CHALLENGE K

ABSTRACT

Heritage is increasingly being recognized as a key element for social cohesion, sustainable socioeconomic development and people's welfare. Resources dedicated to heritage conservation have gone from being considered an expense to being regarded as an investment, with a high revenue. The heritage industry has been an active part of this transformations in recent decades, it has generated employment, contributed to the worldwide expansion of tourism and has become a coveted sign of identity for political communities. Today there is no social or political process that does not use heritage in some way. Hence the actuality of the subject, and the importance of an organization such as the CSIC having research capabilities in this field.

WHAT REMAINS OF THE FUTURE: SUSTAINABILITY THROUGH HERITAGE

Coordinators

Felipe Criado Boado
(INCIPIT, CSIC)

Blanca Ramírez Barat
(CENIM, CSIC)

1. INTRODUCTION

"What is the future if there is nothing left of your past?" Do you remember? Albert Pla, June 2020, post-COVID-19 anthem.

The past shapes our entire life environment, expressing itself in multiple ways. The material world that surrounds us, our practices, our language, thought, and ourselves, are part of becoming which is a continuous transformation and sometimes abrupt but almost always imperceptible. Everything changes, and we are part of a process that does not stop: what has been, the memory that is our environment, materialized in places, landscapes, architectures, artifacts, and remains, or idealized in values and symbols, conditions our life. What it is, what we do, will determine the life to come. We will be the memory of the future.

All societies have been related to their own past, but it was the European powers of the modern age, from the 18th century and especially in the 19th and 20th centuries, which, in different ways, came to be. Furthermore, there is a set of elements and practices we inherit from the past and that we want to preserve for their present use and their legacy to future generations. This set of elements was called heritage. As such an invention of the Western powers, it is a historical category pregnant with games of value and power, linked to our own historical experience and to the cultural domination of our civilization over others, which is the history of Western globalization. From very early on in cultural attitudes towards heritage it became clear (as Aloïs Riegl

Felipe Criado Boado and Blanca Ramírez Bara (Coordinators) **351**

perfectly exemplified in his precursor work "The Modern Cult of Monuments" of 1903) that there was no single criterion for selecting those assets that should be safeguarded, and that heritage was a process of negotiation involving scientific, aesthetic, political and economic criteria, among others, which changed over time, just like the assets to be preserved and protected.

There is no social or political process nowadays that does not use heritage in any way. Resources for heritage conservation have gone from being considered an expense to being considered an investment with a high return. The heritage industry has been an active part in the transformations of the last decades, it has generated employment, it has contributed to the global expansion of tourism and it has become a coveted identity emblem by political communities. The celebration in 2018 of the "European Year of Cultural Heritage" is an example of the fundamental importance being given to heritage in Europe, and the chosen slogan "Our heritage: where the past meets the future," demonstrates the relevance given to it for the construction of future time.

As part of this magnification and expansion, heritage has been considered as an important asset not only for attracting visitors and, therefore, for generating income, but as an essential part of sustainable development, in which they intervene more values besides the economic, from the scientific to the educational. Various international organizations, such as ICCROM, ICOMOS, UNESCO, and Europa Nostra, have highlighted the fundamental role that heritage plays in achieving Sustainable Development Goals (Agenda 2030) and improving the future of people and the planet.

The Spanish heritage elements inscribed on the UNESCO World Heritage List are among the most varied worldwide, being the third country after Italy and China with the largest number of sites. The World Heritage Convention establishes the obligation of countries to "identify, protect, conserve, rehabilitate, and transmit to future generations the cultural and natural heritage, to the maximum of the resources available to them, and if necessary, through international assistance and cooperation from which it may benefit, especially in financial, artistic, scientific and technical aspects" (1972). Among the means to do so, countries undertake "develop scientific and technical studies and research and perfect the intervention methods that allow a state to face the dangers that threaten its cultural and natural heritage." Likewise, the UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage establishes "the identification, documentation, research, preservation, protection, promotion, valorization, transmission, and revitalization of this heritage" (2003) as its main objective.

Different strategic documents have highlighted the importance of scientific and technical research to achieve these objectives. Heritage is increasingly recognized as a key element in identities, social cohesion, sustainable socio-economic development, and the wellbeing of people, highlighting that the investments made in its study, dissemination, and conservation have a very high return —social and monetary—. The establishment in 2010 of the *Joint Programming Initiative on Cultural Heritage* and Global Change (JPI-CH), in which Spain has participated from the beginning, starts from the recognition that scientific and technical research is a fundamental element to preserve, know, and disseminate heritage and ensure its positive effects. In the European Commission Recommendation on the establishment of JPI-CH, it is noted that "joint programming of research on cultural heritage and global change would provide coordination to research in this area, which would contribute significantly to the construction of a fully operational European Research Area on the conservation of cultural heritage, while strengthening Europe's leadership and competitiveness in research in this field" (2010/238/EU).

Within the future *European Horizon Europe program*, cultural heritage plays a much more relevant role than in previous programs (H2020 where it was a cross-cutting theme), as reflected in its strategic plan.

In the Spanish context, in 2011 the Heritage Council approved the National Plan for Research in Conservation of Cultural Heritage (PNIC), as a "management tool and conceptual framework in which research actions on heritage conservation are programmed and financed." This document starts from the recognition of the importance of research in this field in our country, the potential of the agents of the national R & D & I system to address this issue, and the need to coordinate them and / with the institutions in charge of its execution and financing. It includes various priorities grouped into five programs: conservation and environment; materials and new technologies for study and analysis; study of the technology of cultural property; economy, social value, and sustainability, and improvement of conservation and restoration methodology and protocols.

The conservation, study, and documentation of cultural and natural heritage are, likewise, mentioned frequently in the current State Plan for Scientific and Technical Research and Innovation 2017-2020, and very specially in Challenge 6, where the interdisciplinarity of the field and the alignment with the principles in the PNIC is specifically recognized.

Although this is not alien to the genealogy and own history of the concept of heritage (attached, as indicated, to European modernity and globalization), Europe occupies a world leading position in the appreciation and use of heritage and, above all, in its study, research and, in the creation and development of a heritage science. In this regional context, Spain must play its part in advancing scientific research on heritage in line with the leadership that its heritage has on a global scale.

2. HERITAGE AS A RESEARCH PROBLEM

Heritage is a privileged area to study the interactions between the material and the symbolic in their generation and development, through social practices that interact with other areas of human reality and experience (be it cognition, communication, or economics). This means that an open and inclusive notion of heritage has no ceiling: it is all-encompassing, it is everything or, at least, it can be everything. This can constitute a practical problem because of its scope and therefore make it difficult to specify priorities, themes, and strategies. Nevertheless, it is also a field of possibilities that highlights the real power of "Heritage studies": all human reality can be studied from heritage.

Like so many other categories generated by Western modernity and exported to the rest of the world (from the separation of powers to rock-and-roll), heritage has become widespread and has been adopted with remarkable success as it provides a basic notion for building games of identity and power and establish or negotiate the patterns of relationship between groups within them or with other societies. Heritage translates the intangible webs of social processes: intra- and inter-community relations, gender, perceptions, forms of appropriation of resources and goods, of spaces, or of power. Heritage is not alien to power, but a weapon of power, hence its conflictive nature. This process must be one axis of study of the challenge: the triumph of heritage as a social phenomenon and its own constitution as a process, in many cases, of dominance, colonialism, and expropriation of communities and cultures.

However, although this phenomenon is modern, what current societies consider heritage results from centuries, even millennia, of interactions between human communities and with their environment. These complex and diachronic processes generate a diverse register which requires an increasingly

specialized investigation, based on analytical approaches, capable of producing a solid corpus of solid interconnected data, from which rigorous explanations and interpretations in terms of social processes arise.

Because heritage is a research problem. The most inclusive and comprehensive way of considering this problem and linking it to the related social dimensions and processes is to focus on the value chain of cultural heritage, which is the study of the processes that create elements in the past and in the present. The certain processes of cultural valorization grant patrimonial character; which introduces these assets into social life and turns them into contributors to much community uses; which are related to tradition, customs, habits, language, and politics; its implementation as a resource for social movements as a weapon of conflict or agglutination, and even its economic profitability. Research generates innovative knowledge about the societies of the past and the present, and from it is possible to know and recognize their social value for today's society and that of the future.

Although formulated for a long time, the concept of value chain applied to heritage requires in-depth reflection to update it and position it as the conceptual framework of the research strategy for the future. Scientific proposals for safeguarding, conservation, protection, restoration, or dissemination should be born from the research, in which the research staff must be an active part with other social agents. However, research must also know how to recognize these proposals when they emanate from non-academic spheres and must be there to evaluate and help the emergence of bottom-up appreciation and patrimonialization processes.

3. HERITAGE SCIENCE: A GENERAL, INCLUSIVE, AND DEMANDING PROPOSAL

The scientific study of heritage, "heritage science," has unique characteristics and a high interdisciplinary component. Heritage science is based on three key ideas: safeguarding / conservation, valorization, and analysis of closely related social processes. The concept of "safeguard" can be applied equally to intangible and natural heritage, besides tangible. For example, a language at risk of extinction or a specific ecosystem may be the object of measures that make the forms of life that produce them possible. The concept "valorization" refers to the social processes (in the broadest sense) that generated that materiality, or that immateriality, which we now recognize

as heritage; the processes of generation of social value that occur around heritage, so heritage does not have an intrinsic value, but that it, in its multiple dimensions (existential, cognitive, ethical, aesthetic, political, economic...) is socially constructed. Although value is generally linked preferentially to the economy and economic value, which is why its application to heritage is often censored, in the context in which it is used in this text we refer to the broad notion of value not to be confused with "price" but rather in the sense that Rullani (2009) gives to the process of meaning-creation: "Which is conducted in the networks and flows that connect various physical places and draws forth their recognized and sustainable differences of identity. In other words, it is an exercise of differentiation, rather an exercise in identification."

The scientific questions that arise in the field of heritage are complex. The process of creation or execution, with the transformations suffered throughout their history, make heritage objects often unique, and this requires a particular approach to each problem that arises. In addition, because of the dual material and immaterial nature of cultural assets and the practices in which they are enrolled, it is necessary to address issues originating from the human sciences using scientific techniques and tools, in a framework that requires collaboration between professionals from very diverse disciplines.

Heritage science, when approached from the field of the humanities and social sciences, tries to solve questions related to the origin, history and meaning of cultural goods and practices, their influence on development, and their value and meaning for the companies that have generated, guarded, possessed, disputed, or dispossessed it.

When done from the field of experimental sciences, heritage science studies the material composition, construction systems and technology of cultural assets, the mechanisms of deterioration, and addresses the problems of conservation and developing new materials and new analysis techniques. Likewise, it also studies materials and technology diachronically.

Both in one case and the other, digitization involves the use of ICT as tools to access and understand our cultural assets, through the approach and verification of research hypotheses, the computerized management of data, 3D virtualization of heritage environments, the generation of whole new documents and files, which may be converted into digital heritage, and a wide range of possibilities to multiply the potential for safeguarding and enhancing the heritage.

Therefore, this challenge aims to strengthen the relevance of scientific research on heritage, always go further, transcend the social relevance it has today to be an active part of it. Contribute to the sustainable development of society through heritage, its diversity of values, its importance for the processes of creating social welfare and the analysis of its risks as a field of identity confrontation.

Heritage is part of the processes of social appreciation. This means it must be part of the community empowerment and articulation of the community at different spatial scales (from the local to the global) and temporal (from the remote past to the most recent memory), and a factor of equality, multiculturalism, miscegenation, and hybridization; in short, diversity. Moreover, it can and should also be an active part of landscape management and planning policies, a comprehensive concept that brings together the dual natural and cultural dimension of heritage and projects them toward a horizon of sustainability and lasting development, from the present moment, as a generator of employment opportunities and wealth generation, and as a didactic and educational means.

4. THE CHALLENGES OF THE PRESENT AS CHALLENGES OF THE FUTURE

Beyond its immediate effects, disrupting COVID-19 raises the need to think and resolve how the memory of the experiences that, as a society and as individuals, we are living will be built, which concerns heritage: how the heritage conditions and has effects on our lives, and how our lives change an environment that tomorrow will be memory and heritage. The strength of this idea is captured by the theme from which the introductory quote of this Challenge is extracted: the speaker is not capable of talking about the pandemic without thinking about memory, about memory and weaving a fold between past and future; heritage does this. We will see a specific heritage of the COVID era and soon we will witness processes of ritualization, memorialization, and patrimonialization.

However, and although it is not the first time this has happened in history, nor will it be the last, the current abatement of statues (May and June 2020) because of the awareness of the systemic social injustice that our civilization above all others, and its dependent sectors, returns us to old unresolved patrimonial doubts: what do we want and must protect from the wind of history?

They seem different things, because in the first case a destructive process requires the construction of the social imaginary that represents it for the future, and in the second a constructive process in the past is destroyed in the present to challenge the dominant memory. However, what is common to both is the processes that build memory from elements that represent social values and historical processes. We result from what we were, and we will be the product of what we are. Heritage cannot freeze becoming, but heritage science can help us understand, manage, and guide it.

There can be no better way to update the critical importance of heritage in our societies. Both recent phenomena (still underway and will be for a while) remind us of the complex, ever-present, and increasingly conflictive nature of cultural heritage. They allow us to show the relationship between heritage and society and life, with groups and individuals, remind us of its importance in constituting essential aspects of identities and historicity, and alert us to the relevance of studying heritage in all its scientific dimensions, for which it is necessary to start from the conditions that make it possible from the existence of something called heritage to the fact that everything can be considered as such.

Therefore, the challenge facing heritage research at this time is, from the outset, a return to the origin: What do we want, and should we select for safeguarding, and why? When and where? Who should do it for and who should participate? Having come this far, the memory we are, generates new questions in relation to the heritage of the future, to which we must respond: What role should experts play in a process that is no longer our exclusive competence? How do we jointly approach, from research, the materiality of our world and ourselves with the symbolic and imaginary dimension, social relations, culture, and language? What are the instances in which the need to safeguard certain entities is generated? How do we do it when these relationships take place increasingly widely in a digital space that is, by definition, more energy than matter?

They are universal questions that transcend borders: but, while working in international scientific frameworks, we must not neglect responsibility toward our closest environment, where we can act and interact, as scientists and citizens, with greater efficiency and intensity.

5. ANALYSIS OF THE SOCIAL ENVIRONMENT: OPPORTUNITIES AND THREATS

From the viewpoint of the social context, there are opportunities and threats for undertaking the challenge of creating a sustainability-oriented heritage science.

5.1. European collaboration

In the context of the creation of the European Research Area, there are numerous European initiatives for coordination in scientific policies, major projects and shared scientific infrastructures, also in the area of heritage science. In addition to the aforementioned JPI-CH, the Spanish participation in the future European Research Infrastructure for Heritage Science (E-RIHS) is an opportunity to promote the development of research in heritage science and align ourselves with research of excellence in this field at a European and global level.

The threat is any movement against these joint European initiatives, and the isolation of the research strategies of the different member states. The current political moment implies a certain risk of regression in this sense.

5.2. Valuation of heritage

Heritage is usually perceived by people and social groups as their own. This supposes, in a certain sense, an opportunity, given the positive valuation, the prestige and the social interest for the goods object of our study. However, it is also a threat because the daily life and proximity of cultural property sometimes makes it difficult to appreciate their fragility and the need to advance in their knowledge and safeguarding. In addition, associated with the heritage phenomenon a series of social risks have to do with its overexploitation, commercialization, and trivialization, but also with processes of domination. From an objective viewpoint, heritage would be a victim of these processes; but, from a more procedural viewpoint, heritage is part of these valorization processes, not always desired.

Possibly the economic sector where the presence of heritage is most evident is that of cultural tourism. In a country like ours, where tourism is one of the main economic sectors, heritage undoubtedly plays a key role. However, there is no awareness in this sector of the importance of field research, because its effects, both positive and negative, are indirect and difficult to perceive in the short term, as mentioned in the previous section. For this

Felipe Criado Boado and Blanca Ramírez Bara (Coordinators)   **359**

reason, it is essential that heritage science incorporates as part of its scientific strategy aspects related to heritage valorization, and safeguarding.

5.3. Current context and anticipation

The crisis generated by COVID-19 has had a very negative impact on access to heritage, with the closure of museums, archives, and other cultural institutions, although it has promoted a notable impulse in developing new forms of access and dissemination (we return below on this). International institutions such as ICCROM and ICOM, or national institutions such as IPCE have generated and compiled information and advice for immediate action, but the subsequent impact is unknown. Changes that occur in aspects such as the decrease or change in tourism patterns, the availability of funds for the conservation and study of heritage, the social appreciation of heritage compared to other assets, or the role it can develop for the resilience of societies are, at this time, uncertain.

It is necessary to continue working to make research in heritage science socially visible and this offers an opportunity for rapprochement between science and society.

Nonetheless, it is necessary to delve into a line still incipient, but which is given by introducing the critical perspective of heritage studies worldwide of management: that is, applying the critical knowledge generated. Regarding work in the field of heritage enhancement, it is necessary to assume responsibility: faced with the generalization of problems associated with tourist overcrowding and the proliferation of tourist-cultural circuits (gentrification, tourismophobia, trivialization of the visit...), we need to investigate the long-term social effects that critical wealth management can also have.

Finally, also the crisis generated by COVID-19, amplified by the radical questioning it supposes of the normality assumed until now and legitimized by having evidenced everything that does not work, worked badly or required to be updated (also in heritage, at the as occurs in many other fields), it is an opportunity for reflection on which heritage management models may be more suitable to diversify, specialize, spatialize (territorialize), season, and scale the impact of tourist flows. However, it is also to contribute to an urgent territorial rebalancing that must look toward the past, toward sustainable forms of resource and territory management, and toward the future, trying to fill the spaces that late modernity emptied, but in an orderly and scientifically informed way. Heritage research must also be present and relevant: heritage

is not only an element of attraction for tourism, but an engine of other activities (for example, the primary sector), a factor of demographic stabilization in rural areas, active in land use planning or joint programs for preservation / access to the cultural and natural as part of the same processes.

The COVID-19 crisis has clearly affected heritage, which will also be persistent, as different international organizations have recognized in different declarations and actions (Europa Nostra, ICOMOS, Historic England, European Association of Archeologists...) and in the joint action of over two dozen organizations that on May 19, 2020 addressed to the Minister of Culture and Sports a joint letter on COVID-19 and how it compromises the viability of many museum institutions and heritage assets, companies, and cultural projects. The economic impact on the sector is dramatic and will require empirical and innovative studies to found new management models. Going beyond this impact will imply enabling new forms of enjoyment and access to heritage (visitation regime, etc.) that, from a positive perspective, they will be an opportunity for, while always complying with the health security measures in force, the demand for visits and use of heritage can be redistributed and deconcentrated among a vast universe of sites and not only limited to heritage "flagships." Something that will in passing be synergistic with strategies in the face of rural emptying and the priority that puts on the public agenda the debate on Emptied Spain.

However, these two fields of action are, although urgent, only some possible ones. It will also be necessary to think about how, from the heritage, constructing the memory of this crisis is documented and valued and how it is reflected in future memorialization processes. Even from the heritage and from the expertise provided by the knowledge of the traditional forms of mourning and pain, it will be possible to better understand the social and psychological effects of the truncation of mourning, or the emergence of substitute forms of non-existent mourning.

The COVID-19 crisis does not come alone. By hitting the world when it had not yet recovered from the socio-economic and political-organizational effects of the Great Recession, by hitting a society stressed by the growing inequality in distributing income and its concentration in a reduced percentage privileged (one of the great effects of the Great R), and by hitting on social structures weakened by the previous processes, the post-COVID-19 situation is being characterized by the substantial increase in social tensions everywhere. The BlackLivesMatter movements, which denounce social injustice

as inherent and systemic in capitalist societies, are also reflected in heritage and in heritage construction-destruction processes (for example, the demolition of statues, etc.). Once again, examples of how heritage is linked to the construction of the memory of power and how its questioning is the testimony of the claims and struggles of alternative groups emerge here.

The foregoing converges with the pending issue that Spain has with its historical memory and its self-representation as a state. The policies of historical memory will (or were) going to be one priority of the coming years and particularly of this legislature, they are the object of a specific Challenge, but as far as they involve creation, use and acts of evaluation (positive or negative) of heritage elements, are also an urgent field of study for heritage science.

6. FUTURE CHALLENGES

Once the interdisciplinary domain and the generic challenges have been limited, and an analysis of the conditions of research in heritage and environmental science has been conducted, it is necessary to more clearly outline the challenge this strategy faces on the horizon of sustainability, its fundamental characteristics, which will allow us to specify the research challenges where it would be specified.

6.1. Strategic challenge

The main and immediate challenge is the strengthening of heritage science as a research strategy, which translates into the heritage value chain as its conceptual framework. This chain, which links the basic processes of generation and socialization of knowledge (registration, analysis, interpretation, intervention, management, circulation, and valorization) with the environment in all its phases (interaction between scientific agents and social agents in all its variety) is the condition of possibility for the future challenge: the emergence of an open and richer, plural, and relevant heritage. Therefore, makes it possible for heritage to be a means that contributes to the Sustainable Development Goals to a different extent.

For this, a main challenge is the need to *strengthen interdisciplinarity* and collaboration between disciplines, not only in the terms in which there is already a consolidated trajectory (projects and networks), but in the design of lines of research itself essentially interdisciplinary, with different but complementary projects, and with support for scientific careers of young researchers with

interdisciplinary training. This must also take place within an international framework. Although disciplinary variety is important, the main nexus to be worked on is the one that seeks to bridge the gap between the experimental sciences and the social and human sciences.

Another challenge is *reflective immersion in the digital environment*, in terms of production, management, and socialization of knowledge. Although this is already a reality, it is quite a challenge to make the digital humanities something more than a compendium of humanistic and social disciplines that manage software tools. The potential implied by the digital challenge in terms of research action goes beyond this: it opens a world of lines of work in which, in addition, the feasibility of the interdisciplinarity to which we alluded before multiplies. However, the capacity for handling and generating data provided by the digital environment requires a deep reflection on its conditions of use, and on its ethical implications. Finally, digitization greatly multiplies the possibilities of integrating into the field of heritage (in terms of registration and safeguarding) the intangible entities that have been hard to attract: social practices, oral and artistic expressions, or languages in their different modes of expression and in their evolution.

The digital dimension of the world to come does not cancel out the persistence of a physical reality that, to a large extent, is being modified by it. Applying advanced technologies for the *design of a new materiality* is another of the challenges that heritage science faces: from the field of experimental sciences, it contributes to the generation of more sustainable materials both in their production and in their use, something that is essential to manage and safeguard the materiality of a part of the set of cultural and heritage assets.

In the same way, experimental, social, and human sciences must converge in the *design of a new territoriality*: this implies working in the field of spatiality, which is again made possible, in part, by digitization. This new territoriality is also rooted in the need to reconfigure intra- and inter-community ties of sociability. The modern model that segregates the rural and the urban, and subordinates the first to the second, with such dramatic results in our country, is a model under review and heritage science has much to contribute, thus this requires reordering. Essentially from geography, sociology, and anthropology, but also from an archeology that can delay into the historicity of the modes of occupation of the territory and spatialization of social relations, research lays the foundation for a heritage designed in terms of sustainability: rethinking the concept of cultural tourism in terms of supply, demand, and mediation.

This scientific strategy points toward the need to contribute, in this horizon of sustainability, to the *emergence of a new citizenship*, in the sense of an alternative model of sociability, which tries to manage the real, local, and global problems of a world in which the conflicts derived from the periodic human and economic crises continue to grow. Heritage is not a neutral entity, much less intrinsically positive, in this world; it is part of it. Therefore, the challenge is that heritage can function to transform reality: this justifies a science of heritage in the last resort, its social relevance. Our role as scientists and scientists is not limited to studying and safeguarding heritage for its own sake, but because it is socially valuable. However, this social value is plural, and it is neither homogeneous nor stable. Heritage studies help to understand why heritage is a field of dispute and therefore provide us with critical insight into the processes of which we ourselves are part. The contribution of gender studies and the feminist approach is especially significant: de-patriarchalizing heritage as a means of de-patriarchalizing society. Heritage science must contribute to increase the critical awareness of citizens (not only through narratives but also through the experience of access to the entity or event), and to generate alternative forms of social relationship, based on equality, cooperation, solidarity, and sustainability, understood as respect for the memory of those who preceded us, which we ourselves embody, and as respect for the vital dignity of those who will succeed us.

6.2 Specific challenges (SC)

For example, here we reflect on some lines of work, understood as specific remains that should make up this challenge, in line with the global challenges we have expressed above. These lines, in which progress has been made, will undoubtedly continue to be relevant in the coming years, and will give rise to new ones. This section has been organized by first describing the more general specific challenges that concern the challenges related to changes in social processes, to the more specific ones on the conservation and forms of registration and documentation of heritage.

Challenges related to changes in social processes

SC.1. Territory, landscape, and heritage

Basic research on processes of social change and technological change, and the production of historical knowledge through various documentary sources is essential to generate the narratives and content that nourish heritage and its multiple signifiers with meaning. To transmit this knowledge, heritage is a vehicle imperative for providing today's society with the networks of meaning

necessary to understand the phenomena of accelerated change in which we find ourselves immersed, and to help manage the processes of change both at a symbolic (collective identities) and territorial level. Knowledge about the past is necessary to manage the present reality, to contextualize current time and space and to project them into a horizon of sustainability.

Archeological research on landscapes, and their heritage recognition, have been and are generators of community and lasting resources in rural areas. These are alternative resources both to aggressive activities on the environment (such as extractive or industrial) and to abandoning the rural world, because they directly affect the development of the service sector, but they can and should also be an incentive for development of the primary sector (see previous paragraph) stimulating its recovery. This leads us to actively converge with regional and local governments, responsible for asset management, and with local communities, associations, entrepreneurs, and other local members in which the viability resides of a living landscape.

Examples: Study of prehistoric and ancient mining as a field of research that allows understanding the effects of the Anthropization of the environment in different historical times, from the concrete event to the long duration (which includes the patrimonialization of prehistoric mining landscapes); on different territorial scales, from the most immediate area (extraction area) to long distance (different forms of contamination); and at different social levels, from the organization of work processes to the ideology of exploitation.

SC.2. Critical study of the patrimonialization processes
The objective of this challenge is to study the processes of formation and use of heritage in the present and the past. Until recently, and still shared by many social and academic sectors, a vision of heritage has been maintained as something intrinsically positive, and not as a social field in which values and interests are displayed, often conflicting, and whose effects are not always are positive for the community, or for the most vulnerable sectors of it. To build sustainable and innovative heritage valorization strategies, it is necessary to start from critical research and analysis: that is, from the production of critical knowledge about how societies appropriate and use heritage.

Example: Decolonizing the Archive: Memory and identity this line rescues the whole range of semantic and instrumental potentialities of the colonial archive, recovering its critical genealogy and clearing its praxis of the theoretical and epistemic prejudices with which it has been taxed.

SC.3. Social innovation and cultural heritage
The objective is the development of actions for a social appreciation of the heritage which the communities own and the entire citizenry benefit, as an integrating element and part of the national and European identity. Within this line, a new dimension of valorization toward society is beginning: citizen science. Developing an optimized work methodology and establishing citizen science networks would allow this phenomenon to be exploited to the maximum, both to contribute to the creation of knowledge and to make visible and increase the value of both scientific research and heritage. It could also be considered involving society, from the premises of scientific knowledge in the definition of heritage research strategies and even in the study processes, for example, in the phases of data collection or monitoring.

Research is not justified without a social projection that contributes to the valuation and exploitation of heritage. However, given the conservation requirements for future generations of heritage, the landscape economic profitability must be screened by social profitability itself. This is a conflictive aspect which places heritage in an ambiguous situation in which a balance must be sought between its social value and its economic value. This balance is the basis of its condition as a community and lasting resource. Social innovation must be put at the service of generating resources, above all social (including patrimonial), that allow an increase in the quality of life.

Example: Conservation practices in the community: the objective is to design and implement management practices for heritage spaces based on the generation of collaborative knowledge and open science principles, to achieve an optimal involvement in preventive conservation strategies.

SC.4. Heritage, languages, and communication
The study of language and communication from the heritage viewpoint is a priority in most heritage regulations because languages are considered heritage assets. The great challenge for a horizon of sustainability is to articulate a strategy of investigation and safeguarding of languages and their variants that integrates the immanent dimension of the linguistic system with its different historical, geographical, social, or stylistic manifestations.

Example: Relationships between languages and linguistics: Investigating the relationships between languages and language varieties helps to understand what unifies languages and what differentiates them. In addition, a view from linguistics allows us to distinguish the ideological contents implicit in

certain discourses of society that uses languages as weapons for its identity interests.

Challenges related to changes in records, forms of documentation, and materials

SC.5. Development and application of non-destructive analysis techniques

The development and application of non-destructive or non-invasive techniques that provide information about the cultural property without damaging or modifying the object. It is especially relevant to emphasize in situ evaluation techniques, which allow studying objects that for different reasons cannot be transferred to the laboratory, and in developing *diagnostic techniques* that provide information on the state of conservation of the materials or the cultural goods. These techniques can be applied to all types of cultural objects in *remote sensing* mode from the scale of the object to that of the deposit or that of territorial units.

Examples: Technological advances underway make it possible to use compact and hybrid equipment in which complementary techniques are combined, and that allow undertaking multi-analytical campaigns with a single, sometimes portable instrument (for example, portable impedance spectroscopy equipment electrochemical or instrument that combines three modalities of laser spectroscopy). Another example is the development of spatial data infrastructures (SDI) and, especially, of IDEARQ (Spatial data infrastructure in archeological research), with which the investigation of archeological heritage from a spatial approach has a powerful tool.

SC.6. Advances in preventive conservation

Advances in preventive conservation, including monitoring systems and developing mathematical prediction models and dose-response equations from long-term data. One problem of current science is the temporary limitation of projects (usually 3 years) that prevents the development of long-term ambitious projects, which because of the nature of the assets studied are very important for heritage. For this reason, it is necessary to resort to accelerated tests, whose results are not always well interpreted. The identification and prediction of problems derived from climate change, the appearance of new pollutants, development of knowledge of their interactions with the materials of the cultural assets, etc. is important. Regarding developing monitoring and analysis systems, using digital tools, artificial intelligence, mobile applications, etc. must be considered for monitoring and diagnosis.

On another scale, the maintenance of land uses, and traditional activities is an excellent form of preventive conservation of heritage often, especially in rural areas.

Example: New techniques to study in situ deterioration of the underwater heritage caused by new agents of deterioration: i.e., fuels, plastics. The emergence of new pollutants in the seas requires the use of new techniques to study the deterioration of underwater heritage.

SC.7. Development of new materials
Developing new materials for conservation and restoration, compatible with existing ones and that do not accelerate their deterioration, with special attention to using non-toxic products and sustainable and durable materials or even nanomaterials. In this challenge, one of the most important aspects is the study of the interaction between new and old material, with special attention to its long-term evolution. This development is fundamental to contribute to a sustainable conservation of the cultural heritage objects and to their greater accessibility to the public.

Example: Design of new sustainable lime-based repair mortars. Use of waste as a source of pozzolanic material and design of lime mortars. Obtaining the lime involves CO_2 emissions; one way of reducing this is to use waste without carbonates, thus it is necessary to study the behavior of these "new materials."

SC.8. Standardization and data management
The standardization in both methodological and data, which favors the access and dissemination of knowledge and the exchange of information on cultural heritage, in line with the open science approaches, complying with the FAIR criteria. The standardization and interoperability of data is a challenge with different aspects. We must consider methodological standardization in conducting laboratory measurements and tests, defining protocols, etc. that allow obtaining comparable data between different groups and techniques, considering that often the instrumentation and methodology used are not standard, but have been developed specifically for heritage. Nonetheless, are the standardization and data management in the field of digital humanities. The heterogeneity of the scientific and documentary data managed in this field poses a challenge for its definition and efficient management. Finally, the possibility of collecting the tests and methodologies applied in European regulations should be facilitated.

Example: Semantic technologies for cultural heritage: The objective is to create, select, develop, analyze, validate, demonstrate, and disseminate the technologies for the construction of meaning around the information generated and managed during research and management of the cultural heritage.

SC.9.Protocols for the management of heritage material

Heritage —both in Spain and in other countries— is kept in the hands of public and private institutions, including CSIC itself. Usually, these institutions need and seek to value their material, which often requires a methodology of intervention, management and conservation of heritage that goes hand in hand with multidisciplinary scientific research. It is necessary that CSIC be able to offer a holistic analysis of the heritage of these institutions, forming, maintaining, and consolidating a management protocol that institutionalizes the trust and prestige of scientific research. The existence of this protocol, in addition, could launch, in a tutored way, the processes of conservation and restoration of heritage, no longer in the hands of researchers, but in the hands and funding of the Autonomous Communities interested in its preservation. Finally, this protocol must include a wide space for the effort and dynamization of transferring knowledge that must also be conducted by the proprietary institutions, taking as a basis and main source the results of research on heritage.

Example: Written Arab heritage management protocol. The objective is to propose and review a protocolized management model between the institutions that keep the documents and the researchers, for the characterization and material restoration of the collections, and a historical-cultural study of them.

7. SUMMARY / EXECUTIVE REPORT

Heritage is increasingly recognized as a key element for social cohesion, sustainable socio-economic development, and the wellbeing of people in different national and international strategic documents. For this reason, scientific and technical research is essential; especially in a country like ours, which has one of the richest and most diverse heritages worldwide.

The scientific study of heritage, or heritage science, is a complex field that requires collaboration between professionals from diverse disciplines, often interacting with each other: Archival, Archeology, Architecture, Anthropology, Astrophysics, Library Science, Materials Science, Soil Science, Philology, Physics, Geochemistry, Geology, Art History, History, Engineering,

Linguistics, Literature, Museology, Chemistry, and Sociology. This interdisciplinary characteristic is one of the greatest difficulties, both in its development and in its recognition. Given the traditional division between the human sciences and the experimental sciences for defining priorities, allocating resources, etc., people doing heritage science research are often at a disadvantage in either field. Fortunately, this aspect has improved in recent times and at the national level, heritage appears in research plans as a cross-cutting element in many instruments and calls.

However, the impact of heritage science research is not very visible to society. Although the volume of the heritage-related cultural industries sector is very large, its structure is very dispersed and lacks large companies. In this context, the economic impact of research is indirect, and difficult to quantify, which does not contribute to its visibility. Despite this, in recent years awareness of the value of cultural and natural heritage as a fundamental element of identity for people and different social groups has grown significantly, and an important asset for sustainable economic development.

Heritage science has recently turned toward several key issues, which will undoubtedly remain relevant in the near future and will give rise to new challenges:

- Advances in *territory, landscape, and heritage,* from historical knowledge to understanding and transmission of the spatial context of heritage.
- The *critical study of patrimonialization processes*, which allows us to understand what heritage is and how it has been used, and how it is necessary to manage complex social processes of which it is a part.
- Research in *social innovation linked to heritage*, which is the full appreciation of the research generated, including the approach of citizens to science and knowledge and new models of participation such as citizen science, as it is about implementing the model socially in which heritage and society are mutually conformed: heritage is, thus, a means for the transformation social toward a horizon of sustainability.
- Advances in *heritage, languages, and communication*, affecting both the communicative essence of the heritage phenomenon and the heritage nature of the communicative instrument par excellence: language.
- Advances in the *development and application of non-destructive* or non-invasive techniques that provide information on the BBCC and especially in situ evaluation techniques, which allow studying objects that for different reasons cannot be transferred to the laboratory.

- Advances in *preventive conservation*, including advanced materials analysis and remediation / restoration procedures, monitoring systems and development of long-term prediction mathematical models, with special attention to the identification and prediction of problems derived from climate change or the appearance of new pollutants.
- *Development of new materials* for conservation based on non-toxic products and sustainable materials; *management and standardization of methodologies, protocols, and data,* which favor the access and dissemination of knowledge and the exchange of information about heritage, in line with open science approaches, complying with the fair criteria (*findable accessible interoperable and reusable*).
- *Development of management protocols for heritage material.* For example, material written in Spanish archives and libraries, in its least studied aspect, such as material written in non-European languages (Arabic, Greek, Coptic, Hebrew, etc.).

Felipe Criado Boado and Blanca Ramírez Bara (Coordinators) **371**