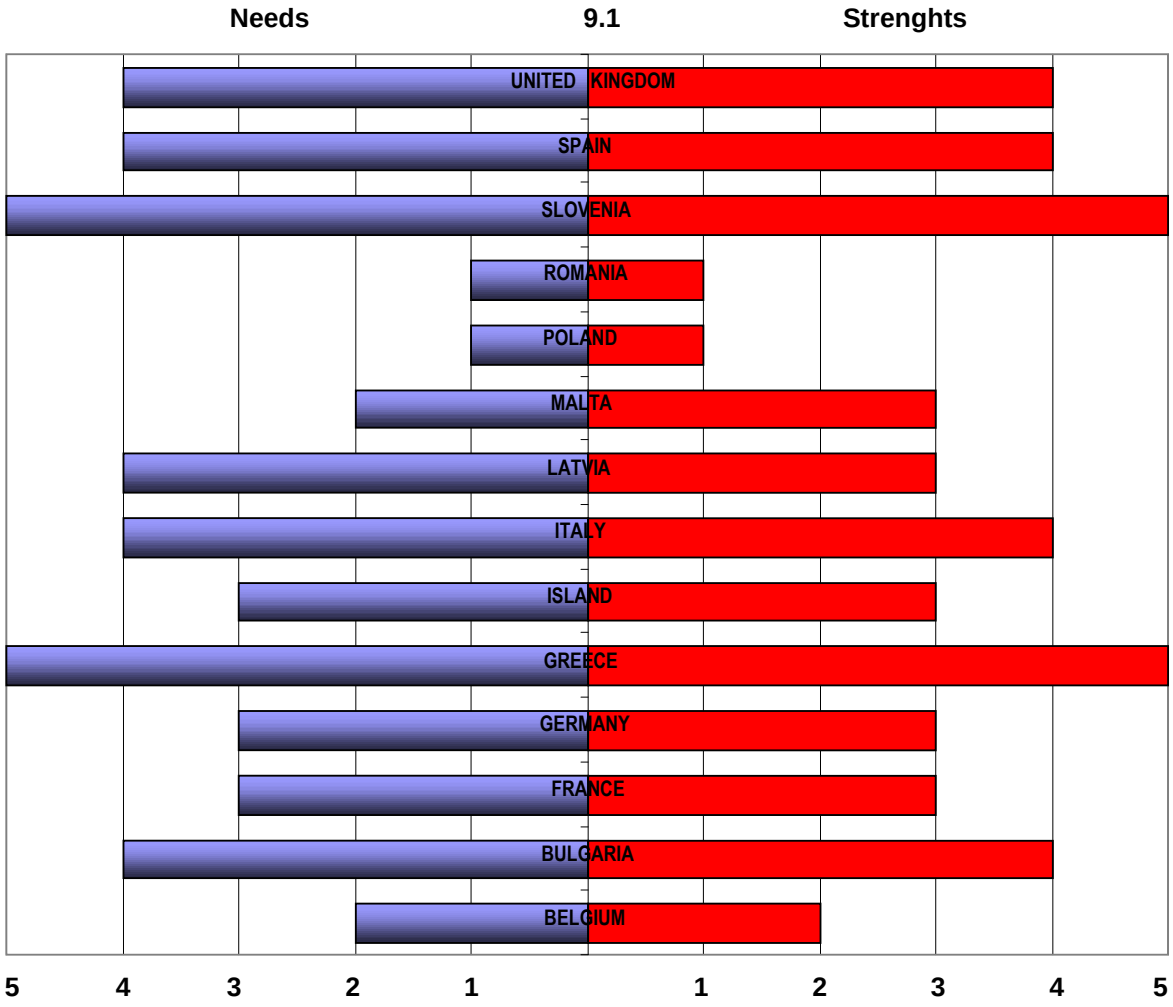
8.3 Development of techniques to support the identification of fakes or stolen artefacts with special reference to the insurance issues.



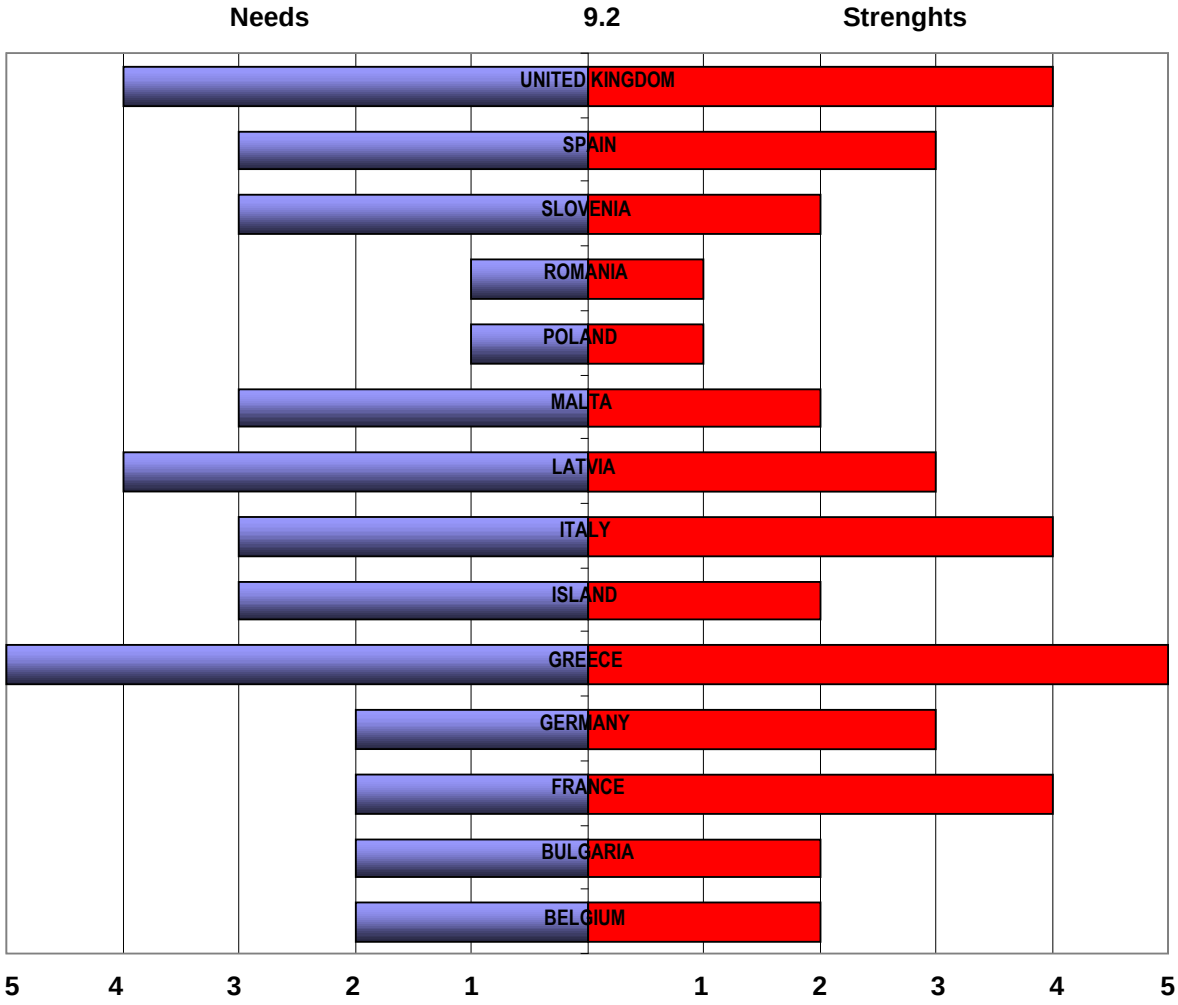
8.4 Techniques for inventory, cataloguing and traceability of cultural heritage objects reference to the insurance issues.



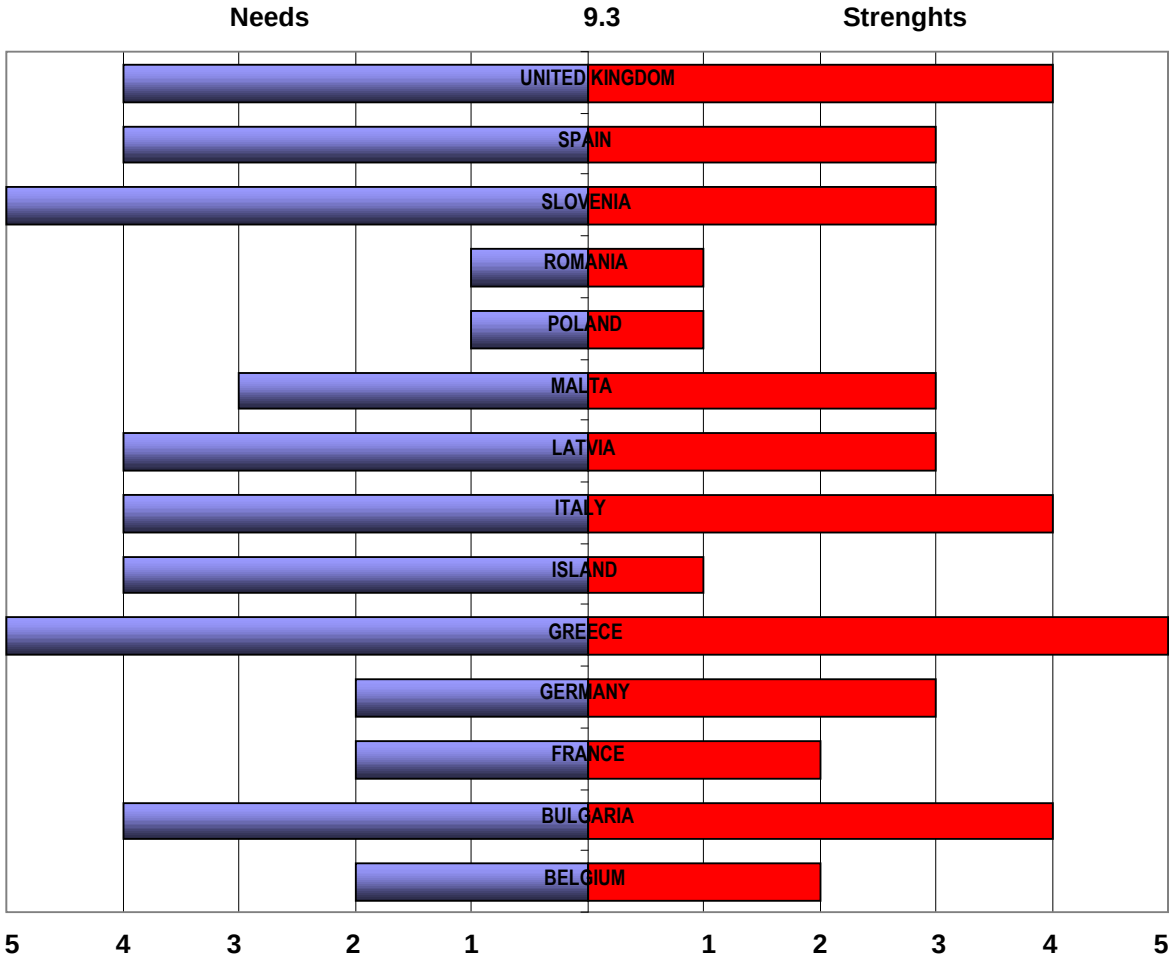
9.1 Web mapping and Web GIS innovative tools for the tele-monitoring and remote control of the archaeological sites and cultural landscapes.



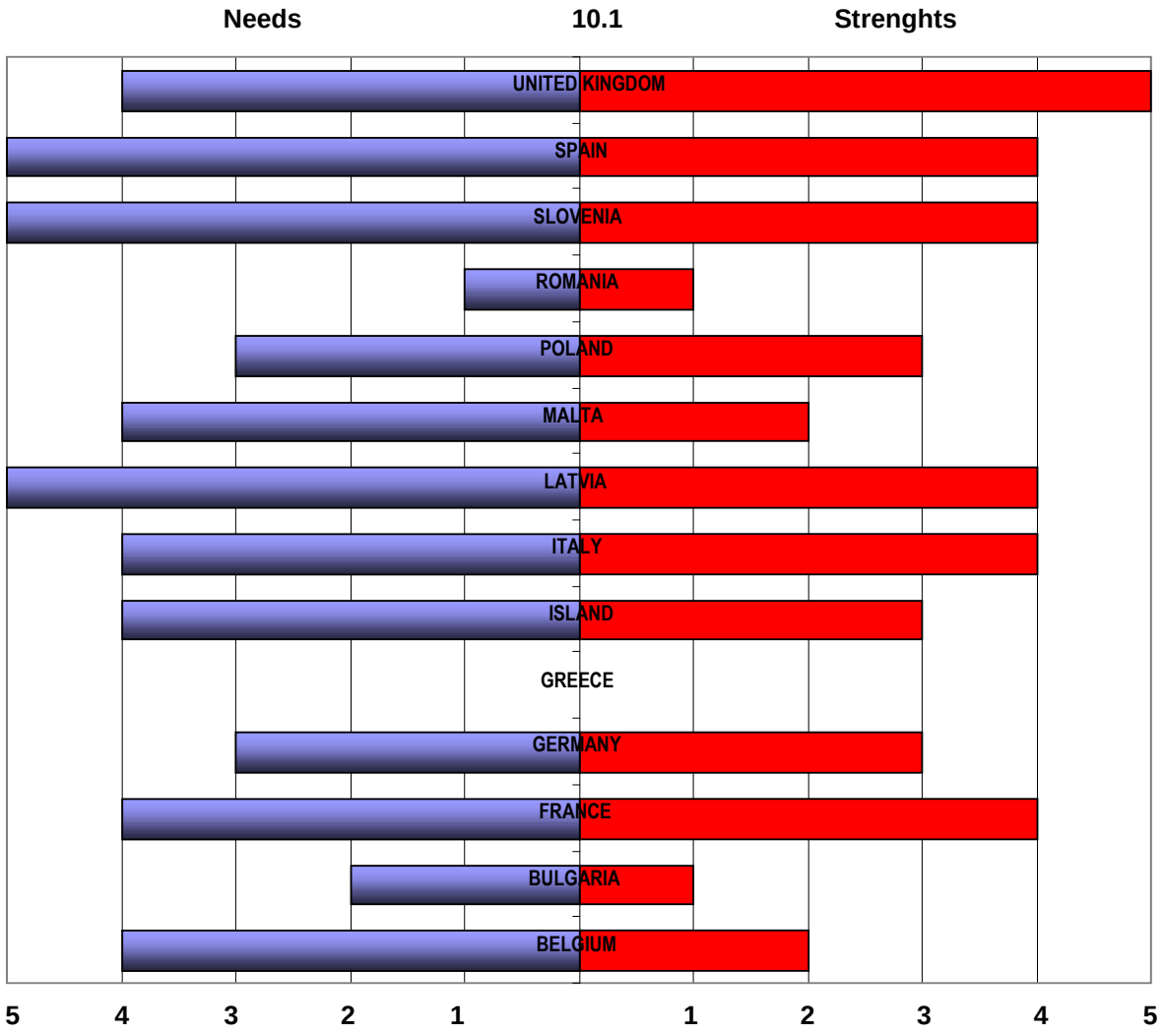
9.2 Development of innovative and aesthetically acceptable devices for the tele-survey of movable artefacts



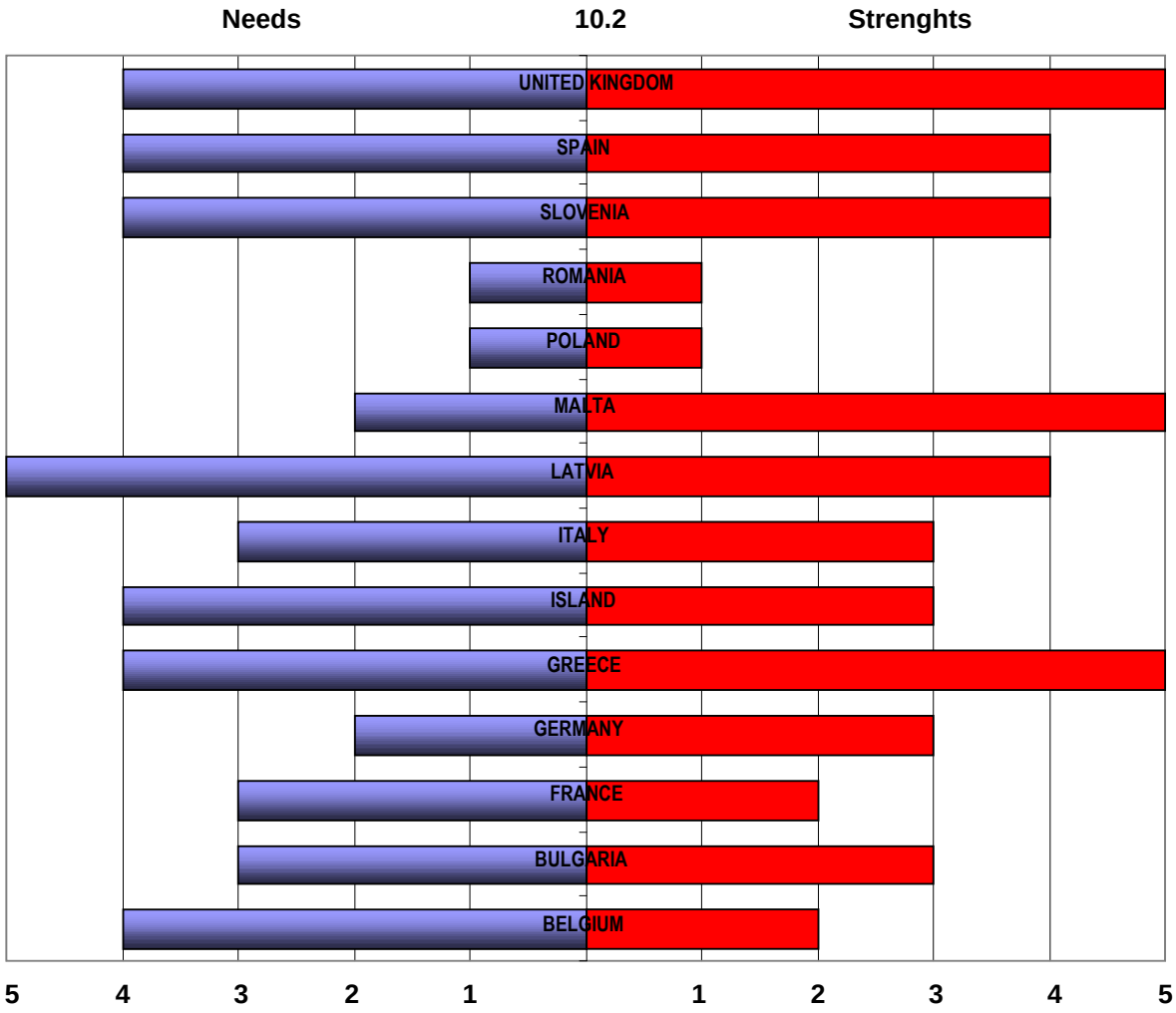
9.3 Development of advanced systems for the tele-survey and remote fruition of underwater cultural heritage.



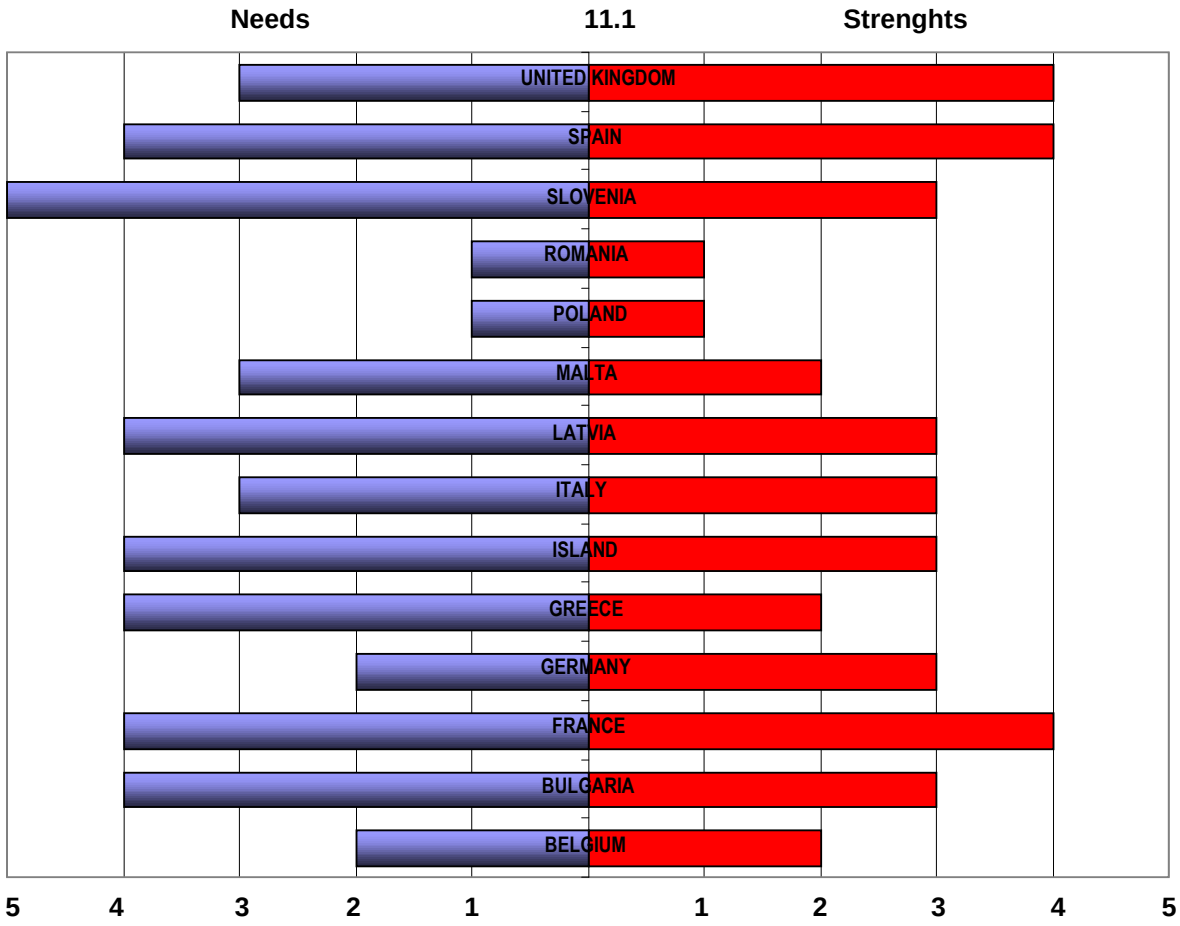
10.1 Preservation of industrial heritage: objects, buildings and landscape.



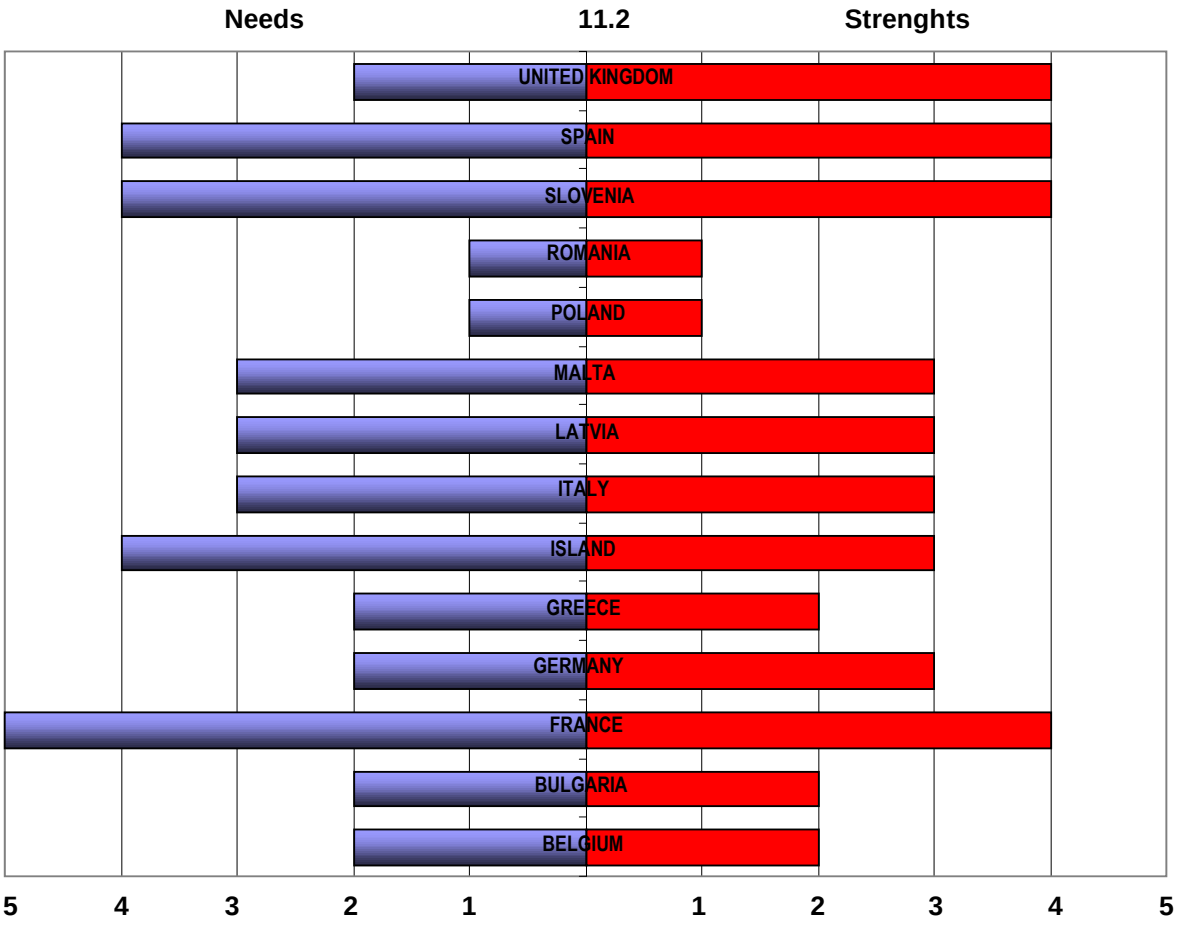
10.2. Preservation of 20th century military heritage: objects, buildings and ladscapes.



11.1 Development of Quality Management Systems (planning, implementation, assessment, reporting and quality improvement) addressed to the process of conservation of cultural heritage.



11.2 Prenormative activities goal-oriented to improve the reproducibility and repeatability of testing results.



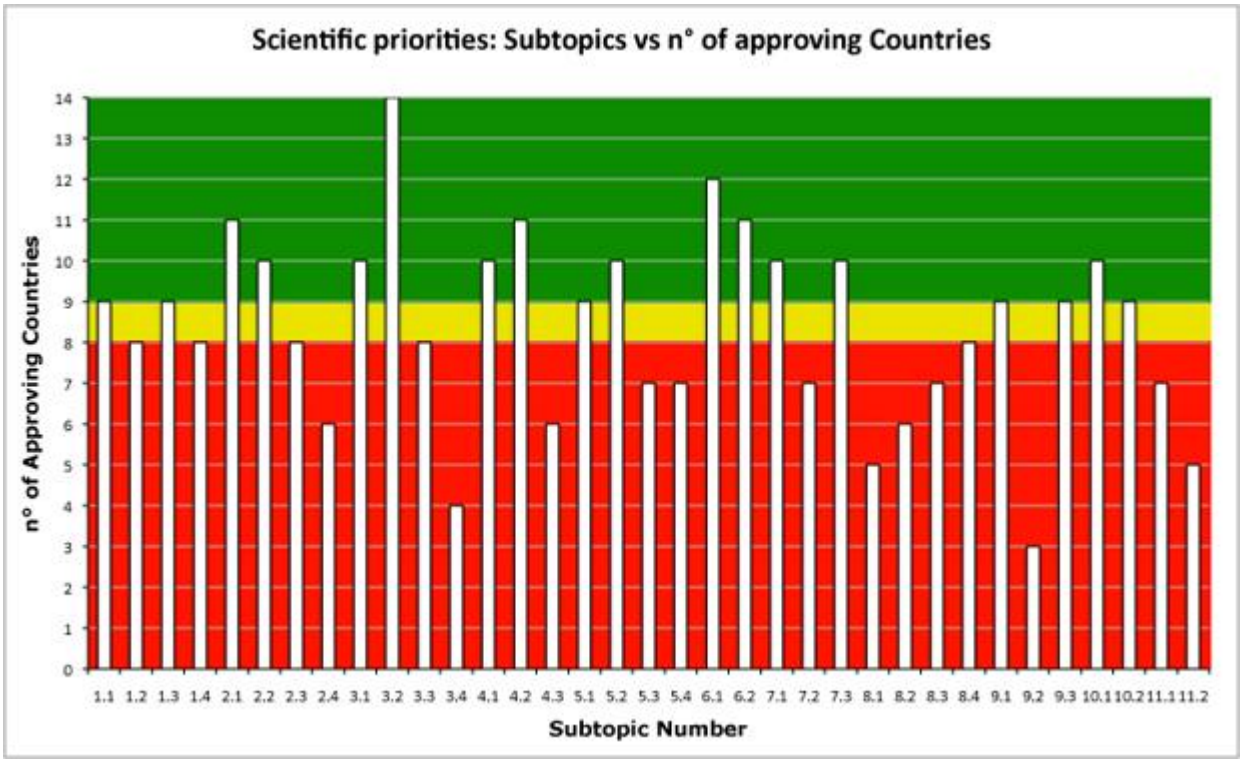
6. Research priority identification

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), three threshold for common priority identification are proposed:

high priorities is determined from 10 out of 14 countries giving scores 4 or 5

medium priorities is determined from 8 out of 9 countries giving scores 4 or 5

low priorities is determined from less than 8 countries giving scores 4 or 5



Low priorities		Medium priorities		High priorities	
Subtopic	**Score**	**Subtopic**	**Score**	**Subtopic**	**Score**
1.2	**8**	**1.1**	**9**	**2.1**	**11**
1.4	**8**	**1.3**	**9**	**2.2**	**10**
2.3	**8**	**5.1**	**9**	**3.1**	**10**
2.4	**6**	**9.1**	**9**	**3.2**	**14**
3.3	**8**	**9.3**	**9**	**4.1**	**10**
3.4	**4**	**10.2**	**9**	**4.2**	**11**
4.3	**6**			**5.2**	**10**
5.3	**7**			**6.1**	**12**
5.4	**7**			**6.2**	**11**
7.2	**7**			**7.1**	**10**
8.1	**5**			**7.3**	**10**
8.2	**6**			**10.1**	**10**
8.3	**7**				
8.4	**8**				
9.2	**3**				
11.1	**7**				
11.2	**5**				

HIGH PRIORITIES LIST

2.1 Multidisciplinary approach on the synergic interactions between environment and materials.

2.2 Interactions between specific environmental factors (temperature, humidity..) and complex artifacts made by different materials.

3.1 Portable instruments for in situ measurements.

3.2 Non invasive instruments and methodologies for diagnosis and monitoring.

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

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

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

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

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

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

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

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

Conclusion

As a conclusion, working on different criteria defined (needs, strengths and priorities), a scientific analysis of the deep national evaluations brings to results that are considered fully reliable.

This is credible both for the good levels of scientific items and as a tool to be used to solve through research the knowledge gaps highlighted during this analysis in the European contest related with NET-HERITAGE.

An evidence of the national distribution of needs and competences have been possible to identify trustable and useful convergence on common priorities.

Considering the results, the 12 high priorities (score 10-14) finally identified, on 35 total taken into consideration, demonstrate that also the screening approach followed seems to be correctly developed.

The intermediate score (9) appears also interesting to be taken into consideration if it would be possible to enlarge the horizon of the European research interests of this important field of knowledge development, not so much coordinated and synergistically considered until today.