

Francesco Bellini

**THE SOCIO-ECONOMIC IMPACT
OF TECHNOLOGICAL
INNOVATION:
MODELS AND ANALYSIS
OF THE DIGITAL
TECHNOLOGIES FOR
CULTURAL AND CREATIVE
INDUSTRIES**

Eurokleis Press

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Frankleis Press

Declaration

The work presented in this book is my own and derives from the thesis prepared for the PhD degree of the University of Rome La Sapienza. Where information has been derived from other sources, I confirm that this has been indicated in the text.

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“The Socio-Economic Impact of Technological Innovation: Models and Analysis of the Digital Technologies for Cultural and Creative Industries”

by

Francesco Bellini

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Abstract

The research activity synthesized in this book starts from the consideration that there is a growing need to verify how public investment in innovation can guarantee the best value for money and maximise the impact on European economy and society. The cultural heritage sector represents a strategic target for the R&D investment in Europe and it is strongly needed to have also here a set of tool able to assess the socio-economic impact of projects' activities. With the aim of supporting the maximisation of the research outputs effectiveness and efficiency, we analysed projects' outputs both in terms of innovation and improvement related to the state of the art of the ICTs for creative and cultural sector, and in terms of transferability of results to the wider society in general and to the supply-industry in particular.

During the research activates we:

- performed the analysis of the DigiCult domain through the literature review and analysis of EC FP7 Call 1, Call 3, Call 6, Call 9 and Europeana projects;
- developed the assessment methodology for the DigiCult projects';
- gathered the feedback from experts and projects on the methodology through webinars and online questionnaires;
- developed the Self-Assessment Toolkit (SAT);
- performed the assessment of 19 projects in the DigiCult domain by using the data gathered through the Self-Assessment Toolkit.

The analysis produced interesting results such as:

- the design of a specific Hype Cycle for the DigiCult projects;
- a better understanding about the innovation dynamics in the

- sector;
- the information on how to improve the diffusion of the knowledge generated by DigiCult projects;
 - the information on how to improve the socio-economic impact of DigiCult projects.

¹ The views expressed in this paragraph are the sole responsibility of the authors and in no way represent the view of the European Commission and its services

Acknowledgments

When I had the chance of pursuing a PhD after more than 15 years of research activities, I thought to have the occasion, scientifically speaking, to put “everything in the right order”. Probably I did not fully succeed but surely it was possible for me to further deepen my knowledge of the technological innovation domain and this happened thanks to the teamwork that got me there. Though it will not be enough, I would like to give many thanks to all those people that worked with me.

First of all, I am deeply grateful to my supervisor and friend prof. Fabrizio D’Ascenzo, Director of the Department of Management that supported this PhD and hosted me in a comfortable environment. Special thanks are also given to prof. Antonio Annibali that is my mentor since from the beginning of my scientific and professional activities.

The work on this book is originated from the research activities carried out within the MAXICULTURE (FP7-ICT-601070) funded under the European Commission 7th Framework Programme in the period 1/1/2013-31/12/2014. The project was developed by a high level team which I had the honour to coordinate and to whom I want to address my special thanks. They are: Dr. Francesca Spagnoli, Dr. Antonella Passani, Luca Satolli, David Crombie, Dr. George Ioannidis, Marie Debicki, Alessandra Prampolini and Andrea Nicolai. I have also to acknowledge and thank the precious comments and suggestions received by the EC reviewers Dr. Kseniya Khovanova-Rubicondo and Prof. Victor Lebreton as well as the contribution of the EC project officer Mikolt Csap.

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or the complement of many other EC funded projects during which I had the chance to share ideas on socio-economic impact assessment with, among the others, Dr. Shenja van der Graaf, Dr. Paolo Dini, Dr. Fabiana Monacciani and Andrea Manieri.

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I wish to thank my entire extended family and my parents for always providing a loving environment for me. A special thanks goes to Giorgia and to my children for their patience; moreover, Giorgia was involved in the boring proofreading and provided useful comments. This book is dedicated to them.

Although many people have helped me with their insightful ideas and critique, I am fully responsible for any mistakes, problems, and flaws that this piece of work may contain.

Roma, December 2017

Francesco Bellini

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Setting the scene

The research activities summarised in this book start from the consideration that there is a growing need to verify how the public investment in innovation can guarantee the best value for money and maximise the impact on European economy and society. It is worth to remember that the European Commission (EC), with the contribution of the European Union Member States, invests a huge amount of money through its innovation programmes and the current framework programme – the eighth – called Horizon 2020 has a financial endowment of more than 80 billion Euro.

The cultural and creative sector represents a strategic target for the R&D investment in Europe and it is strongly needed to have a set of tools able to assess the socio-economic impact of innovation activities. The aim of this book is to analyse the impact of innovation activities in the field of Information and Communication Technologies (ICTs) through the adoption of a novel approach that attempts to overcome the limits of traditional models or, at least, to introduce some additional perspectives. The approach has been then applied to the specific sub-domain of ICTs for cultural and creative industries focusing on Research and Development collaborative projects¹ funded under the 7th Framework Programme (FP7) of the European Commission. This specific research domain is called Di-giCult and will be better described in the following chapter. With the aim of supporting the maximisation of the research outputs effectiveness and efficiency, we analysed projects' outputs both in terms of innovation and improvement related to the state of the art of the cultural and creative sector, and in terms of transferability of results to the wider society in general and to the supply-industry in particular.

¹ A relevant part of the EU funding goes to the “collaborative projects” where a number of organisations (from academia and research, public and private sectors) decide to cooperate in order to reach some pre-defined R&D results.

In this chapter we will set the scene by introducing the concepts of innovation, evaluation and cultural and creative industries (CCIs).

1.1 Defining innovation

Innovation plays a crucial role in the current economic scenario. The knowledge economy on one side, and the recent economic crises on the other, emphasized the need of having a deeper understanding of the innovation dynamics in order to identify the elements that may leverage the growth, competitiveness and better target the investment flows.

Innovation activities aim at stimulating the up-take of research results in the productive sectors, enabling technology transfer also through the involvement of the SMEs.

According with Schumpeter's definition (1951) innovation is "The introduction of new goods (...), new methods of production (...), the opening of new markets (...), the conquest of new sources of supply (...) and the carrying out of a new organization of any industry".

In defining innovation, an important contribution comes from the work done by OECD in their well-known Oslo manual (2005). The manual summarises the state of the art on the study and observation of innovation; it constitutes the basement for the OECD evaluation of the innovation and takes into account the most important achievements of national statistical institutes worldwide. The manual focuses mainly on technological product and process (TPP) innovations, which are defined as follows: "A technological product innovation is the implementation/commercialisation of a product with improved performance characteristics such as to deliver objectively new or improved services to the consumer. A technological process innovation is the implementation/adoption of new or significantly improved production or delivery methods. It may involve changes in equipment,

human resources, working methods or a combination of these.” [Ibid.: p.9].

Taking on board the Schumpeter and Oslo manual definitions we will consider product, process and organisational innovation and, to a certain extent, what the latter refer to as “other creative improvements”.

We will apply this definition of innovation to DigiCult projects outputs even if the technological products and processes under analysis are not yet commercialised or used in a real productive environment. This definition is indeed important and valid for mapping the different types of innovation produced by DigiCult projects.

In order to be innovative, a product or a process “should be new (or significantly improved) to the firm (it does not have to be new to the world)” [Ibid.: p.31]. In our case, where we observe the results coming from collaborative R&D projects, innovation it has to be new to the project consortium as a whole, to each of its members in particular and propose an advancement beyond the state of the art. In other terms, we will not consider as innovation the transfer of an innovative product² from a project partner to another one.

TPP innovations can be broken down by the degree of novelty of the change introduced in each case.

In this way, technological product innovation can take two forms:

- technologically new products;
- technologically improved products.

“A technologically new product is a product whose technological characteristics or intended uses differ significantly from those of previously produced products. Such innovations can involve radically new technologies, can be based on combining existing technologies in new uses, or can be derived from the use of new knowledge”. [Ibid. :32]

“A technologically improved product is an existing product whose performance has been significantly enhanced or upgraded. A sim-

² According to the Oslo manual the term “product” is used to cover both goods and services. We will use the term accordingly.

ple product may be improved (in terms of better performance or lower cost) through use of higher-performance components or materials, or a complex product which consists of a number of integrated technical sub-systems may be improved by partial changes to one of the sub-systems”.

In Schumpeter’s words, “radical” innovations shape big changes in the world, whereas “incremental” innovations fill in the process of change continuously.

In this work, we are interested in both the possible kinds of innovation and this will be reflected in the variables that will be used for the impact assessment.

Other changes in product and process include minor modifications, not relevant and/or have a low level of novelty and “other creative improvements”. In case of creative improvements, the novelty is related to the aesthetic or other subjective qualities of the innovation. We will not consider the latter, while we will consider organisational innovations which include:

- the introduction of significantly changed organisational structures;
- the implementation of advanced management techniques;
- the implementation of new or substantially changed corporate strategic orientations”. [Ibid. :36-37].

To these dimension we added also innovation related to promotion processes and to methods for interacting with users as they are both significant for the DigiCult domain, in the software industries and in the CCI industries as well.

Finally, in order to gather more descriptive information on the innovation produced by DigiCult projects, we will use the classification of nature of innovation provided in the manual, which is as follows:

“Classification by nature of innovation:

- application of a scientific breakthrough;
- substantial technical innovation;
- technical improvement or change;
- transfer of a technique to another sector;

• adjustment of an existing product to a new market” [Ibid. :81]. The information related to the nature of innovation will not influence the assessment, as all the typologies of innovation are equally valid, but the gathered info will be useful for the aggregated data analysis at descriptive level.

1.2 Cultural and Creative Industries

Creativity has taken on wider meanings than the endeavours of talented individuals; it also became generalised across numerous activities as “new and valuable” and “original and useful”. Creativity is also considered to play a significant role in the concept of the New Economy and it plays a role in technical innovation, teaching, business, the arts and sciences, etc. [Runco, 2007].

Author	Definition
Woodman, Sawyer, Griffin (1993).	The creation of valuable useful product, service, idea, procedure, or process by individuals working together in a complex social system.
Amabile (1996a); Amabile (1996b).	Creativity is the set of products or responses that are judged to be creative by appropriate observers; Creativity is the production of novel and useful ideas in any domain.
National Advisory Committee on Creative and Cultural Education (1999).	Creativity is possible in all areas of human activity, including the arts, sciences, at work, at play, and in all other areas of daily life. All people have creative abilities and we all have them differently. [...] Developing creativity involves, amongst other things, deepening young people's cultural knowledge and understanding. This is essential both in itself and to promote forms of education which are inclusive and sensitive to cultural diversity and change.
Sternberg and Lubart (1999); Runco and Pritzker (1999).	Creativity is the ability to produce work that is both novel (i.e. new, original, unexpected) and appropriate (i.e. useful concerning task constrains).
Pope (2005).	Creativity is extra/ordinary, original and fitting, full-filling, in(ter)ventive, cooperative, un/conscious, fe>male, re . . . creation.
Runco (2007).	Creativity is a vital form of human capital.
Alves, Marques, et al. (2007) (cit. Rhodes, 1961; Im, 1999).	Creativity has been conceptualized as: (a) the individual personality traits that facilitate the generation of new ideas, (b) the process of generating new ideas, (c) outcomes of creative processes, and (d) environments conducive to new ideas and behaviour.

Table 1 - Definitions of creativity [Markevičiūtė I. and Jucevičius G., 2013]

The creative economy, includes the contribution of those who are in creative occupations outside the creative industries as well as all those employed within them.

The creative industries are a subset of the creative economy embracing only those working in the creative industries themselves (and who may either be in creative occupations or in other roles e.g. finance).

Creative Economy:



Creative Industries:



Figure 1 - Creative economy and creative industries

Creative industries are those industries which have their origin in individual creativity, skill and talent and which have a potential for wealth and job creation through the generation and exploitation of intellectual property in different products and services markets [DCMS, 2001].

The term creative industries encompasses a broader range of activities which include the cultural industries plus all cultural or artistic production, whether live or produced as an individual unit. The creative industries are those in which the product or service contains a substantial element of artistic or creative endeavour and include activities such as architecture and advertising.

The term cultural industries traces its genealogy back to earlier work in the Frankfurt School in the 1930s and 1940s [Adorno and Horkheimer, 1944], which scathingly described the commodification of art as providing an ideological legitimization of capitalist societies

and the emergence of a popular culture industry. The term refers to those industries that combine the creation, production, commercialization and consumption of creative contents that are intangible and cultural in nature (printing, publishing and multimedia, audiovisual, phonographic, cinematographic productions, crafts and design).

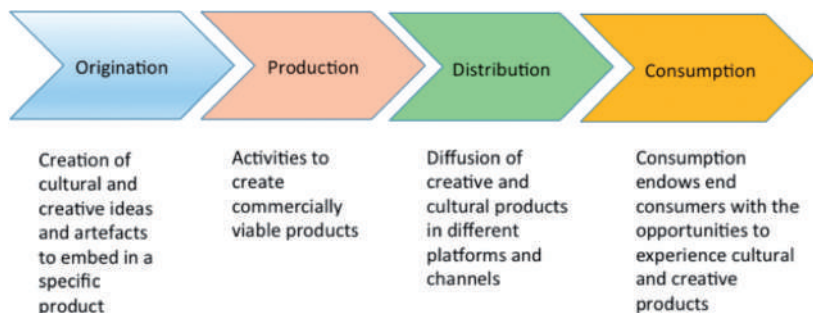


Figure 2 - CCIs value chain

The definition of cultural industry began to enter policy-making, such as the national cultural policy of Australia in the early 1990s, followed by the transition made by the influential Department for Culture, Media and Sport of the United Kingdom from cultural to creative industries at the end of the decade. With the advent of stronger globalisation processes, faster communication channels, rapidly changing technologies and global connectivity, the way we produce and consume cultural products and services has undergone radical change [UNCTAD, 2008]. This dynamic convergence between technological, social, economic and cultural aspects has altered significantly the cultural landscape and creativity is now acknowledged as fostering cultural, social as well as economic gains [KEA, 2009: p. 33-44]. Different models were developed to explain how this economic sector works³, but most are based upon the recognition of the

³ See the WIPO model, the UK Classification, the "concentric circles model" and the different national approaches to tackle the Creative Economy, such as; Santagata, W., (2009), White paper on Creativity : Towards an Italian model of development, Milan: Bocconi University Ed; DCMS (2008), Creative Britain- New Talents for the New Economy, London: DCMS; Netherlands Mini-

importance of services and the dynamic effects of the cultural and creative industries. The report 'Creative Economy', published in 2008 by UNCTAD (and updated in 2012), was also a cornerstone in entrenching the concept: "The interface among creativity, culture, economics and technology, as expressed in the ability to create and circulate intellectual capital, has the potential to generate income, jobs and export earnings while at the same time promoting social inclusion, cultural diversity and human development. This is what the emerging creative economy has already begun to do as a leading component of economic growth, employment, trade, innovation and social cohesion in most advanced economies" [UNCTAD; 2008]⁴.

'Culture-based creativity' (first outlined by KEA, 2009) is enabled through the combination of personal abilities, culture, creativity, technical skill and social environments that can have a substantial impact on stimulating research, optimising human resources and inspiring people; this is the definition that we will consider for our purposes.

Although there are dissenting voices, the concept of the 'creative economy' is now broadly accepted and understood and has been translated into high-level policy initiatives that can be seen at a European, national and regional level. Indeed, with the partial unbundling of the nation state as a spatial unit [Sassen, 2002], these initiatives are more easily implemented at a sub-national regional or city level. The study 'The Economy of Culture in Europe', commissioned by the European Commission in 2006, was the starting point for a political revaluation of the cultural and creative industries in Europe and its member states. It makes a distinction between 'culture' and 'economy'" and argues that although the EU was formed on the basis of economic and market forces, culture and European cultural diversity is an important factor for the EU's political, economic and social strength. As noted in the 2011 EACEA study on creative entrepreneurship [Bellini et al., 2011]: "In recent years, the EU Council also followed the move to recognise the potential of the cultural and creative industries in contributing to the Lisbon objectives,

stry of Culture and Ministry of Economics (2009), Creative Value- Culture and Economy Policy Paper, The Hague: Netherlands Ministry of Culture and Ministry of Economics

⁴ The potentialities of creative economy here expressed are reflected in MAXICULTURE sub-categories of impacts.

acting as catalysers of Europe's innovative potential. Similarly, in the Maastricht Treaty (the EU Lisbon process for strengthening the economic growth in Europe), as well as in the UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Expressions (hereafter named UNESCO Convention) the role of the cultural and creative industries has gained greater attention. In parallel, several European initiatives have been undertaken to promote the idea of the creative economy; for example, 2009 was designated the European Year of Creativity and Innovation and the Green Paper on 'Unlocking the potential of the cultural and creative industries' solidified this recognition" [Ibid. : p. 46].

The abundance of studies on the CCIs - such as those undertaken by KEA, NESTA, the European Cluster Observatory, the work on 'Design as a driver of user-centred innovation', the reports produced recently by the European Platform, and the Expert Working Group on CCIs (set up as part of the European Agenda for Culture) - have highlighted the critical impact of CCIs on growth and employment, and acknowledged their great economic, social, cultural and innovative potential. CCI activities act as important drivers of 'economic and social innovation' within the sector but also outside the CCI sector, contributing to Europe's strengths in times of challenges and, as such, are in line with the EU 2020 Strategy [Bellini et al., 2011].

The current debate on creativity is reflected in the DigiCult domain work programmes and calls and related initiatives in Future Emerging Technologies (FET) and addresses concepts such as combinational creativity, exploratory creativity, transformational creativity, metaphorical blending and creative generation⁵. Defining and measuring creativity per se is understandably difficult, with many different theoretical approaches followed over the centuries.

There is an abundance of related research areas examining aspects of computational creativity, creative cognition, consciousness studies, organisational creativity and there is an even greater abundance of studies on the value and uses of creative thinking, discovery and invention x⁶. In this context, the creativity becomes

⁵ http://en.wikipedia.org/wiki/Computational_creativity

⁶ <http://en.wikipedia.org/wiki/Creativity>

even more relevant when considering the cultural and creative industries as a driver of innovation and growth. With imaginative solutions such as the integration of user-centred approaches, the development and use of ICT, the design of new services for increased social inclusion, cultural and creative industries contribute to drive dynamic change in the economy as well as contributing to broader cultural diversity.

1.3 Evaluation of innovation impacts

1.3.1 Evaluation of innovation investments in ICTs

The growth of the ICT sector can be linked to its broad socio-economic impact. The literature contains many examples of ICT investment potential [Hirschheim and Smithson, 1999; Crowston et al., 2004; Piccoli et al., 2005]. These potentialities are also affected by risks: size and complexity, newness of technology, project structure, hidden costs, human political and cultural factors [Willcocks et al., 1999]. If we move from a market point of view to an R&D perspective, especially in FP7, the risks concern also an unclear sustainability process of the projects' outputs and an unclear "time to market", i.e. when and how these outputs will become part of the market. In Strassmann [1997] and Tingling et al. [2004] it is suggested that the investment in ICT is different from other investment types, due to the problem associated with the identification and quantification of costs and benefits, including also intangibles. Some studies [Willcocks et al., 1999; Al-Shehab et al., 2005] focused on failed projects, unidentified costs, unrealised benefits, budget overruns, limited or negative returns and discrepancies between expected and materialised benefits.

It is important to highlight that, from a socio-economic impact assessment point of view, the benefits and costs are not only those re-

lating to the projects' partners, but it is necessary to take into consideration both the 1st-order (direct) and 2nd-order (indirect) impact of benefits and costs. We already know that, on one hand, the analysis of a project management and sustainability, and the analysis of the cost and revenues arising from the projects' outputs are only the first step of an impact assessment methodology and, on the other hand, the effects on the whole society are very blurred and difficult to identify.

In order to find a feasible methodology for the impact assessment of a research project in the DigiCult domain, it is necessary to start analysing the main objectives of an investment in ICT.

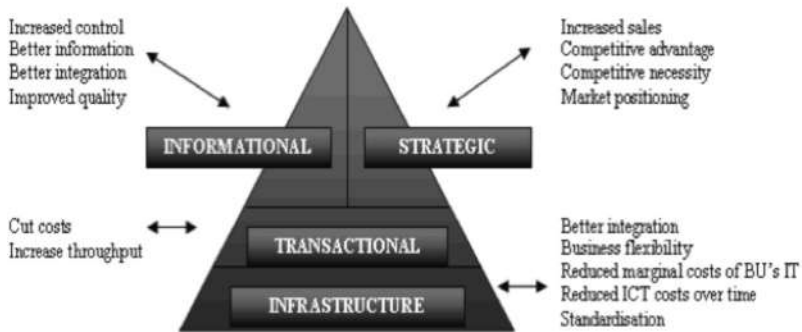


Figure 3 - Management objectives of ICT

In Weill et al. [1999], the identified objectives of a large-scale ICT investment are strategic, informational, transactional and infrastructural. In the DigiCult research projects domain we can further specify:

- the strategic objective suggests that a partner of a research project, or a final user, could aim to enhance its market position through, for example, the cost reduction or the increase of its market share or sales and other strategic objectives such as opening a new field of research, making possible research that is not possible before, and so on;
- the informational objective aims at providing easy access to information related to research results or through project out-

put(s). “Information” could be not only “better quality and accuracy”, but could be “information” which was not easily accessible. This increases the knowledge, enhances the use of this information, and enables research that otherwise could not be performed;

- the transactional objective primarily supports operational management and the enhancement of remote and asynchronous team-working;
- the infrastructural objectives in the DigiCult domain can be identified with standardization and interoperability issues.

These objectives are both of the partners in a project, as well as of the potential end-users outside the project. Essentially they answer the questions: “Why develop a project?” and “Why use this (these) product(s)? What are the potentialities/results?”.

Broadly speaking, the answers lie in assessing the effects of investments in terms of efficiency [Fried et al., 1993] and effectiveness [Löf and Hesmati, 2004]:

- Efficiency in general describes the extent to which time or effort is well used for the intended task or purpose. It is often used with the specific gloss of relaying the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount or quantity of waste, expense, or unnecessary effort. Efficiency has widely varying meanings in different disciplines.
- Effectiveness means the capability of producing an effect, and is most frequently used in connection with the degree to which something is capable of producing a specific, desired effect.

In order to measure the efficiency of a task, activity or project, the first items to evaluate are the costs and benefits related to it. The “costs” include both the direct and indirect costs for running the task, and the costs for the final users of the output’s task. The direct costs are those directly associated with ICT’s implementation and operation and are easily captured in the accounting system.

They include: hardware and software costs; architecture design, test and evaluation; system security; communication costs; training and support costs; environmental costs; personnel and overhead costs; legal and compliance costs.

Indirect costs include human and organisational costs and are not immediately attributable to the ICT investment. Indirect human costs include management resources, time and effort; employee time (when not direct), motivation and training; personnel issues; employee overtime and rewards; increased staff turnover; system support and troubleshooting; and cost of ownership.

Other costs relate to the down-time of the system (for the project and for the final users), additional cost for the users (e.g. organisational and re-engineering costs, training costs, etc.), negative impact on the environment, changes in the labour market(s) due to the exploitation of the project output(s)⁷.

On the opposite side of the costs, ICT benefits are numerous. In Bannister (2005) it is suggested that benefits may be individual, organisational, economic, social or a combination of all four. In particular, the benefits can include: cost reductions (cost avoidance of increased productivity) and financial benefits (sales, fees, royalties), time savings, resource efficiency, productivity improvement, quality or effectiveness improvement, environmental savings, scientific and knowledge benefits, improved service delivery (customer satisfaction, improved reputation, ...), enhancements to policy process; enhancements to democracy; allowing more, better and new data to be collected; improved security, etc.

1.3.2 The Input-Output-Outcomes-Impacts model

In this section we will describe some key terms that inform our assessment methodology and that can guide the reader in better understand the next paragraph/chapters of the deliverable.

Evalued [2012) defines impact as “a consequence affecting direct beneficiaries following the end of their participation in an intervention or after the completion of public facilities, or else an indirect consequence affecting other beneficiaries who may be winners or

⁷ The list is not exhaustive.

losers. Certain impacts (specific impacts) can be observed among direct beneficiaries after a few months and others only in the longer term (e.g. the monitoring of assisted firms). In the field of development support, these longer-term impacts are usually referred to as sustainable results. Some impacts appear indirectly (e.g. turnover generated for the suppliers of assisted firms). Others can be observed at the macro-economic or macro-social level (e.g. improvement of the image of the assisted region); these are global impacts. Evaluation is frequently used to examine one or more intermediate impacts, between specific and global impacts. Impacts may be positive or negative, expected or unexpected.”

This definition shows that impacts tend to be observable only sometime after the end of a project. As we will better explain in the following paragraphs, we were not always able to capture these impacts, due to the difficulties in engaging partners of already-finished projects and gathering their related data. The methodology and assessment focus on expected impacts and describes, coherently with the definition of impact provided by the International Association for Impact Assessment (IAIA), “the difference between what would happen with the action and what would happen without it⁸”.

However, we do not consider only observable or expected impacts, since the study describes also and measures project inputs, outputs and outcomes. Here below a definition of each term [KEA, 2012a]:

- Input: resources invested in the project. These can be monetary (project EU funding) or non-monetary (project consortia) investment. We include in the analysis of the input also the activities and practices established by project under assessment in order to endure the smooth running of the project (monitoring systems, evaluation practices, etc.). We describe the input of each project, as this is crucial for carrying out a Cost-Benefit Analysis, as the outputs need to be related to the invested input.
- Output: the direct consequence of a project, e.g. a product and

⁸ Available at http://www.iaia.org/publicdocuments/special-publications/What%20is%20IA_web.pdf

service produced. Describing outputs mean describing the observable results of a project such as the number of published scientific papers, the number of released software, the number of developed policy papers, the number of project deliverables, etc. They need to be constantly monitored during the project lifecycle. We will consider only those outputs that can contribute for evaluating the project impacts in terms of efficiency and sustainability.

- **Outcomes:** analysing outcomes means analysing the short-time effect produced by the project on its stakeholders, on economy and on society. The main difference between outcomes and impacts is the time frame in which they can be observed: outcomes are short-term effects while impacts are long-term effects. Additionally outcomes are observable at micro and meso level while impacts are generally observed at macro level: i.e. on society and economy as a whole. As described in chapter 3 our methodology developed a set of variables that merge outcomes and impact as suggested, among others, by the KEA Benchmark Methodology ⁹ [KEA, 2012b]. This choice is guided by the fact that we have analysed mainly on-going projects so that long-term impacts will not be, as mentioned, directly observable. The variables selected, however, assure the possibility to map both outcomes and impacts. Moreover, to deeply analyse the economic impact we have to stress the fact that, due to the restricted number of projects under assessment and considering the distributed nature of projects,(that do not focus on a single territory) we do not assess the impact on the European or local/national economy but we will assess the sustainability of each of the project outputs, the economic benefit a project will provide to the project consortia and to the users and its impact on the development of new business models and on the attractiveness of a territory.
- **Impacts,** as described before, are the net difference made by an activity after the outputs interact with society and the economy. They are long-term and long-lasting effects of an action

⁹ Ibidem

and can be, as outcomes, direct or indirect, intentional or unintentional, positive or negative.

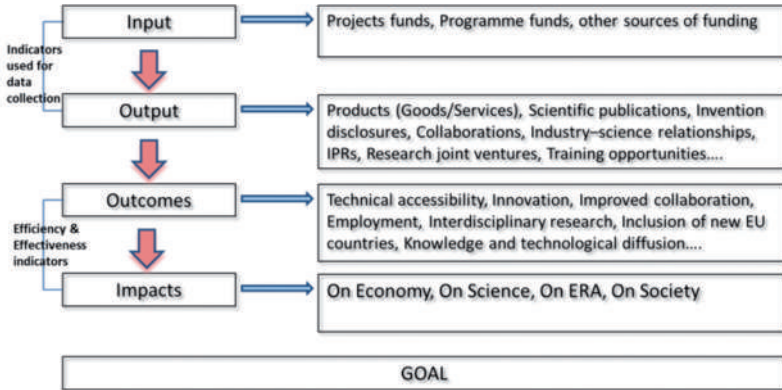


Figure 4 - The Input-Output-Outcomes-Impacts approach

The terms just described are important in the methodology as it follows an input-output-outcome-impact model for the evaluation exercise.

1.3.3 The impact assessment methods

Evaluation techniques to perform projects' impact assessment are numerous. For example, in Berghout and Renkema [2001] 65 methods were identified. Each differs in its level of detail, the range of stakeholders considered, and the characteristics of the data required. The selection of an appropriate method is critical, since success and evaluation accuracy and depends on the technique's suitability and the rigor with which it is applied [Berghout, 2002]; Khalifa et al., 2001; Pouloudi et al., 1999]. To help in identifying a suitable method, in Farbey et al. (1999) a set of matrices that enable project characteristics and evaluation techniques to be matched was proposed.

The method chosen is influenced by many factors [Lech, 2005; Bannister and Remenyi, 2000] and these include: social and organisational contexts, the organisational domain, the level of ana-

lysis, evaluation purpose and perspective, investment purpose, measurability of system impacts, and ICT application. It is now widely believed that several metrics are required to evaluate the different aspects of an ICT project.

The number of existing evaluation techniques are classified in various ways in the literature. For example, De Jong et al. (1999) categorised techniques as "fundamental measures", "composite approaches" or "meta approaches". Lech [2005] distinguished among "financial techniques" and "qualitative methods" such as multi-criteria methods, "strategic analysis methods" and "probabilistic methods". Berghout et al. (2001) categorised four predominant approaches, which they termed the "financial approach", "multi-criteria approach", "ratio approach" and "portfolio approach".

Many more existing classifications are not cited here. Some overlaps between the various classifications are evident, however there are also distinct differences between them. This highlights the difficulty associated with establishing an agreed, coherent framework for evaluating ICT investments. A review of all available techniques cannot be exhaustive; new methods continue to be introduced while other techniques combine several existing tools [Carcary (2008)].

According to Evalsed Guide 2012, four main methodologies are currently used for socio-economic impact assessments:

- Contingent evaluation: this is also called priority evaluation method. Its aim is to involve the general public in decisions. The method combines economic theories with social surveys to simulate market choices and to identify priorities of choices and preferences. This approach is useful for decision-making, especially with techniques using value judgements. The aspects of the current scenario are compared to an ideal scenario to assess public preferences. This method is usually applied in an environmental impact assessment, especially to evaluate non-

- marketable environmental goods;
- **Cost-Benefit Analysis (CBA):** it is aimed at evaluating the net economic impact of a public project involving public investments. A CBA is used to determine if project results are desirable and produce an impact on the society and on the economy by evaluating quantitatively monetary values. Compared to other accounting evaluation methods, a CBA considers externalities and shadow prices, allowing also the consideration of market distortions. Usually, a CBA is used in ex-ante evaluations for the selection of an investment of a project or in the ex-post evaluation in order to assess the economic impact of project activities;
 - **Cost-Effectiveness Analysis (CEA):** it is a method for selecting the most effective alternative in terms of costs between projects with the same objective. A CEA is used for evaluating benefits that are not expressed in monetary values. It is not based on subjective judgements and it is not useful in case of projects with many different objectives (in this case a weighted CEA is used). The main objective of a CEA is to evaluate the effectiveness of a project, but it does not consider the efficiency. A CEA is mainly applied to projects in the health sector with a strict definition of the programme objectives. A CEA should be applied only to compare simple programmes providing the same kind of impact;
 - **Multi-Criteria Analysis (MCA):** it is used to evaluate non-monetary values of a project and to compare heterogeneous values. A MCA combines different decision-making techniques for assessing different impacts of the same project. It is aimed at identifying the opinion expressed by all stakeholders and end-users of a project in order to formulate recommendations and to identify best practices.

Considering these different methods and related perspectives, we decided then to ground our assessment methodology on the Cost-Benefit Analysis (CBA) and on the Multi-Criteria Analysis (MCA). The reasoning behind this choice, together with a short re-

view of Cost-Benefit and of Multi-Criteria, are presented in the following paragraphs identifying for both methods advantages and disadvantages.

1.3.3.1 Cost-Benefit Analysis

The Cost-Benefit Analysis (CBA) origins date back to the 19th Century in France [OECD, 2006]. In 1920, the Welfare State Economy formalised the concept of divergence of private and social costs. The idea that costs and benefits should be compared to assess the profitability of investments was born in the United States in the late 1930s. After the Second World War, the analysis focused on the evaluation of the efficiency of public funds' investments. Since 1960, the Cost-Benefit Analysis has been recognised as a technique for the evaluation of public investments.

In the CBA methodology, benefits are defined as the increase in human well-being (utility) and costs are defined as a reduction of the human welfare. A project or a policy to be profitable must ensure that its benefits outweigh its costs. According to Evaled 2012, Cost-Benefit Analysis is a method of evaluating the net economic impact of a project which involves public investments.

The Cost-Benefit Analysis aims to demonstrate that the project is socially and economically sustainable, considering a positive Net Present Value¹⁰ and showing that outputs of the project will contribute to achieve its objectives. The optimal field of adoption of a CBA is when the most significant costs and benefits can be measured in monetary terms, evaluating expected economic, social and environmental outcomes. However, a market price does not always exist: therefore, it needs to be substituted by a proxy, or more often by a shadow price.

According to the European Commission (2008), the Cost-Benefit Analysis process for analysing European public and policy investments is divided in 6 main steps:

- 1 Presentation and discussion of the socio-economic and investment objectives.

¹⁰ Business Dictionary, available at <http://www.businessdictionary.com/definition/net-present-value-NPV.html>

- 2 Identification of costs, benefits, direct and indirect effects of the project.
- 3 Feasibility analysis of the project and the alternative options.
- 4 Financial analysis (approach based on discounted cash flows), which includes:
 - Total investment cost
 - Total operating costs and revenues
 - Financial return on the investment costs: Financial Net Present Value¹¹ on costs and Financial Internal Rate of Return¹² on costs
 - Financial resources analysis
 - Analysis of financial sustainability
 - Financial return on national capital: Financial Net Present Value on national capital and Financial Internal Rate of Return on national capital
 - Impact of European grants on national investors.
- 5 Economic analysis for evaluating a project net impact on economic welfare which includes:
 - Observed prices or public tariffs analysed and converted into shadow prices
 - Externalities transformed into monetary values
 - Indirect effects
 - Costs and benefits discounted with a real social discount rate
 - Calculation of economic performance indicators: economic net present value (ENPV), economic rate of return (ERR) and the benefit-cost (BCR) ratio.
- 6 Risk assessment which includes:
 - Sensitivity analysis (identification of critical variables, elimination of deterministically dependent variables, elasticity analysis, choice of critical variables, scenario analysis)

¹¹ FNPV is defined as the sum that results when the expected investment and operating costs of the project (suitably discounted) are deducted from the discounted value of the expected revenues. Definition provided by European Commission, Directorate General Regional Policy, Guide to Cost-Benefit Analysis of Investment Projects, 2008, page 40, available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf

¹² FRR the financial internal rate of return is defined as the discount rate that produces a zero FNPV. Definition provided by European Commission, Directorate General Regional Policy, Guide to Cost-Benefit Analysis of Investment Projects, 2008, page 41, available at http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide2008_en.pdf

- Assumption of a probability distribution for each critical variable
- Calculation of the distribution of performance indicators (typically FNPV and ENPV)
- Discussion of results and acceptable levels of risk
- Discussion of ways to mitigate risks.

The CBA is very useful to assess the cohesion policy in terms of sustainable growth, a goal that includes competitiveness and environmental considerations at the same time. For large projects at national level, the analysis of economic impacts can be considered as a complement to the CBA, in order to identify and assess the macroeconomic effects that are not well represented by the estimated shadow prices.

The following table shows benefits and disadvantages of the Cost-Benefit Analysis methodology. Advantages are mainly related to the ability of analysing both negative and positive effects of projects' activities and of comparing costs and benefits in the long-term. Disadvantages are mainly related to the fact that a Cost-Benefit Analysis is able to evaluate only monetary values.

Advantages	Disadvantages
<ul style="list-style-type: none"> <input type="checkbox"/> accounts for all (negative and positive) effects of policy measures <input type="checkbox"/> allows comparison of the ordering of costs with the ordering of benefits of the proposal over time <input type="checkbox"/> can also be used to rank alternative (including non-regulatory) proposals in terms of their net social gains (or losses) 	<ul style="list-style-type: none"> <input type="checkbox"/> cannot include impacts for which no quantitative or monetary data exist <input type="checkbox"/> needs to be supplemented by additional analysis to cover distributional issues

Table 2 - CBA: advantages and disadvantages [European Commission 2009]

1.3.3.2 Multi-Criteria Analysis

The Multi-Criteria Analysis (MCA) is a methodology defined in 1960s as a decision-making tool. "It is used to make a comparative assessment of alternative projects or heterogeneous measures. With this technique, several criteria can be taken into account si-

multaneously in a complex situation. The method is designed to help decision-makers to integrate the different options, reflecting the opinions of the actors concerned, into a prospective or retrospective framework” [Evalsed, 2012].

A MCA is complementary to a CBA, as it is used when some objectives are not identifiable in monetary terms and the project does not show an adequate Economic Rate of Return (ERR)¹³. Additionally, it is complementary to a CBA for assessing socio-economic impacts, because a CBA evaluates mainly monetary values and provides only a quantitative measure. A Multi-Criteria Analysis uses a wide range of different techniques: “Structured, formative, semi-subjective and socio-political methods that recognise there are alternative measures to monetary values. Qualitative and quantitative decision criteria are assessed through weighted scoring” [Carcary, 2008]. This method is useful to compare impacts of different scenarios of a project. MCA was identified as being useful to support our approach in analysing and comparing the impact of the zero scenario (also called do-nothing scenario) and of each DigiCult project under assessment with reference to variables that are not measurable in monetary terms.

The main steps of the Multi-Criteria Analysis are:

- 1 Definition of the projects or actions to be judged: this phase includes all the activities performed by the project.
- 2 Definition of judgement criteria: the criteria should be as exhaustive as possible in order to define the research question properly. A key issue is the involvement of the different actors in the definition of criteria and of the weighting system.
- 3 Analysis of the impacts of the actions: a quantitative estimation or a qualitative description of the impact of each project, according to the criteria selected previously.
- 4 Judgements of the effects of the actions in terms of each of

¹³ Economic Rate of Return (ERR): index of the socio-economic profitability of a project. It may differ from the financial rate of return (FRR) due to price distortions. The economic rate of return implies the use of shadow prices and the calculation of a discount rate at which the benefits of the project equal the present costs, that is the economic net present value is equal to zero. European Commission, Evalsed Sourcebook: Method and techniques, p. 144 - 145 available at http://ec.europa.eu/regional_policy/sources/docgener/evaluation/guide/evaluation_sourcebook.pdf

the selected criteria: this phase is aimed at evaluating the impacts of each project. Compensation methods are used to allocate scores to each impact developed by each project.

- 5 Aggregation of judgements: final assessment of the projects by using a weighting system that can be defined by the evaluators or can be obtained by engaging other stakeholders [Evalsed, 2012].

The projects analysed in this work were asked to rate the relevance of each impact enabling the development of a weighting system for their assessment. Besides this, in the aggregated analysis of the DigiCult we completed the step 4, allowing the EC to define the relevance of each of the observed impacts.

The following table shows the advantages and disadvantages of the Multi-Criteria Analysis. Advantages are mainly related to the ability of capturing and providing information about multi-dimensional data and the sustainability of a project. A MCA allows comparing qualitative and quantitative information: this can constitute both a benefit in terms of providing analysis of a mix of different types of data as well as a disadvantage in terms of subjectivity of the evaluation, especially in the case of qualitative analysis.

Advantages	Disadvantages
<ul style="list-style-type: none"> □ recognises multi-dimensionality of sustainability □ allows different types of data (monetary, quantitative, qualitative) to be compared and analysed in the same framework with varying degrees of certainty □ provides a transparent presentation of the key issues at stake and allows trade-offs to be outlined clearly; contrary to other approaches such as Cost-Benefit Analysis, it does not allow implicit weighting □ enables distributional issues and trade-offs to be highlighted 	<ul style="list-style-type: none"> □ includes elements of subjectivity, especially in the weighting stage where the analyst needs to assign relative importance to the criteria □ because of the mix of different types of data, it cannot always show whether benefits outweigh costs

Table 3 - MCA: advantages and disadvantages [European Commission, 2009]

Our methodology uses both Cost-Benefit Analysis and Multi-Criteria Analysis in order to overcome the problem of a purely

quantitative evaluation and to provide a deeper analysis that considers also not monetary values that will constitute a relevant part of the socio-economic impact assessment of DigiCult projects. Chapter 3 describes how the two methods will be used in assessing different typologies of impact. In fact, a CBA will be applied in the analysis of the economic impact (although non-monetary variables will be used also), while the Multi-Criteria Analysis will be used for assessing the impact on society and on the DigiCult domain.

1.3.3.3 Applicability of Cost-Benefit Analysis and Multi-Criteria Analysis to EU projects in the DigiCult domain

Before providing the detailed description of the methodology in the following chapter, it is important to acknowledge the peculiarities of using the above described methods in analysing EU projects. One of these will be described more in depth in the next paragraphs and is related to the temporary nature of EU projects: we evaluated projects that have a limited timeframe and that are carried out by transnational consortia that exist only for the limited timeframe of the project duration. This makes an ex-post assessment of a project complicated, as it is difficult to engage the consortium in the necessary data gathering after the end of a project as they lack motivation and resources. For this reason, our methodology should be considered, mainly, as an on-going impact assessment methodology.

Another peculiarity is the fact that impact assessment methods are applied to research and development projects. The term “research” in the DigiCult domain does not refer to fundamental research but - to a certain extent - DigiCult projects can be seen as applied research that also foresee development and exploitation activities. However, from the feedback gathered during the workshops and the webinars and from the analysis of the projects, we can assume that DigiCult projects cannot be considered as market driven and their closeness to the market is limited. Therefore, we evaluate mainly “expected” impacts. This means that only in a few

cases we were able to observe tangible impacts. In fact, a research project can have a tangible impact on the market and on society only if their results are taken up by a consistent number of stakeholders. This can happen through the commercialisation of the project outputs, by the diffusion of research outputs in a large research community, that will lead to a change at social or economic level or by an up-take of project outputs by a community of users (following the model of Open Source communities). However, all these scenarios happen, normally, after the project closure. Therefore, we focused the analysis and the methodology, necessarily, on those characteristics of DigiCult projects that suggest their potential exploitation after the end of the project, their sustainability and their relevance in terms of the generated outputs.

In this respect, our methodology focused on the analysis of projects outputs and outcomes as defined in paragraph 1.3.2. For our purposes outputs then are defined as the direct consequences of a project [KEA, 2012b] that need to be monitored during the entire duration of the project and are the condition sine qua non of an impact. Outcomes, defined as the short-term benefits produced by a project, are equally relevant, especially considering the ongoing nature of the impact assessment methodology. In this way, we were able to provide a tool enabling projects to monitor their outputs and outcomes from the beginning of the project. This also allows projects to identify and describe their potential and expected impacts for the next future in order to develop plans used for the correct development of each stage of the projects.

The choice of focusing mainly on outputs, further justifies the use of Cost-Benefit Analysis and Multi-criteria Analysis and not Cost-Effectiveness Analysis [Passani et al., 2014]. Indeed, during the development of the methodology we took into account “The Guide to Cost-Benefit Analysis of Investment Projects” developed by the European Union that clearly states: “CEA allows project comparison when only a single dimension of outcome matters. This aspect significantly limits its field of application: in most circumstances, projects have impacts not falling into a unique effectiveness mea-

sure. Also, without evaluation of benefits, CEA can only measure technical efficiency rather than allocative efficiency¹⁴. In the case of DigiCult domain project assessment, we decided to not use CEA as the interest of this study is in identifying all the different dimensions strictly related to the digital and cultural domain. For this reason, we associated to the cost-benefit analysis the multi-criteria analysis that, as described above, can be used for assessing those impacts that cannot be described in monetary terms. Moreover, we developed a methodology that identifies also transversal indices in order to assess for each project in a precise way efficiency, effectiveness, sustainability and innovativeness of each area of impact under consideration. Finally, as supported by the Guide from the European Union¹⁵, Cost Effectiveness Analysis cannot be seen as substitute for Cost-Benefit Analysis but as complements when actual CBA is impossible and it is really difficult to be standardised. As explained, CEA is mainly applied to projects in the health sector with a strict definition of the programme objectives. For these reasons we decided to use Multi-Criteria Analysis instead of Cost-Effectiveness Analysis. In fact, Multi-Criteria Analysis is complementary to CBA, which takes into account only one benefit of each output. Instead, the MCA allows aggregating a set of different objectives for each output. In our case, the Multi-Criteria Analysis is taken into account and implemented by using the impact analysis approach, i.e. for each output we identify the effects and the impacts it produces for the users of the project. This approach enables our methodology to evaluate the impact of each output of the projects and the overall set of objectives.

1.3.4 Capturing the knowledge circulation

The above mentioned techniques are potentially able to capture the impacts of innovation investments both at the macro and the micro level. In our case, we concentrated our attention on a rela-

¹⁴ European Union, Regional Policy, "Guide to Cost-Benefit Analysis of Investment Projects", 2008, page 67, available http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf

¹⁵ European Union, Regional Policy, "Guide to Cost-Benefit Analysis of Investment Projects", 2008, page 66, available http://ec.europa.eu/regional_policy/sources/docgener/guides/cost/guide02_en.pdf

tively small domain and on the projects' activities. Consequently, our work focuses on the impacts at the micro level while the extension of the analysis at the macro level implies strong and often hazardous assumptions. However, it is important to see the DigiCult domain as innovation system where "the elements and relationships ... interact in the production, diffusion and use of new, and economically useful, knowledge" [Lundall, 1992]. From this perspective what counts is not, or not only, the R&D stock but the knowledge spread and its diffusion in the economic system. The progress of a sector and the transfer of this progress to the economic system cannot be evaluated according to static allocative efficiency criteria but it must be explored through the capacity of promoting the technical and structural enhancement. The perspective is then not micro nor macro but "meso" where the single projects' partners are considered as a part of a wider innovation network of collaborating and competing enterprises; this innovation system can be local, regional, national or global [Mazzucato, 2013]. From this perspective emerges the need of analysing the network and not only the single player. Indeed, the competencies that generate innovation are a part of collective activity that is developed through a network of players, connections and relationships [Freeman, 1995]. In order to explore the "meso" dimension we decided then to collect the information useful for studying the DigiCult domain by using the Social Network Analysis (SNA) [Scott, 2013].

ICT innovation projects for Cultural and Creative Industries

This chapter describes the DigiCult domain and defines more in detail the terms used in the methodology and already introduced in the previous chapter.

2.1 DigiCult domain and relevant projects

“DigiCult” is a term created by the European Commission in the context of the Fifth Framework Programme for Research and Technological Development, which ran from 1998 to 2002. DigiCult encompassed all the activities carried out by the EC research projects in the context of the Information Society Technologies (IST) Programme, focusing on the pervasion of Information and Communication Technologies (ICT) into all aspects of the European citizen’s life¹⁶. The main beneficiaries of the DigiCult domain, as defined by the Fifth Framework Programme were libraries, museums, archives, research centres and universities. The main focus of the DigiCult domain was on two concepts: the access to cultural heritage and the preservation of cultural resources for future generations: “EU-funded ICT research on access to cultural heritage and digital preservation deals with leading-edge information and communication technologies for expanding the availability of Europe’s rich cultural and scientific resources and for enhancing user experiences with them. This research also investigates how digital content created today will survive as the cultural and scientific knowledge of the future”¹⁷.

The term DigiCult was also used during the Sixth EU Framework Programme (FP6) (running from 2002 to 2006), as a key the-

¹⁶ Available at <http://cordis.europa.eu/fp5/> Available at <http://cordis.europa.eu/fp5/>

¹⁷ Available at http://cordis.europa.eu/fp7/ict/telearn-digicult/digicult_en.html

matic area of research. The DigiCult domain encouraged EC projects to use ICT technologies to improve the Cultural Heritage resources and increase the online access to Cultural sites and objects¹⁸.

During the Seventh Framework Programme the DigiCult domain was included in the “Creativity” Unit of the General Directorate Connect that covers a wider range of themes, including creativity processes and technologies, aimed at:

- “enhancing creative processes and user experiences with digital cultural resources and digital preservation;
- developing innovation activities for improving the up-take of research results in the creative industry;
- supporting policy activities;
- promoting Europeana¹⁹”.

Within this new context it becomes evident that the European Commission focuses more on increasing innovation, competitiveness and access to market of products developed by DigiCult projects. Starting from the information gathered through the DigiCult domain analysis²⁰ where 61 projects managed by the Unit G2 Creativity were analysed, we decided to use the DigiCult term that best defines the research focus of the projects under analysis. We evaluate the socio-economic impact of the following four groups of projects managed by the Creativity Unit: “Digitisation technologies”, “Digital Preservation” and “Digital cultural experiences”, “Take up of research results”, from:

- Call 1 ICT-2007.4.1 “Digital Libraries and technology-enhanced learning”.
- Call 3 ICT-2007.4.3 “Digital Libraries and technology-enhanced learning”.
- Call 6 ICT-2009.4.1 “Digital Libraries and Digital Preservation”.
- Call 9 ICT-2011.8.2 “ICT for access to cultural resources”.
- CIP-ICT-PSP calls for the development of the Europeana framework.

¹⁸ Available at http://ec.europa.eu/research/fp6/index_en.cfm

¹⁹ Available at <http://www.europeana.eu/>

²⁰ See also MAXICULTURE D2.1

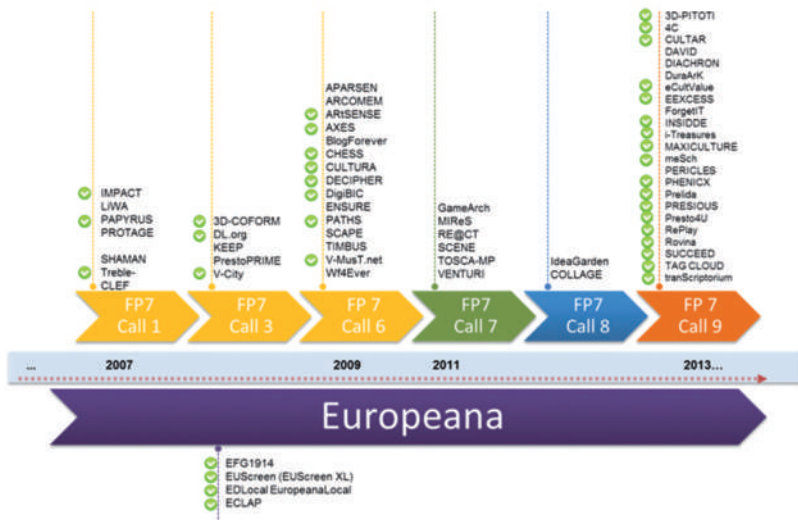


Figure 5 - Projects, calls in the DigiCult domain

In particular:

- “Digitisation technologies” projects are aimed at facilitating large-scale digitisation and make digitisation more cost-effective”.
- “Digital cultural experiences” projects are aimed at improving the meaningful use of cultural resources and user experiences.
- “Digital Preservation” projects are aimed at developing tools to make digital Cultural Heritage artworks online accessible.
- “Take up of research results” category includes Support and Coordination actions aiming at improving projects’ results, dissemination and exchange of projects’ best practices.

We also analysed two other categories of projects managed by the Creativity Unit: the “Creativity for Learning” projects that are developing tools and services for research and education, and the “Computational Creativity” projects, that are developing services and methodologies for creative and transfer knowledge practices through ICTs.

The following figure provides the visualisation of all the Creativity Unit projects’ activities.



Figure 6 - Creativity Unit projects' activities

After the definition of the framework, as described above, the European Commission decided to extend the categories of the Creativity projects including the activities developed from Call 10 and Call 11 projects. We provide below a figure presenting the new framework that includes two more categories: human computer interfaces for the Cultural and Creative industries and Intelligent environments stimulating and enhancing human creativity.



Figure 7 - Creativity Unit projects areas of impact

We selected the projects that were then invited to participate in the self-assessment exercise by choosing the ones working for increasing the access to cultural resources. For projects financed under Call 9 ICT-2011.8.2 “ICT for access to cultural resources”, the situation is slightly different: the call strictly defined two different objectives, one for digital preservation (ICT-2011.4.3) and one for “ICT for access to cultural resources” (ICT-2011-8.2). Instead, the previous calls did not distinguish between these two objectives. We analysed mainly projects working in the access to cultural resources area but, since it is difficult to strictly differentiate these projects from the digital preservation ones, we decided to include in the self-assessment some digital preservation projects that have also an impact on increasing the access to cultural resources.

Finally, during the discussion carried out within the MAXICULTURE team and with the European Commission, it emerged that some projects from Europeana, developed by the Digital Libraries initiative, have objectives that are coherent with proposed approach and for this reason they were included in the domain and in the socio-economic impact assessment.

2.2 Groups of projects per instrument

The classification of projects related to the instrument of funding detected that the majority of projects (29 projects) are Specific Targeted research Projects (STREP). There are also 15 Integrated Projects (IP), 11 Coordination and Support Actions (CSA), 4 European (CIP-PSP) and 2 Networks of Excellence (NoE). This analysis aims to provide a first idea of the kind of activities that the projects develop and their main focus (for example NoE are more research oriented than CSA). Moreover, different instruments imply different level of budget (having IP a larger budget than STREP) and different durations. The following figure provides also the detailed list of projects for each typology of instrument.

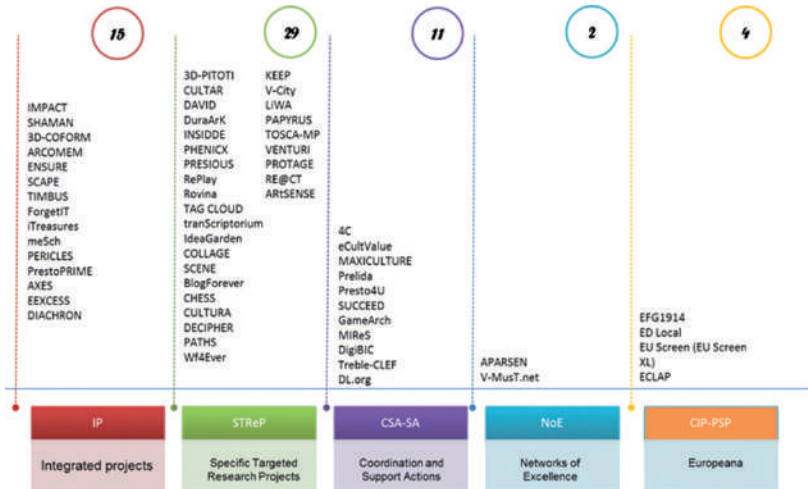


Figure 8 - Groups of projects per instrument

2.3 Groups of projects per total cost

The 61 projects were divided in three main categories, according to the total cost declared:

- projects with a total cost lower than 2 million €
- projects with a total cost between 2 and 5 million €
- projects with a total cost higher than 5 million €.

This analysis aims to compare several groups of projects on the base of the total cost. This classification is very relevant, as the total cost is a useful tool for the normalisation of the data gathered through the self-assessment. Projects with larger budgets usually have more complex partnerships, since part of the budget is allocated to a huge set of activities (management, communication and networking) and not immediately to the creation of greater outputs. The majority of projects have a total cost between 2 million € and 5 million €, this is reflected also by the analysis of the funding instrument, as the projects are mainly STREPs. The following figure provides the detailed list of projects divided in three categories on the base of the total cost.



Figure 9 - Groups of projects per total cost

2.4 Groups of projects by lifecycle

Projects were also divided according to their lifecycle of development. This classification is needed to identify which are the projects nearly started, the projects that have developed products/services and the ones that have just ended and may have started the commercialisation of their outputs. In similar research activities²¹ we experienced that the cooperation with completed projects is very difficult to establish. The classification detected that 23 projects are in the first year of the activity, 19 projects are in the full development phase and 19 projects completed their activities. The following figure provides a visualisation of the classification per projects lifecycle.



²¹ SEQUOIA and ERINA+ projects

Figure 10 - Groups of projects by lifecycle

2.5 Groups of projects by research focus

The classification of projects by research focus is necessary in order to assign to the 61 projects a strict definition of activities developed. The information and the definition of clusters are updated according to the new classification of projects included in the DigiCult domain provided by the European Commission and available on the following website:

http://cordis.europa.eu/fp7/ict/creativity/creativity-projects_en.html. The new classification taking into account Call 1, Cal 3, Call 6 and Call 9 projects presents 5 clusters:

- Digitisation technology: the research focus is related to mass digitisation of Cultural Heritage resources and cost-effective digitisation. The projects in this cluster develop innovative technological solutions for digitisation and best practices analysis.
- Digital preservation: this research cluster is related to the projects providing technological advances for ensuring the long-term availability of heterogeneous Digital Cultural Heritage resources and contents in several different domains.
- Digital cultural experience and Virtual Heritage: the research focus is to improve the meaning of Digital Cultural Heritage resources and the Digital Cultural experience of users through the development of leading edge technologies. Projects in this cluster also develop Network of Excellence and Centre of Competence in the field.
- Intelligent environments stimulating and enhancing human creativity: this cluster includes all the projects that are not developing technological advances specifically in the DigiCult domain, but are providing new tools and methodologies for supporting the creative sector (such as gaming, tourism, fashion, etc...).
- Support Activities: this research cluster is constituted by Support and Coordination Actions aimed to increase the awareness of potential users of research results in the DigiCult domain and

to improve the access to the market or the commercialisation of products.

Each project has been assigned only to one research focus. We included in the analysis also the classification of 3 new projects that were not included in the first evaluation, as they were not already funded: 4C, EEXCESS and DIACHRON. The classification detected that the majority of the projects are mainly focusing on Digital Pre-



servation and Digital Cultural Experience and Virtual Heritage. 6 provides a representation of the projects per research focus.

Figure 11 - Groups of projects per research focus

2.6 Groups of projects by typology of direct users

The classification of projects by typology of direct users is required to identify a set of users which are divided into several categories related to the activities, products and services developed by the projects. Each project can be included in more than one category of direct users. The direct users were divided into a set of 10 main categories:

- libraries and archives

- museums and curators
- researchers, academia and field experts
- training sector
- citizens and end users
- creative sector, including media institutions and other industries
- EU projects
- ICT providers or developers
- policy makers or government bodies, officials
- others.

The majority of projects are often addressing more than one category of direct users, especially: researchers, the creative sector, museums and curators, libraries and archives. The follo-



wing two figures provide a visualisation of the classification of

each project per direct users' categories.

Figure 12 - Groups of projects by direct users

2.7 Groups of projects per technological tools and methods

We have also developed a classification of all the projects related to the technological tools and methods developed, in order to better identify the different technological outputs. This analysis is also relevant for defining technological indicators for the self-assessment methodology that will produce also social and economic impacts. The projects analysed can be included in more than one class, as they develop different technological tools and methods.

Technologies are:

- Search engine tools/Mining techniques
- 3D processing, capture and manipulation techniques
- Digitization and access of archives and library techniques
- Social web crawling, analysis and mining
- Augmented/mixed reality techniques
- Creative learning methods
- Tools for preservation and security
- Storytelling
- OCR/Language technologies
- Mobile technologies
- Preservation planning

Figure 13 provides a visualisation of the projects in each class.



Figure 13 - Groups of projects by technological tools and methods

An Assessment Model for the DigiCult domain

As anticipated in chapter 1 the assessment methodology is based on the fundamentals of the Cost-Benefit Analysis [Boardman, 2006; Brent, 2007], with additional features of the Multi-Criteria Analysis [Köksalan et al., 2011] and Social Network Analysis [Scott, 2013]. In this chapter we will provide a detailed description of variables, indicators and indices used and the rationale behind their choice. This chapter also illustrates the process that has been followed for defining the assessment model: thanks to the MAXICULTURE project activities, experts of the domain and representatives of DigiCult projects were engaged in a participatory approach for the methodology development.

3.1 Definition of impact areas, indicators and variables²²

The process for the definition of indices, indicators and variables, necessary for a socio-economic impact assessment methodology, started with a background analysis of the DigiCult domain and a literature review. In the background analysis, the DigiCult domain and its projects were studied mapping and reviewing publicly available information. This led to a better understanding of the domain (see chapter 2) and supported in grouping the projects according to their outputs, stakeholders, starting dates and budgets. This classification was very useful to better define the domain under analysis, and individuate the correct indicators and variables necessary to widely analyse the main outputs and activities carried out by the

²² For a definition of “variable”, “indicator” and “index” please see the “Acronyms and definitions” section at the beginning of this deliverable.

projects in the domain. In other words, this first activity was important in order to ensure the set of indices/indicators/variables developed are really meaningful and customised for the domain. Indeed, it is important to remember that the aim of MAXICULTURE project from which this book originates, was to develop an impact self-assessment for the DigiCult domain: a specific research field developing ICT solutions for very different spheres of the cultural heritage and creativity sectors. This research area (not an industrial/productive sector) is based on transnational projects producing effects at micro level and often not localised in a specific territory. For this reason, it was not possible to use cultural-related standard statistical approaches [UNESCO, 2009 ²³] that focus on the cultural sector in its broad sense and have as unit of analysis national economies and clearly defined cultural goods and services. However, some of the topic highlighted in UNESCO [2009], especially those related to the social dimensions of culture are covered by the methodology even if by using ad hoc indicators and variable (among others: cultural participation, identity building practices, cultural diversity, social cohesion and social appropriation). With reference to the literature review, different sources were studied: on one hand, policy documents issued by the European Commission in order to map the expectations of the EC in terms of DigiCult impacts; on the other hand, a number of studies in the area of cultural domain impact assessment. With reference to the latter, the survey included not only documents analysing the DigiCult domain, as the relevant documents were scarce, but also many studies in the area of cultural heritage impact assessment. Additionally, documents dedicated to the analysis of the relationship between ICT and the cultural heritage sector were considered (see bibliography).

²³ This important report shows how to map and measure the cultural sector both in its economic and social aspects. It provides guidelines to national and regional authorities on how to monitor the contribution of the cultural sector to the social and economic wellbeing of their territories. In this sense the report offer indication about how to define the cultural sectors in sub-dimensions, its products and services and the professions that animate it. It also offers methods for quantifying citizens consumption of cultural goods and services. The relative difficult application of the proposed framework to our purposes is due to the different unit of analysis under investigation: the UNESCO report considers the entire cultural sector of a specific nation or region at macro level, while we focus the attention on ICT-driven projects which develop services for specific and limited spheres of the cultural sector without a clear territory of reference and with no impact at macro-meso level.

Besides the literature review, a number of in-depth interviews with experts were carried out with domain experts. These interviews further helped to understand the domain under analysis, the challenges that it is facing and the expectations of the stakeholders in terms of innovation and potential contribution to European social and economic sustainable growth.

We developed a map of potential impacts based on the literature review and used it as the starting point for the development of variables, indicators and indices.

The process described above led to the identification of 29 potential/expected impacts of DigiCult projects. Those are listed in the map that follows, but are also reported in the Table 4 for a better clarity. For each potential impact we show the reference to the main source(s) (coming from available literature or from EU DigiCult work programmes). The potential/expected impacts here listed have been presented to experts in three workshops held in Brussels in March 2013. Domain experts supported us in selecting the most relevant potential/expected impacts and in better frame each of them.

The potential impacts emerged from the literature review and from an accurate reading of the DigiCult and Creativity call objectives of the ICT work programme led us to a clear view of the indicators to be included in the methodology. The 29 potential impacts were aggregated in 4 areas of impacts excluding repetitions and merging those expected impacts with similar or complementary aspects.

This inductive exercise was based on the previous experience of project partners [Bellini et al., 2012; Passani et. al, 2014] and on the literature dedicated to impact assessment (among the others, KEA, 2009). In this way, we were able to consider all the expected impacts through 4 vertical indices that represent four areas of impact, and through 4 transversal indices. The list of eight indices is reported here:

Horizontal indices:

- Economic impact
- Social impact
- Technological impact
- DigiCult and creativity impact

Vertical indices:

- Efficiency
- Effectiveness
- Innovativeness
- Sustainability

Below the table and the image, that illustrate the potential/expected impacts as emerged from the literature review and the analysis of EC work programmes and the related sources.

N.	Potential/expected impacts	Source
1	Sustainable access to information: keeping resources not only available but also meaningful and usable	ICT work-programme 2011-2012, expected impact for DigiCult-related challenge
2	Advances in the ability to offer customizable access services to scientific and cultural digital resources, improving their use, experiencing and understanding	Work programme 2009, expected impact for DigiCult-related challenge
3	Unlock people's and organization' abilities to access contents, master it, transfer to desired contexts and preserve it over time	Work programme 2007, expected impact for DigiCult-related challenge
4	Increase the number of digitalization cultural contents available through digital libraries	Work programme 2007, expected impact for DigiCult-related challenge
5	Significant reduction in the loss of irreplaceable information and new opportunities for its re-use, contributing to efficient knowledge production	Work programme 2009, expected impact for DigiCult-related challenge
6	Better recovery and repairing techniques and deeper understand of the reasons and implications of digital decay and other forms of data loss	ICT work programme 2011-2012, expected impact for DigiCult-related challenge
7	On Number of Culture Resources' users can access in real and virtual contexts	ICT work programme 2011-2012, expected impact for DigiCult-related challenge
8	On Education, i.e. reduction of drop-out rates, improve students performances, etc.	ICT work programme 2011-2012, expected impact for DigiCult-related challenge
9	on Science	ICT work-programme 2011-2012, expected impact for DigiCult-related challenge
10	on Leisure Context	ICT work-programme 2011-2012, expected impact for DigiCult-related challenge
11	on Ways citizens and workers Experience Culture: more personalized and adaptive interactive setting	ICT work-programme 2011-2012, expected impact for DigiCult-related challenge
12	on Economy: releasing the economic potential of cultural heritage in digit forms. Availability and affordability of tools and services.	ICT work programme 2011-2012, expected impact for DigiCult-related challenge

N.	Potential/expected impacts	Source
13	Faster and more effective acquisition of knowledge, competence and skills, increased knowledge worker productivity and more efficient organizational learning processes	Work programme 2007, expected impact for DigiCult-related challenge
14	Reinforce capacity for organizations to preserve digital content in a more effective and efficient manner.	Work programme 2009, expected impact for DigiCult-related challenge
15	on Creativity	KEA (2009). The impact of culture on creativity, Brussels: Study prepared for the European Commission - DG Education and Culture.
16	on Intercultural Dialogue and International Relations	European Commission, COM(2007) 242, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a European agenda for culture in a globalizing world
17	on Networking and Social Capital, for cultural sector actors and their users/consumers.	RAND Report. McCarthy K.F., Ondaatje E.H., Zakaras L. and Brooks A. (2004). Gifts of the Muse, Reframing Report the Debate About the Benefits of the Arts.
18	on Technology	Passani A., Monacciani F., Van Der Graaf S., Spagnoli F., Bellini F., Debicki M., Dini P. (2014), Sequoia: a methodology for the socio-economic impact assessment of software-as-a-service and internet of services research projects, available in pre-view at http://eprints.lse.ac.uk/47133/
19	on Social Innovation	KEA (2012a). Measuring economic impact of CCLs policies. A practical guide to implement the Benchmarking Raster. European Commission, COM(2010) 183, GREEN PAPER Unlocking the potential of cultural and creative industries.
20	on Cultural Cohesion	Matarasso F. (1997). Use or ornament? The social impact of participation in the arts. Stroud: Comedia. UNESCO (2009)
21	on the Promotion of Values and Objectives of Public Interest	KEA (2012). Measuring economic impact of CCLs policies How to justify investment in cultural and creative assets
22	on Cultural Goods Consumption - growth in the demand	Benhamou, 1996. "Is increased public spending for the preservation of historic monuments inevitable? The French case," Journal of Cultural Economics, Springer, vol. 20(2), pages 115-131, June. UNESCO (2009)
23	on Cities and Regions Attractiveness	Regions contributing to Smart Growth 2010) European Union, Working Group of EU Member States Experts (Open Method of Coordination) on Cultural and creative industries (2012). Policy Handbook on How to strategically use the EU support pro-

N.	Potential/expected impacts	Source
		grammes, including Structural Funds, to foster the potential of culture for local, regional and national development and the spill-over effects on the wider economy? KEA (2012a). Measuring economic impact of CCLs policies. A practical guide to implement the Benchmarking Raster.
24	on Cultural Resource Demand (increase in the number of persons accessing resources and information, increase in the expenditures related to cultural services, etc.)	KEA (2012a). Measuring economic impact of CCLs policies. A practical guide to implement the Benchmarking Raster.
25	On other sectors	MAXICULTURE consortium
26	on Employment	European Commission, COM(2012) 537, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. Promoting cultural and creative sectors for growth and jobs in the EU.
27	on DigiCult Business Models	Passani A., Monacciani F., Van Der Graaf S., Spagnoli F., BELLINI F., Debicki M., Dini P. (2014). SEQUOIA: A methodology for the socio-economic impact assessment of Software-as-a-Service and Internet of Services research projects. RESEARCH EVALUATION; ISSN: 0958-2029
28	Impact on Personal Development, i.e. character development, critical thinking and creative problem-solving	RAND Report. McCarthy K.F., Ondaatje E.H., Zakaras L. and Brooks A. (2004). Gifts of the Muse, Reframing Report the Debate About the Benefits of the Arts.
29	On the internal organization of cultural domain institutions and their working routines	Passani A., Monacciani F., Van Der Graaf S., Spagnoli F., Bellini F., Debicki M., and Dini P. (2014) SEQUOIA: A methodology for the socio-economic impact assessment of Software-as-a-Service and Internet of Services research projects Research Evaluation 2014 23: 133-149.

Table 4 - DigiCult projects' potential/expected impacts and related references

The map of potential/expected impacts was used during the three experts' consultation workshops held in Brussels in March 2013. For this occasion, experts were asked to suggest variables for almost all the potential/expected impacts [MAXICULTURE D2.2, 2013]. A first list of variables was developed on the basis of the inputs coming from the experts (variables and comments), selecting the most relevant ones. Other indicators and variables coming from the literature review and the in-depth interviews were added afterwards and resulted in a second release of the list.

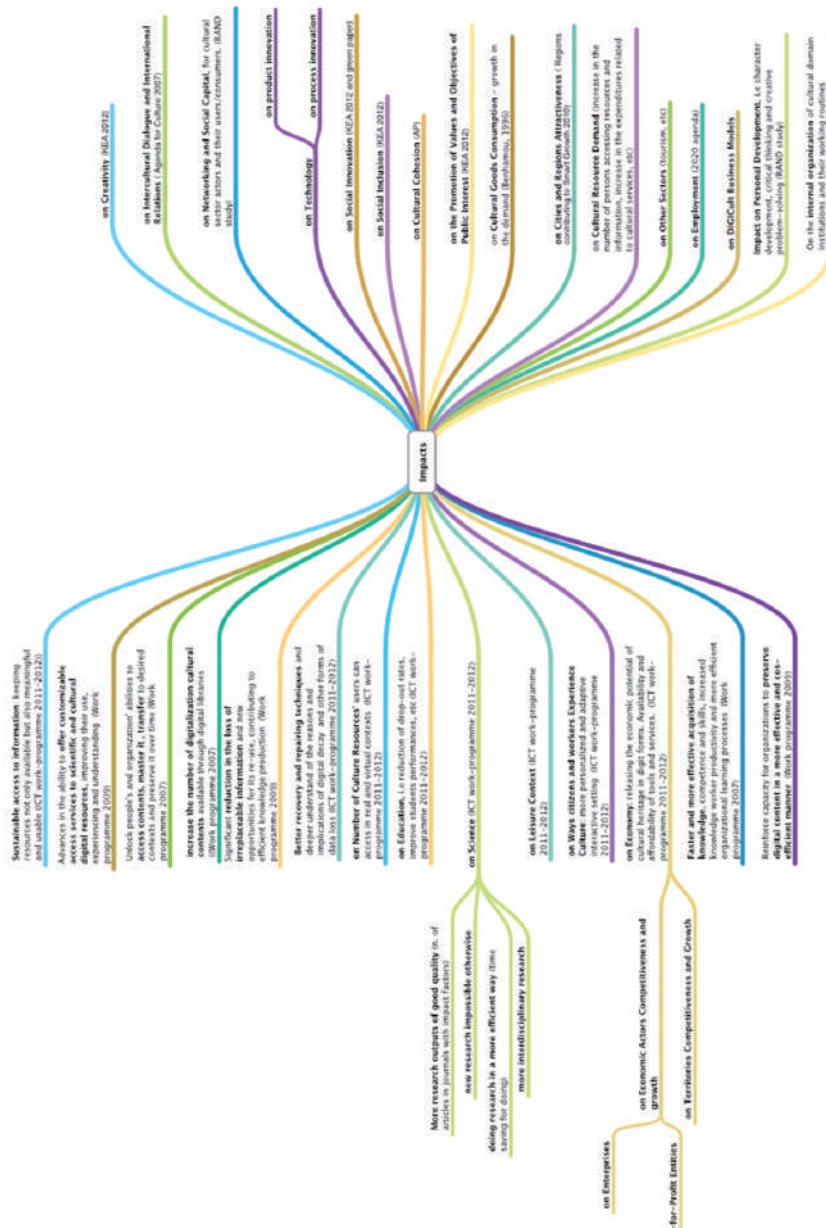


Figure 14 - Map of the potential/expected impact of DigiCult projects and domain (MAXICULTURE elaboration)

In a following step, the representatives of DigiCult projects were invited to participate in a webinar with the aim of presenting them the methodology, its main indices and the variables developed. 15 projects participated in three webinars. In each of the webinars, a selected set of variables was presented:

- economic indicators and variables in the 1st webinar;
- social indicators and variables in the 2nd webinar;
- technological indicators and variables related to the DigiCult domain in the 3rd webinar.

In each of the webinars participants discussed the general framework of the methodology and a specific subset of indicators and variables²⁴. An additional topic covered during the webinars was related to projects' stakeholders. In fact, for any impact assessment it is crucial to clearly identify who will be impacted by a project. We presented a draft list of stakeholders, which was enlarged and fine-tuned according to the suggestions of the webinar participants.

After the three webinars, the indicators and related variables were fine-tuned, transformed in questions, when appropriate, and sent to the experts and representatives of the DigiCult projects asking them to validate their relevance. For this purpose, an online questionnaire was developed by using a dedicated software called Surveygizmo²⁵. Both groups were asked to rate the relevance of each variable/question by attributing a value from 1 to 6. The decision to engage also the projects themselves in the variables validation was not planned originally and emerged during the webinars: some projects shown their interest for the variables and asked to see the complete set instead of the ones selected for the discussion during the webinar. For the validation exercise we were able to engage 42 persons: 28 experts and 14 representatives of DigiCult projects. Overall 11 persons responded to the questionnaire, but they did not rate all the questions. 6 or more persons rated 2 indicators, 5 persons rated 25 indicators and 4 or less persons rated the rest of them. Moreover, the scores attributed were

²⁴ Considering all the variables in a single webinar would have been impossible due to the high number of variables that compose the methodology.

²⁵ <http://www.surveygizmo.com/>

sometimes too different and too widely spread to give a clear indication of the relevance of the indicators. For 94 indicators the scores tended toward a clear answer and were selected for our purposes.

We took into consideration the answers received for the elaboration of the list of indicators/variables and questions presented in this deliverable (see Annex A). However, the number of respondents was not sufficient to consider the validation process as completed and, as a result, we used also the feedback coming from the following research phase dedicated to the data gathering activities.

In conclusion, it can be stated that we followed a bottom-up/inductive approach for the definition of the assessment indices, indicators and variables, moving from the observable changes that DigiCult projects can develop in the cultural heritage area, in society and at economic and technological levels (background analysis and literature review), to the identification of indices, and, finally, indicators and variables.

3.2 The validation of the methodology, variables, indicators and indices

As mentioned, the self-assessment approach has been tested through the engagement of representatives of the DigiCult projects that used the methodology developed for self-assessing the impacts of their project. During this phase we interacted with the involved projects and supported them in their self-assessment exercise. In addition, the interaction with the EC and the MAXICULTURE project reviewers has been fundamental to further improve the methodology, that is presented here in its final version.

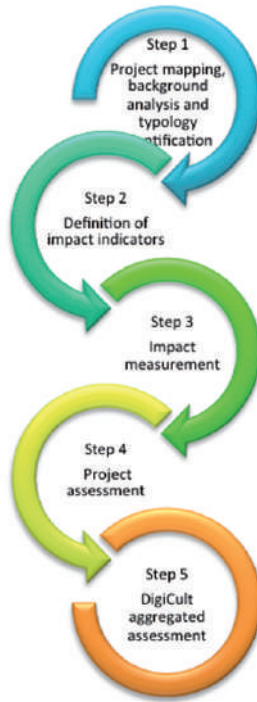


Figure 15 - Methodology development and validation process

Figure 15 synthesises the process developed for the methodology definition and validation. It also visualises (pink arrow) the feedback loop that the testing with the DigiCult projects delivered to the methodology development.

The testing of the methodology represented the basis for the analysis of the project impacts and the socio-economic impact analysis of the DigiCult domain. In fact, two separate assessments at domain and projects level were then performed and reported.

The following paragraphs describe the methodology by:

- framing the areas under analysis;
- defining the methodology as an instrument for on-going impact assessment;

- describing its purposes;
- identifying the stakeholders of the assessment methodology;
- describing the underlying structure of the methodology;
- describing the areas of impact and the related main indices, the indicators and variables that will be used;
- describing how the assessment model is made operational through construction of indicators and indices as well as the benchmarking system and the comparison models that the collaborating projects will use for self-assessing their projects.

As mentioned earlier, the methodology is based on the fundamentals of the Cost-Benefit Analysis in addition to the Multi-Criteria Analysis and the Social Network Analysis. The three methodologies are combined with the aim of assessing the impact of the DigiCult domain and of its projects but the assessment is not aimed to evaluate EU policies in the area of the DigiCult. Then, by aggregating the impact of the single projects under analysis, it describes the benefit produced by the DigiCult domain. It is worth then to assume that the aggregated analysis of the collaborating projects represents as a good proxy of the domain impact.

3.3 The implementation of the assessment methodology for the DigiCult domain

As described in Chapter 1, this methodology is based on the fundamentals of Cost-Benefit Analysis and of Multi-Criteria Analysis. In addition, the Social Network Analysis is used in order to capture the meso impacts of the innovation induced through the research and development activities in the DigiCult domain.

Starting from the Cost-Benefit Analysis we can summarise that this is the evaluation of the net economic benefit of a project. CBA is normally used for comparing two possible investments or projects and identifies the more efficient one. CBA, however, can also be used in impact assessment, in other terms it can be considered also a counterfactual method and helps in answering the following question: “What difference does a project make?” In other terms,

the CBA can support the comparison of two scenarios: the scenario A without the project and the scenario B with the project implemented (or under development). We can also call the scenario A “zero scenario” or “do nothing scenario”, a scenario in which the investment did not take place. We used the CBA in order to make a comparison of these two scenarios. Similarly, the Multi-Criteria Analysis is a decision-making method used for evaluating two alternative investments, helping policy makers to decide the most appropriate one. It can also be used in an impact assessment in the same way as the CBA, by comparing the “zero scenario” with the scenario with the investment in place. It is normally used in the ex-ante evaluation, but can also be used in the on-going impact assessment. The main difference is represented by the fact that a MCA works with non-monetizable variables. It is therefore complementary to the CBA. The following process is applied for the comparison of the two scenarios with both the CBA and the MCA:

- 1 Definition of areas of impact, including the definition of project objectives and projects stakeholders. This step answers the following questions:
 - impact on what?
 - impact on whom?

The methodology defines a set of impact areas and a set of project stakeholders for the participating projects among which they will be able to choose.
- 2 Baseline identification. This step describes the scenario before the investment under assessment. In our context it is called “zero scenario” and it is investigated through ad hoc variables. However, the identification of the baseline scenario is almost “invisible” to the projects. They are mainly asked to describe and quantify the difference generated by the project. To specify: projects are not asked to know how much it cost to digitalize a resource without the project outputs, but about the cost savings obtained by the project outputs in digitalizing a resource. In this a passage is somehow skipped which is nevertheless implicitly requested. In fact, in order to tell us what the cost saving is which was realised through the project outputs,

a project needs to know the cost without it.

- 3 Alternative scenario. The scenario in which the project and its outputs are implemented or under implementation. The majority of the variables and indicators can be found here covering both a qualitative and quantitative description of the outputs, outcomes and impacts generated by the projects.
- 4 Quantification of the benefits produced by the project. In this phase, the data gathered in the different project phases are analysed and the impacts of the project are described in a synthetic way. Typical outputs of the Cost-Benefit Analysis are the Economic Net Present Value and the Benefit/Cost Ratio.

To conclude, it is important to remember that the Cost-Benefit Analysis measures the difference between two scenarios in economic and monetised terms. For these reasons it is a valid method when assessing economic impacts taking also into account some financial aspects. In our work other impacts have been evaluated, such as social impacts, impacts on technology and impact on the DigiCult domain. Therefore, the Cost-Benefit Analysis is integrated with a Multi-criteria analysis providing the possibility to follow the same process described above and showing the differences among scenarios using the unit of measurement (quantitative or qualitative) that better fits the single variable. Both quantitative and qualitative units of measurements can then be normalised in order to aggregate the results into indices that can be expressed in numeric terms without being monetised.

3.4 Impact assessment areas – VERTICAL INDICES

The figure that follows visualises the 4 areas of impact that will be considered by the methodology:

- Economic impact
- Social impact
- DigiCult and Creativity impact
- Technological impact

Each of the areas includes multiple subcategories of impact that - through the operational definition - have been transformed into variables and, then, in the questions²⁶ included in the Self-Assessment Toolkit (SAT), an on-line platform that has been developed for enabling the assessment activities. This assessment process implies an evaluation of the project performance in each area and related subcategory of impact and will be summarised by a synthetic index built on the indicators calculated in each subcategory; in this way, for each project, we are able to describe, e.g. its impact on society, but also its impact on social inclusion, employment, and so forth. The same process is applicable for all the areas of impacts and related subcategories.

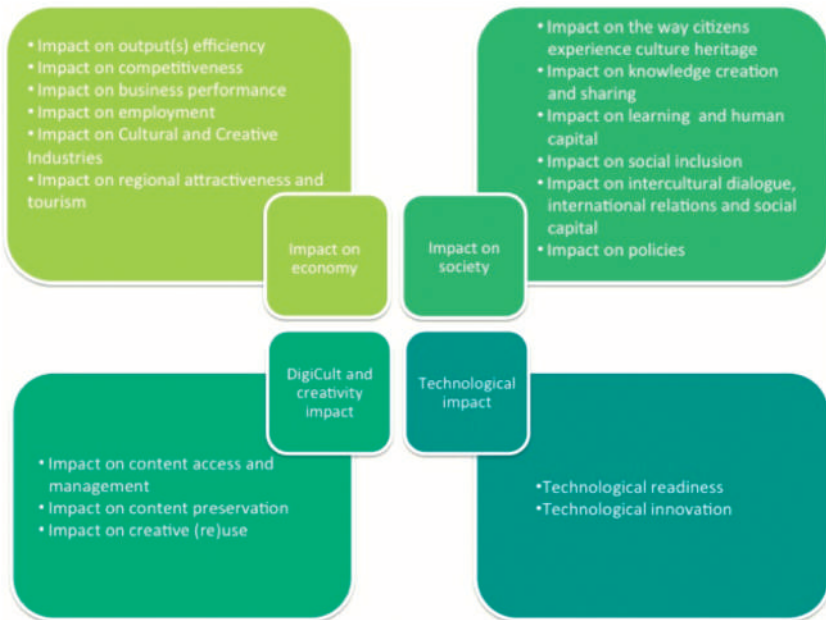


Figure 16 - Areas of impact and subcategories

²⁶ The complete list of variables and questions in Annex A

3.4.1 Economic impact

This area of impacts and the associated index considers all the relevant economic results that DigiCult projects develop along their lifetime. We provide an economic assessment of DigiCult projects focused on their microeconomic impacts. Indeed, our work is not aimed to explore the macroeconomic impacts (i.e. the effects produced on Gross Domestic Product (GDP) nor to discover the direct impacts at programme/policy level. On the other hand, DigiCult projects mainly develop micro and meso economic impacts, especially in terms of positive economic results for each partner of the Consortium, end-users and general stakeholders of the projects.

The analysis of DigiCult projects impact on economy are developed by considering the different phases of development of each project. Three phases will be considered:

- Research: this phase concerns all the activities that are strictly related to research.
- Prototype: this phase is aimed at developing one or more prototypes that will be further exploited in the next phase as a product.
- Product Development: in this phase the prototype is transformed in a real product to be commercialised in the market.

Variables have been developed in accordance with the need to describe projects that are in different phases of development. Therefore, different questions have been asked to projects, according to their current stage of development; it can, of course, change over time on the basis of project progression from one phase to another.

Economic impact has been articulated in 6 subcategories. Each subcategory is defined here below:

- 1 Impact on output(s) efficiency: this subcategory and its indicators are aimed to measure the level of efficiency enabled by the project products/services. The benefits are measured in terms of cost savings, time savings or willingness to pay (WTP) for the specific product/service and compared with the imple-

mentation and maintenance cost taking also into account the number of end users and the possible integration along value chains.

- 2 Impact on competitiveness: this subcategory and its indicators are aimed at analysing the increase of market opportunities enabled by each project in particular for the benefit of business partners. This subcategory includes the analysis of the business model and business plan of each project, and of each commercial partner in the consortia. Through this approach, we aim at analysing not only the contribute of each project to the competitiveness of the domain, but also to the creation of new business and market opportunities for the companies involved in the DigiCult projects. In fact, the advent of digital technologies has increased the typologies of cultural services and products, by also improving the competitiveness of companies in the Cultural Heritage domain. According to the KEA study (2006), the expansion of broadband networks and the digitisation of production processes requires significant investments for the creative and cultural industries to adapt services and products to the opportunities offered by the new ICT technologies. The main challenge is to identify new ways to increase the profitability of the projects by adopting new business models, which affect the traditional way of doing business. Within this framework, DigiCult projects using new technologies for improving the available Cultural Heritage, should also contribute to increase the competitiveness of the sector.
- 3 Impact on business performance: this subcategory and indicators are aimed at evaluating the economic results achieved by DigiCult projects. At general level, the area is aimed at analysing the contribute of DigiCult projects to the improvement of the service/system quality, reduction of the time needed to deliver a service, the ability to keeping pace with research competitors, to better target stakeholders needs and to stimulate projects users to create new products or services. This area of impact takes into account also the impact of projects results

on the cultural resource demand and the ability of each project to transfer its outputs, as this process affect also the impact of DigiCult projects on the competitiveness.

- 4 Impact on regional attractiveness and tourism: this subcategory and indicators are aimed at evaluating the impact of DigiCult projects in terms of improving the attractiveness of regions, citizens and visitors' satisfaction and increasing the number of visitors in a specific city or region. According to the "Study on the Competitiveness of the EU tourism industry" [ECORYS 2009], the big challenges for the future are: to strengthen the European tourism industry and increase the quality of tourism services, to better position the European Union as the n.1 for tourist destination in the world, to make the tourism industry part of the knowledge economy, to develop the European tourism in a sustainable way, to increase the value created by the resources available and to provide financial resources to the tourism industry. Within this context, we analyse the contribution at domain level and at micro-level for each project, in order to contribute to strengthen the European Cultural Heritage Domain and tourism economy, by considering all the previous challenges.
- 5 Impact on employment. Through this subcategory/indicator the methodology analyses two related impacts: on one hand it investigates if and to what extent projects contribute to the creation of new job places and, on the other hand, it describes if and how their outputs change the working routines of their users and stakeholders. The EU 2020 Agenda, as the previous Lisbon agenda, expects the investment in research and innovation to have a positive impact on European employment in terms of more and better jobs. Therefore, we consider this subcategory as relevant even if we are aware of the fact that these impacts occur, generally, after the end of EU projects, when and if the product is deployed on the market. In this sense, the creation of star-ups is already a good variable of a possible positive impact on employment. This subcategory also identifies the

contribution of the project to improve the working practices of cultural domain institutions and the reciprocal understanding between ICT experts and cultural heritage experts.

- 6 Impact on Cultural and Creative Industries. This subcategory/indicator is aimed at identifying the impact of the DigiCult projects on the CCIs in terms of producing more innovative digital tools/platforms, actively involving creative industry professionals in the development of these tools/platforms. Through this subcategory/indicator we also assess the impact of the DigiCult projects on supporting CCIs to access finance, the market and developing collaborative business environments.

3.4.2 Impact on society

This area of impact (and related index) considers all the changes produced by the projects to a specific aspect of social interaction or social interest at micro, meso and macro level. At micro level we are interested in understanding the changes occurred at individual level on project single participants, on users and on other stakeholders as individuals. At meso level we investigate the social relations at group and organisational level; so here we can see the consequences of the project on project partners as companies, research centres, cultural institution, etc. and on social groups (like the ones at risk of social exclusion) and on organisations that can be users of project outputs or stakeholders. At macro level we intend to describe the impacts on society as a whole, such as impact on policies.

This area is articulated in six subcategories that can be defined as follows:

- 1 Impact on the way citizens experience culture. This subcategory/indicator investigates if and to what extent projects are able to increase the number of persons accessing cultural resources, both physically and virtually. Attention is also dedicated the capability of the project in engaging specific target such as children, young people, categories at risk of social ex-

clusion. Moreover, we consider the capability of projects in engaging citizens in development and testing activities as this can be considered an interesting proxy of the attention paid by projects in developing solution that fits citizens needs and expectations, which can have a positive impact in term of facilitating citizens' engagement with culture [Nielsen, 1994].

- 2 Impact on knowledge creation and sharing. Under this subcategory/indicator we gather information about the projects outputs in terms of knowledge creation and about the channel they used for transferring such knowledge also outside the DigiCult domain. It is also investigated the scientific impact of projects and their capability to make their research results available to a wide audience. This is in fact the condition sine qua non for reaching an impact in the scientific domain and beyond. Through this subcategory it is possible to see if the projects are also able to support new research or positively influence the research-related working routines [Passani et al, 2014). Attention is dedicated to the interdisciplinary dimension of the DigiCult projects.
- 3 Impact on learning and Human Capital. This subcategory/indicator allows to understand if and to what extent, projects are working for transferring their research results and, more generally, the knowledge produced by the projects to the training system (the school system and the universities) and to workers. Impact on education was also foreseen by the ICT work programme 2011-2012, that as examples of possible impact mentioned the reduction of drop-out rates and the improvement of students' performances. With reference to Human Capital, we use these terms referring to the competencies, skills and abilities that workers have or acquire and that constitute one important productive factor of any economic organisation. We are, therefore, interested in knowing if DigiCult projects improve the human capital of their users and/or of the professionals working in the cultural heritage and creative sectors. References to human capital improvement were also present in

the ICT work programme 2007²⁷. Beside this, as suggested by the RAND study (2004), the methodology investigates also the capability of projects in having an impact on Personal Development, i.e. character development, critical thinking and creative problem-solving, as this is one expected impact of the investment in cultural heritage that can be amplified by the use of ICT.

- 4 Impact on social inclusion. Different operational definitions can be elaborated to cover such a wide concept. In our context we are interested in understanding if and to what extent projects work toward the inclusion of categories at risk in the local community. Under the label “categories at risk of social exclusion” we recognise the discrimination categories listed by the EU (Art.13 of the Treaty establishing the European Community): sex, age, gender, racial or ethnic origin, religion or belief, sexual orientation and disabilities. Low-income individuals and families should also be considered. Impact on social inclusion will be probably seen by DigiCult projects as an in-direct impact and not directly linked to their activities. However, social inclusion should be one of the expected impacts of any public funded initiative as it is a priority in the European 2020 Agenda. Moreover, the KEA study (2012a) indicate the relevance of the cultural sector in fostering social inclusion so that DigiCult project, innovating the cultural heritage sector should also be interested in supporting the sector stakeholders in working towards social inclusion and accessibility.
- 5 Impact on intercultural dialogue, international relations and social capital. Culture is an important element in creating and reinforcing identities, being at local, national, European or global level. Moreover, the Agenda for Culture 2007 recognises the value of the cultural heritage sector in improving and facilitating international relations and intercultural dialogue. In this context, the methodology allows the analysis of DigiCult projects in terms of their ability to achieve of these important im-

²⁷ “Faster and more effective acquisition of knowledge, competence and skills, increased knowledge worker productivity and more efficient organizational learning processes (ICT Workprogramme 2007)”, available at ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/ict-wp-2007-08_en.pdf

pacts. This impact area includes also the support that projects can provide in developing and reinforcing the social capital of their participants, partners, users and other stakeholders. We define “social capital” as a capital a person or an organisation own thanks to its participation to social relationships [Portes, 1998].

- 6 Impact on policies. Finally, it is worth to investigate if and to what extent projects have an impact on the policy level, considering their potential influence on cultural heritage and creativity policies at European and national level. We also considered if the projects can influence the public investments in cultural heritage.

3.4.3 DigiCult and Creativity impact

DigiCult and Creativity represents a domain of European funded projects exploring the potential of information and communication technologies for expanding the availability of Europe’s rich cultural and scientific resources, enhancing user experiences with these resources and keeping them usable at long-term (digital preservation), investigating how digital content created today will survive as the cultural and scientific knowledge of the future, and enhancing creative processes, in particular in the creative industries²⁸.

The analysis of the main scientific and technological areas²⁹ showed that the DigiCult domain is essentially an application area for a variety of technologies. Technologies have been put together to serve specific digital cultural heritage purposes for e.g. making resources available in a more personalised and adaptive way, enabling access to digital heritage resources, or preserving them in the most intelligent way.

By analysing and clustering the related expected impacts that the work programme states for the DigiCult target objectives, we identified the following main sub-categories of impact:

- 1 Impact on content access and management: This sub-category

²⁸ Definition adapted from http://cordis.europa.eu/fp7/ict/creativity/creativity_en.html and http://cordis.europa.eu/fp7/ict/telearn-digicult/digicult_en.html

²⁹ Also in MAXICULTURE D.2.5 (2013)

refers to the capability of projects to provide sustainable access to content in a meaningful and usable manner, to improve access to high volumes of digital content, to allow and support content lifecycle management, improve collection, sharing and distribution as well personalised presentation and consumption of digital content.

- 2 Impact on content preservation: This subcategory deals with the capability of projects to reduce information loss through better recovery techniques, to support a more efficient and effective selection of resources to be preserved to improve digital preservation processes and workflows and to ensure authenticity and long-term usability of digital resources.
- 3 Impact on Creative (re)use: This sub-category of impact measures the capability of projects to support different forms of use and re-use of cultural resources, to improve content sharing/remixing by non-expert users, to design more participative and communicative forms of content for providing adaptive, collaborative, interactive and creative experiences offering guidance and interpretation in multilingual and multidisciplinary contexts.

3.4.4 Technological impact

The Technological impact area is related to the impact the project outputs have on improving the existing state of the art, products and services, outside of the DigiCult and creativity domain. We analyse product, service and organisational innovation due to the technological outputs of the projects.

- 1 Technological readiness: The technology readiness level (TRL) index describes how close to a potential exploitation a specific technology is. It has specific provisions and requirements to be fulfilled for each specific level, allowing DigiCult projects to accurately assess their current position. The level of technology readiness [US Department of Defense, 2011] ranges from 1 (Scientific research begins to be translated into applied research and development, for example the paper studies of a technology's basic properties) to 9 (Actual application of the technology in its final form and under market conditions, such

as those encountered in operational test and evaluation). Technology readiness level represents an important parameter in Horizon 2020 for determining the access to the different schemes of funding. The TRLs are described below unless otherwise specified (domain specific):

- TRL 1 - basic principles observed
- TRL 2 - technology concept formulated
- TRL 3 - experimental proof of concept
- TRL 4 - technology validated in lab
- TRL 5 - technology validated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 6 - technology demonstrated in relevant environment (industrially relevant environment in the case of key enabling technologies)
- TRL 7 - system prototype demonstration in operational environment
- TRL 8 - system complete and qualified
- TRL 9 - actual system proven in operational environment (competitive manufacturing in the case of key enabling technologies; or in space)

2 Technological innovation of project outputs [OECD, 2005]:

- Impact on product innovation - describes the degree to which project outputs contribute to the development of new products, reduce time to market are associated to patents and other IPR.
- Impact on process innovation - illustrates improvements of processes, management strategies and business practices for capturing and using new ideas for new or improved service offerings.
- Impact on organisational innovation - analyses improvement of delivery or logistics systems for generating outputs, improvement of management systems, of methods for organising work responsibilities or decision making, and of engaging and interacting with end-users.

3.4.5 Variables associated to impact areas/vertical indices

This paragraph describes the relationship between vertical indices (impact areas), associated indicators (impact area subcategories) and variables.

The reader will find in the following tables all the indicators and variables, apart from the ones aiming at describing the projects (project title, date of start, date of end and description of the main problems it will contribute to solve). In the Annex A, the reader will find the questions associated to each variable as they appear in the Self-Assessment Toolkit.

Subcategories	Indicators	Variable
Impact on outputs efficiency	ENPV; BCR; DPP; BCR*; ENPV*, DPP*	Output cost of development
		Output cost for updating/maintaining after the end of the project
		Output end/users
		Type and value of the benefit
		Timing of the benefit
		Project start/end date
		Total budget
		Value chains
	Equipment needed for using the output	Equipment needed for using the output
Impact on competitiveness	Expected Business Models	Expected Business Models
	Project Business Plan	Project Business Plan
	Partner Business Plan	Partner Business Plan
	New market opportunities for partners	New market opportunities for partners
	Number of business collaborations, type of collaboration and description	Number of collaborations
		Type of collaboration
		Description of the collaboration
	Estimation of the increase of turnover that can be enabled by the project results	Estimation of the increase of turnover that can be enabled by the project results
Number of New Businesses created thanks to the project	Number of New Businesses created thanks to the project	
Country Represented in New Business created thanks to the project	Country Represented in New Business created thanks to the project	

Subcategories	Indicators	Variable
Impact on business Performance	Project self-evaluation of its capability to improve its product/service/system quality	Project self-evaluation of its capability to improve its product/service/system quality
	Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service
	Project self-evaluation of its impact on the capability of keeping pace with research competitors	Project self-evaluation of its impact on the capability of keeping pace with research competitors
	Project self-evaluation of its capability to support a better targeting of stakeholders' needs	Project self-evaluation of its capability to support a better targeting of stakeholders' needs
	Project self-evaluation of its capability to stimulate the creation of new services	Project self-evaluation of its capability to stimulate the creation of new services
	Number of persons able to be dedicated to exploitation and innovation transfer	Number of persons able to be dedicated to exploitation and innovation transfer
	Number of activities for the transfer of project outputs	Number of activities for the transfer of project outputs
Impact on employment	Project self-evaluation of its impact on employment	Project self-evaluation of its impact on employment
	Project self-evaluation of its capability to have an influence on the percentage of people employed in the cultural and creative sector	Project self-evaluation of its capability to have an influence on the percentage of people employed in the cultural and creative sector
	Number of researchers working in the project	Number of researchers working in the project
	Number of young researchers working in the project	Number of young researchers working in the project
	Number of persons recruited specifically for the project under assessment	Number of persons recruited specifically for the project under assessment
	Number of new job places generated by the project outputs	Number of new job places generated by the project outputs
	Project self-evaluation of its capability to contribute to improving the working practices of cultural domain institutions	Project self-evaluation of its capability to contribute to improving the working practices of cultural domain institutions

Subcategories	Indicators	Variable
	Project self-evaluation of its capability to contribute to improving the working practices of other organisations	Project self-evaluation of its capability to contribute to improving the working practices of other organisations
	Project self-evaluation of its capability to improve reciprocal understanding between ICT experts and cultural heritage experts	Project self-evaluation of its capability to improve reciprocal understanding between ICT experts and cultural heritage experts
Impact on Cultural and Creative Industries	Project engagement with Cultural and creative industries and/or with Cultural-based tourism	Project engagement with Cultural and creative industries and/or with Cultural-based tourism
	Project self-evaluation of developing more innovative tools for CCIs	Project self-evaluation of developing more innovative tools for CCIs
		Description of sectors of cultural and creative industries effected by the project
	Project self-evaluation of project capability of having an impact on the different segments of the CCIs	Project self-evaluation of project capability of having an impact on the different segments of the CCIs
	Project self-evaluation of actively involving creative industry professionals in the development of digital tools/platforms	Project self-evaluation of actively involving creative industry professionals in the development of digital tools/platforms
		Description of active involvement of creative industry professionals in the development of digital tools/platforms
	Project self-evaluation of project impact on access to finance for CCIs	Project self-evaluation of project impact on access to finance for CCIs
		Typologies of financial support increased by the project for CCIs
		Description of processes leading to the provision of financial support for CCIs
	Impact on access to market for CCIs	Impact on access to market for CCIs
	Typology of increase of impact on access to market for CCIs	

Subcategories	Indicators	Variable
	Number of collaborative business environments (cluster or incubator) developed for CCIs	Number of collaborative business environments (cluster or incubator) developed for CCIs
Impact on regional attractiveness and tourism	Project self-evaluation of its impact on region attractiveness	Project self-evaluation of its impact on region attractiveness
		Region of impact and increment in overnight stays foreseen
	Percentage of budget for improving region attractiveness	Percentage of budget for improving region attractiveness
	Increase of number of visitors in a region	Increase of number of visitors in a region

Table 5 - List of variables associated to the Economic impact Index

Subcategories	Indicators	Variable
Impact on the way citizens experience culture heritage	Percentage of project budget dedicated to citizens engagement and to dissemination activities addressing this specific target	Percentage of project budget dedicated to citizens engagement and to dissemination activities addressing this specific target
	Project self-evaluation to its capability to change the way citizens experience culture heritage	Project self-evaluation to its capability to change the way citizens experience culture heritage
		Description of the processes leading to change the way citizens experience cultural heritage
	Percentage of the project's budget dedicated to make resources available in a more personalised/adaptive way	Percentage of the project's budget dedicated to make resources available in a more personalised/adaptive way
	Expected or measured increment in the number of persons accessing the cultural resources addressed by the project	Expected or measured increment in the number of persons accessing the cultural resources addressed by the project
	Increment of the time spent by the final user in consuming cultural resources virtually and physically	Increment of the time spent by the final user in consuming cultural resources virtually and physically
	Project self-evaluation on its capability to increase the presence of persons belonging to categories at risk of social exclusion in exhibitions and their access/consumption of cultural heritage	Project self-evaluation on its capability to increase the presence of persons belonging to categories at risk of social exclusion in exhibitions and their access/consumption of cultural heritage

Subcategories	Indicators	Variable
	Project self-evaluation of its capability to increase the presence of children and young people in exhibitions and their access/consumption of cultural heritage	Project self-evaluation of its capability to increase the presence of children and young people in exhibitions and their access/consumption of cultural heritage
	Project self-evaluation of its capability of supporting citizens an communities/organisations in the interpretation of cultural and scientific content	Project self-evaluation of its capability of supporting citizens an communities/organisations in the interpretation of cultural and scientific content
		Description of the processes supporting citizens an communities/organisations in the interpretation of cultural and scientific content
	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content
		Description of the processes supporting citizens and/or communities/organisations in producing cultural and scientific content
	Project self-evaluation to its capability of improving collaborative creation of cultural experience at community level	Project self-evaluation to its capability of improving collaborative creation of cultural experience at community level
		Description of the processes improving collaborative creation of cultural experience at community level
Impact on knowledge creation and sharing	Average impact factor of project publications per researcher	Indicate the number of papers with impact factor published at project level
		Indicate the number of researchers in the project
	Number of peer reviewed articles	Indicate the number of peer reviewed articles your project has produced
	Number of non self-citation of the works published	Indicate the number of non self-citation of the works published
	Number of non-peer review articles, books, book's chapters, conference proceedings and other electronically published of printed scientific outputs (excluding deliverables)	Indicate the number of non-peer review articles, books, book's chapters, conference proceedings and other electronically published of printed scientific outputs (excluding deliverables)

Subcategories	Indicators	Variable
	Topics covered by the publications	Topics covered by the publications
	Project self-evaluation on its capability to improve research processes	Project self-evaluation on its capability to improve research processes
		Description of the processes improving research
	Project self-evaluation on if and how it allows its partners to perform research activities that would otherwise have been impossible	Project self-evaluation on if and how it allows its partners to perform research activities that would otherwise have been impossible
		Description of the processes enabling partners to perform research activities that would otherwise have been impossible
	Project level of interdisciplinarity	N. of disciplines represented
		Project self-evaluation of the relevance of interdisciplinary activities
		Description of interdisciplinary work
	Project self-evaluation of its capability of increase knowledge about creativity and creative processes	Project self-evaluation of its capability of increase knowledge about creativity and creative processes
		Description of processes leading to increased knowledge about creativity and creative process
	Project self-evaluation of its capability to carry on and/or stimulate an interdisciplinary use of cultural contents and resources	Project self-evaluation of its capability to carry on and/or stimulate an interdisciplinary use of cultural contents and resources
	Use of social networks for sharing its research outputs	Use of social networks for sharing its research outputs
	Engagement with dissemination, communication and branding professionals	Engagement with dissemination, communication and branding professionals
	Project self-evaluation of its capability to support knowledge transfer between universities/research centres and cultural institutions	Project self-evaluation of its capability to support knowledge transfer between universities/research centres and cultural institutions

Subcategories	Indicators	Variable
	Number of non-scientific dissemination outputs	Number of articles published on non-specialised magazines and newspapers Number of TV appearances
	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content
		Description of processes supporting the creation of cultural and scientific content by citizens and/or communities/organisations
Impact on learning and human capital	Training provided by the project	Number of hours of training provided by the project*
		Number of people trained
		Topic covered by the training
	Project self-evaluation of its capability to support the acquisition of specific skills in the area of creative professions	Project self-evaluation of its capability to support the acquisition of specific skills in the area of creative professions
	Project self-evaluation of its impact on students' performance	Project self-evaluation of its impact on students' performance
	Project self-evaluation of its capability to support the personal development of its users	Project self-evaluation of its capability to support the personal development of its users
	Project self-evaluation of its capability to improve personal and organisational creativity	Project self-evaluation of its capability to improve personal and organisational creativity
		Description of processes supporting personal and organisational creativity
	Project self-evaluation of its capability to improve the skills of people already employed within or outside the consortium	Project self-evaluation of its capability to improve the skills of people already employed within or outside the consortium
Project self-evaluation of its capability to support faster and more effective acquisition of competences?	Project self-evaluation of its capability to support faster and more effective acquisition of competences?	

Subcategories	Indicators	Variable
		Project self-evaluation of its capability to contribute to the reduction of digital divide and the promotion of digital competencies and eSkills
	Project capability to contribute to the reduction of digital divide and the promotion of digital competencies and eSkills	Number of activities supporting the acquisition of digital competences, digital literacies competences, eSkills and the reduction of digital divide
		Number of activities supporting the acquisition of digital competences, digital literacies competences, eSkills and the reduction of digital divide
	Project self-evaluation of its capability to promote changes in university/specialisation curricula	Project self-evaluation of its capability to promote changes in university/specialisation curricula
		Description of processes changing universities/specialisation curricula
Impact on social inclusion	Project self-evaluation of its capability to contribute to the social inclusion of categories at risk	Project self-evaluation of its capability to contribute to the social inclusion of categories at risk
	Number of outputs/activities developed by the project aiming at the inclusion of persons at risk of social exclusion	Number of outputs developed by the project aiming at the inclusion of persons at risk of social exclusion
	Project self-evaluation of its attention to gender equality issues	Project self-evaluation of its attention to gender equality issues
	Specific Gender Equality Actions carried out under the project	Presence of activities dedicated to Gender Equality
Impact on intercultural dialogue, international relations and social capital	Activities performed by the project aiming at adjusting/customizing its outputs to specific local needs	Activities performed by the project aiming at adjusting/customizing its outputs to specific local needs
	Project self-evaluation of its capability to contribute to the creation of a European culture and support the cultural integration of the various national identities	Project self-evaluation of its capability to contribute to the creation of a European culture and support the cultural integration of the various national identities
	Number of employees moving from one organisation to another for carrying on specific tasks	Number of employees moving from one organisation to another for carrying on specific tasks

Subcategories	Indicators	Variable
	Number and quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	<p>Number of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project</p> <p>Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project</p>
	Number and quality of new collaboration links established by project partners with research actors thanks to the participation in the project	<p>Number of new collaboration links established by project partners with research actors thanks to the participation in the project</p> <p>Project self-evaluation of the quality of new partnership established with research actors</p>
	Project self-evaluation of its capability to support network creation/ collaboration for its users	Project self-evaluation of its capability to support network creation/ collaboration for its users
	Project self-evaluation of its capability to support network creation/ collaboration among citizens	Project self-evaluation of its capability to support network creation/ collaboration among citizens
	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries
	Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?	Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?
	Project self-evaluation of its capability to increase trust among users	Project self-evaluation of its capability to increase trust among users

Subcategories	Indicators	Variable
Impact on Policies	Indicate the percentage of budget used for participatory activities, such as engaging citizens in policy definition or for using participatory design approaches for activities other than the technological development	Indicate the percentage of budget used for participatory activities, such as engaging citizens in policy definition or for using participatory design approaches for activities other than the technological development
	Project self-evaluation of its capability to have an influence on European policies in the area of DigiCult domain	Project self-evaluation of its capability to have an influence on European policies in the area of DigiCult domain
		Description of processes leading to influence European policies in the area of DigiCult domain
	Project self-evaluation of its capability to have an influence on European policies in the area of cultural heritage and creativity	Project self-evaluation of its capability to have an influence on European policies in the area of cultural heritage and creativity
		Description of processes leading to influence European policies in the area of cultural heritage and creativity
	Project self-evaluation of its capability to have an influence on national policies in the area of cultural heritage and creativity	Project self-evaluation of its capability to have an influence on national policies in the area of cultural heritage and creativity
		Description of processes leading to influence national policies in the area of cultural heritage and creativity
	Project self-evaluation of its capability to have an influence on the local/national expenditure on culture	Project self-evaluation of its capability to have an influence on the local/national expenditure on culture
	Description of processes leading to influence on local/national expenditure on culture	

Table 6 - List of variables associated to the Impact on Society Index

Subcategories	Indicators	Variable
Content access and management	Project self-evaluation of its capability to provide sustainable access to content in a meaningful and usable manner	Project self-evaluation of its capability to provide sustainable access to content in a meaningful and usable manner
		Description of process allowing more sustainable access to content in a meaningful and usable manner
	Project self-evaluation of its capability to improve access to high volumes of digital content	Project self-evaluation of its capability to improve access to high volumes of digital content
		Description of processes improving access to high volumes of digital content
	Number of resources made available by the project	Number of resources made available by the project
		Typology of resources made available
	Project self-evaluation of the project capability to allow life-cycle management	Project self-evaluation of the project capability to allow life-cycle management
		Description of processes allowing content lifecycle management
	Project self-evaluation of project capability of Improving the collection, sharing and distribution of digital content in collaborative environments	Project self-evaluation of project capability of Improving the collection, sharing and distribution of digital content in collaborative environments
	Project self-evaluation of its capability to improve personalised distribution, presentation and consumption of digital content	Project self-evaluation of its capability to improve personalised distribution, presentation and consumption of digital content
Content preservation	Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques
		Description of processes allowing reduction of information loss
	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used
	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes

Subcategories	Indicators	Variable
		Description of processes improving digital preservation processes
	Project self-evaluation of its capability to enhance workflows of digital preservation	Project self-evaluation of its capability to enhance workflows of digital preservation
		Description of processes enhancing digital preservation processes
	Project self-evaluation of its capability to ensure authenticity of digital contents	Project self-evaluation of its capability to ensure authenticity of digital contents
		Description of processes/instruments ensuring authenticity of digital contents
	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects
		Description of processes ensuring long-term usability of digital resources
Creative (re)use		Description of project application area
	Project self-evaluation of its capability to support users to re-use cultural and scientific content	Project self-evaluation of its capability to support users to re-use cultural and scientific content
		Description of processes supporting the re-use of cultural and scientific resources
	Project self-evaluation of its capability of enabling the design of more participative and communicative forms of content	Project self-evaluation of its capability of enabling the design of more participative and communicative forms of content
		Description of processes supporting the design of more participative and communicative forms of content
	Project self-evaluation of its capability of providing adaptive creative experiences offering guidance and interpretation	Project self-evaluation of its capability of providing adaptive creative experiences offering guidance and interpretation
		Description of processes and instruments providing adaptive creative experiences offering guidance and interpretation
	Project self-evaluation of outputs capability of provide more collaborative experience for users	Project self-evaluation of outputs capability of provide more collaborative experience for users

Subcategories	Indicators	Variable
		Description of processes and instruments providing more collaborative experience for users
	Project self-evaluation of outputs capability of providing more interactive experience for users	Project self-evaluation of outputs capability of providing more interactive experience for users
		Description of processes and instruments providing more interactive experience for users
	Project self-evaluation of outputs capability of improving the use of digital resources in multilingual and multidisciplinary contexts	Project self-evaluation of outputs capability of improving the use of digital resources in multilingual and multidisciplinary contexts
		Description of processes and instruments improving the use of digital resources in multilingual and multidisciplinary contexts
	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users
		Description of processes and instruments improving content sharing/remixing by non-expert users

Table 7 - List of variables associated to the Impact on the DigiCult domain

Subcategories	Indicators	Variable
Starting question (outside the vertical index)	Implementation of open standards	Implementation of open standards
		Description of open standards used
	Implementation of open source	Implementation of open source
	Number of core developers contributing to open source	Number of core developers contributing to open source
	Number of external developers contributing to open source	Number of external developers contributing to open source
	Number of downloads of project open source outputs	Number of downloads of project open source outputs
	Existence of API	Existence of API
	Access through API	Access through API

Subcategories	Indicators	Variable
Technological readiness	Project output tested in large scale test-beds	Project output tested in large scale test-beds
	Project self-evaluation of test beds to be applicable to the project outputs	Project output tests confirming the applicability of each output of the project
		Description of applicability of test-beds to the project output
	Project self-evaluation of improving the technological state of the art	Project self-evaluation of improving the technological state of the art
		Description of improvement of the technological state of the art developed through the output
		Description of technological readiness level of the outputs
Technological innovation		Description of the nature and type of innovation of each output
	Project self-evaluation of having an impact on product innovation	Project self-evaluation of having an impact on product innovation
		Description of typologies of product innovation
	Project self-evaluation of developing new product offerings	Project self-evaluation of developing new product offerings
	Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings
	Number of patents derived from the output	Number of patents derived from the output
	Number of IPRs derived from the output	Number of IPRs derived from the output
	Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation
		Description of typologies of process innovation
	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings

Subcategories	Indicators	Variable
	Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings
	Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings
	Description of product and process innovation having an impact on organisational innovation	Description of product and process innovation having an impact on organisational innovation
	Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs
	Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems
	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making
	Project self-evaluation of engaging users in the development of the output	Project self-evaluation of engaging users in the development of the output
	Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities
	Project self-evaluation of improving methods of interacting with project users	Project self-evaluation of improving methods of interacting with project users

Table 8 - List of variables associated to the Impact on the Technology Index

3.5 Transversal Indices: efficiency, effectiveness, sustainability and innovativeness

The indices used for analysing the transversal characteristics of projects and the DigiCult domain are the following:

- Efficiency
- Effectiveness
- Sustainability
- Innovativeness

Here below we define these indices and map the variables used in order to build them:

- **Efficiency:** describes the extent to which time or effort is well used for the intended task or purpose. It is often used with the specific goal of measuring the capability of a specific application of effort to produce a specific outcome effectively with a minimum amount of waste, expense or unnecessary effort. Efficiency has widely varying meanings in different disciplines. In general, efficiency is a measurable concept, quantitatively determined by the ratio between the output and its maximal possible value.
- **Effectiveness:** this term refers to the capability of producing an effect and is most frequently used in connection with the degree to which something is capable of producing a specific, desired effect. Effectiveness is, generally speaking, a non-quantitative concept, mainly concerned with achieving objectives. Therefore, it is normally used for evaluating the outputs of a project and to what extent the outputs produced are aligned with the planned outputs. However, we do not focus our attention on outputs that are already analysed by the EC, especially during the projects' reviews, but also at the end of each project. Therefore, under the index Effectiveness, we analyse the instruments that a project put in place for assuring the achievement of its goal such as monitoring system and similar.
- **Sustainability:** through this index we analyse if and to what ex-

tent we can expect project outputs to survive to the project end. We are interested in seeing if we can expect to see the benefit produced by project to continue after the funding period.

- **Innovativeness:** under this index we include product, process and organisational innovation related to the technological outputs of DigiCult projects and also related to non-technological outputs. The definition of product, process and organisational innovation is that of the OECD (2005) as described in chapter 1.

The tables that follow show how the variables are aggregated for building these indicators. Some variables are associated to more than an indicator as they contribute to more than an analysis.

EFFICIENCY INDEX	
Indicators	Variable
Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service
Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques
Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used
Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes
Project self-evaluation of its capability to enhance workflows of digital preservation	Project self-evaluation of its capability to enhance workflows of digital preservation
Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects
Project self-evaluation of its capability of recovering loss and repairing damaged digital resources	Project self-evaluation of its capability of recovering loss and repairing damaged digital resources
Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users
Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings
Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation

EFFICIENCY INDEX	
Indicators	Variable
Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings
Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings
Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs
Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems
Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making
Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities

Table 9 - Indicators and variables building the Efficiency Index

EFFECTIVENESS INDEX	
Indicators	Variable
Project output tested in large scale test-beds	Project output tested in large scale test-beds
Project self-evaluation of test beds to be applicable to the project outputs	Project self-evaluation of test beds to be applicable to the project outputs
Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used
Expected Business Models	Expected Business Models
Project Business Plan	Project Business Plan
Partner Business Plan	Partner Business Plan
Internal monitoring/evaluation system adoption	Internal monitoring/evaluation system adoption
Internal risk assessment system	Internal risk assessment system

Table 10 - Indicators and variables building the Effectiveness Index

SUSTAINABILITY INDEX	
Indicators	Variable
ENPV; BCR; DPP; BCR*; ENPV*, DPP*	Output cost of development
	Output cost for updating/maintaining after the end of the project
	Output end/users
	Type and value of the benefit
	Timing of the benefit
Equipment needed for using the output	Equipment needed for using the output
Expected Business Models	Expected Business Models
Project Business Plan	Project Business Plan
Partner Business Plan	Partner Business Plan
New market opportunities for partners	New market opportunities for partners
Number of business-related collaborations	Number of business-related collaborations
Estimation of the increase of turnover that can be enabled by the project results	Estimation of the increase of turnover that can be enabled by the project results
Number of New Businesses created thanks to the project	Number of New Businesses created thanks to the project
Project self-evaluation of its capability to improve its product/service/system quality	Project self-evaluation of its capability to improve its product/service/system quality
Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service
Project self-evaluation of its impact on the capability of keeping pace with research competitors	Project self-evaluation of its impact on the capability of keeping pace with research competitors
Project self-evaluation of its capability to support a better targeting of stakeholders' needs	Project self-evaluation of its capability to support a better targeting of stakeholders' needs
Project self-evaluation of its capability to stimulate the creation of new services	Project self-evaluation of its capability to stimulate the creation of new services
Number of persons able to be dedicated to exploitation and innovation transfer	Number of persons able to be dedicated to exploitation and innovation transfer
Number of activities for the transfer of project outputs	Number of activities for the transfer of project outputs
Training provided by the project	Number of hours of training provided by the project*Number of people trained
Number and quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Number of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project

SUSTAINABILITY INDEX	
Indicators	Variable
	Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the pro
Number and quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Number and quality of new collaboration links established by project partners with research actors thanks to the participation in the project
	Project self-evaluation of the quality of new collaboration links established by project partners with research actors thanks to the participation in the project
Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries
Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?	Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?
Number of core developers contributing to open source	Number of core developers contributing to open source
Number of external developers contributing to open source	Number of external developers contributing to open source
Number of downloads of project open source	Number of downloads of project open source
Existence of API	Existence of API
Access through API	Access through API
Number of patents derived from the output	Number of patents derived from the output
Number of IPRs derived from the output	Number of IPRs derived from the output
Project self-evaluation of engaging users in the development of the output	Project self-evaluation of engaging users in the development of the output
Project self-evaluation of improving methods of promoting the project	Project self-evaluation of improving methods of promoting the project
Project self-evaluation of improving methods of interacting with project users	Project self-evaluation of improving methods of interacting with project users
Increase of number of visitors in a region	Increase of number of visitors in a region

Table 11 - Indicators and variables building the Sustainability Index

INNOVATIVENESS INDEX	
Indicators	Variable
	Number of peer reviewed articles
Project self-evaluation of test beds to be applicable to the project outputs	Project self-evaluation of test beds to be applicable to the project outputs
Project self-evaluation output capability to improve existing the technological state of the art	Project self-evaluation output capability to improve existing the technological state of the art
Project self-evaluation of having an impact on product innovation	Project self-evaluation of having an impact on product innovation
Project self-evaluation of developing new product offerings	Project self-evaluation of developing new product offerings
Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings
Number of patents derived from the output	Number of patents derived from the output
Number of IPRs derived from the output	Number of IPRs derived from the output
Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation
Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings
Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings
Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings
Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs
Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems
Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making
Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities
Project self-evaluation of developing more innovative tools for CCLs	Project self-evaluation of developing more innovative tools for CCLs

Table 12 - Indicators and variables related to the Innovativeness Index

3.6 Variables and indicators according to an input-output-outcomes-impacts model

We mentioned in previous paragraphs that the methodology follows an input-output-outcomes-impact approach. Here below the reader will find the indicators and variables organised according to these categories.

INPUT INDICATORS AND VARIABLES	
Indicators	Variable
Problem solved by the project	Problem solved by the project
Instrument of funding	Instrument of funding
Cluster of projects	Cluster of projects
Total budget	Total budget
EU funding	EU funding
Budget percentage for Training	Budget percentage for Training
Budget percentage for Dissemination	Budget percentage for Dissemination
Budget percentage for Development	Budget percentage for Development
Budget percentage for Demonstration	Budget percentage for Demonstration
Indicate the percentage of budget used for participatory activities, such as engaging citizens in policy definition or for using participatory design approaches for activities other than the technological development	Indicate the percentage of budget used for participatory activities, such as engaging citizens in policy definition or for using participatory design approaches for activities other than the technological development
Percentage of budget for improving region attractiveness	Percentage of budget for improving region attractiveness
Percentage of project budget dedicated to citizens' engagement and to dissemination activities addressing this specific target	Percentage of project budget dedicated to citizens' engagement and to dissemination activities addressing this specific target
Percentage of the project's budget dedicated to make resources available in a more personalised/adaptive way	Percentage of the project's budget dedicated to make resources available in a more personalised/adaptive way
	Project start date
	Project end date
	Project phase
	Consortium
Project Relationships with other projects	Project Relationships with other projects
Partner connection with growth or innovation cluster	Partner connection with growth or innovation cluster
Quality of support received	Quality of support received
	Previous DigiCult engagement
	Previous intra-consortium engagement
	Stakeholders
Number of persons able to be dedicated to exploitation and innovation transfer	Number of persons able to be dedicated to exploitation and innovation transfer

INPUT INDICATORS AND VARIABLES	
Indicators	Variable
Number of activities for the transfer of project outputs	Number of activities for the transfer of project outputs
Number of researchers working in the project	Number of researchers working in the project
Project engagement with Cultural and creative industries and/or with Cultural-based tourism	Project engagement with Cultural and creative industries and/or with Cultural-based tourism
Number of researchers in the project	Number of researchers in the project
N. of disciplines represented	N. of disciplines represented
Engagement with dissemination, communication and branding professionals	Engagement with dissemination, communication and branding professionals

Table 13 - Input indicators and variables

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
	Output definition and description
Output cost of development	Output cost of development
Output cost for updating/maintaining after the end of the project	Output cost for updating/maintaining after the end of the project
Equipment needed for using the output	Equipment needed for using the output
Output end/users	Output end/users
Type and value of the benefit	Type and value of the benefit
Timing of the benefit	Timing of the benefit
	Categories of cost saving
Equipment needed for using the output	Equipment needed for using the output
Expected Business Models	Expected Business Models
Project Business Plan	Project Business Plan
Partner Business Plan	Partner Business Plan
Number of business collaborations, type of collaboration and description	Number of collaborations
	Type of collaboration
	Description of the collaboration
Project self-evaluation of its capability to improve product/service/system quality	Project self-evaluation of its capability to improve product/service/system quality
Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service
Project self-evaluation of its impact on the capability of keeping pace with research competitors	Project self-evaluation of its impact on the capability of keeping pace with research competitors
Project self-evaluation of its capability to support a better targeting of stakeholders' needs	Project self-evaluation of its capability to support a better targeting of stakeholders' needs
Project self-evaluation of its capability to stimulate the creation of new services	Project self-evaluation of its capability to stimulate the creation of new services
Number of young researchers working in the project	Number of young researchers working in the project

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
Number of persons recruited specifically for the project under assessment	Number of persons recruited specifically for the project under assessment
Project self-evaluation of developing more innovative tools for CCI	Project self-evaluation of developing more innovative tools for CCI
Project self-evaluation of actively involving creative industry professionals in the development of digital tools/platforms	Project self-evaluation of actively involving creative industry professionals in the development of digital tools/platforms
	Description of actively involvement of creative industry professionals in the development of digital tools/platforms
Number of collaborative business environments (cluster or incubator) developed for CCI	Number of collaborative business environments (cluster or incubator) developed for CCI
Expected or measured increment in the number of persons accessing the cultural resources addressed by the project	Expected or measured increment in the number of persons accessing the cultural resources addressed by the project
Increment of the time spent by the final user in consuming cultural resources virtually and physically	Increment of the time spent by the final user in consuming cultural resources virtually and physically
Project self-evaluation on its capability to increase the presence of persons belonging to categories at risk of social exclusion in exhibitions and their access/consumption of cultural heritage	Project self-evaluation on its capability to increase the presence of persons belonging to categories at risk of social exclusion in exhibitions and their access/consumption of cultural heritage
Project self-evaluation of its capability to increase the presence of children and young people in exhibitions and their access/consumption of cultural heritage	Project self-evaluation of its capability to increase the presence of children and young people in exhibitions and their access/consumption of cultural heritage
Project self-evaluation of its capability of supporting citizens and communities/organisations in the interpretation of cultural and scientific content	Project self-evaluation of its capability of supporting citizens and communities/organisations in the interpretation of cultural and scientific content
	Description of the processes supporting citizens and communities/organisations in the interpretation of cultural and scientific content
Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content
	Description of the processes supporting citizens and/or communities/organisations in producing cultural and scientific content
Number of non-peer review articles, books, book's chapters, conference proceedings and other electronically published or printed scientific outputs (excluding deliverables)	Number of non-peer review articles, books, book's chapters, conference proceedings and other electronically published or printed scientific outputs (excluding deliverables)
	Topics covered by the publications
Project self-evaluation on its capability to improve research processes	Project self-evaluation on its capability to improve research processes
	Description of the processes improving research

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
Project self-evaluation on if and how it allows its partners to perform research activities that would otherwise have been impossible	Project self-evaluation on if and how it allows its partners to perform research activities that would otherwise have been impossible
	Description of the processes enabling partners to perform research activities that would otherwise have been impossible
Project self-evaluation of the relevance of interdisciplinary activities	Project self-evaluation of the relevance of interdisciplinary activities
	Description of interdisciplinary work
Project self-evaluation of its capability of increase knowledge about creativity and creative processes	Project self-evaluation of its capability of increase knowledge about creativity and creative processes
	Description processes leading to increased knowledge about creativity and creative process
Project self-evaluation of its capability to carry on and/or stimulate an interdisciplinary use of cultural contents and resources	Project self-evaluation of its capability to carry on and/or stimulate an interdisciplinary use of cultural contents and resources
Use of social networks for sharing its research outputs	Use of social networks for sharing its research outputs
Project self-evaluation of its capability to support knowledge transfer between universities/research centres and cultural institutions	Project self-evaluation of its capability to support knowledge transfer between universities/research centres and cultural institutions
Number of non-scientific dissemination outputs	Number of articles published on non-specialised magazines and newspapers
	Number of TV appearances
Training provided by the project	Number of hours of training provided by the project*Number of people trained
	Number of people trained
	Topic covered by the training
Project self-evaluation of its capability to support the acquisition of specific skills in the area of creative professions	Project self-evaluation of its capability to support the acquisition of specific skills in the area of creative professions
Project self-evaluation of its capability to support faster and more effective acquisition of competences	Project self-evaluation of its capability to support faster and more effective acquisition of competences
	Description of processes supporting faster and more efficient acquisition of competences
Number of activities supporting the acquisition of digital competences, digital literacies competences, eSkills and the reduction of digital divide	Number of activities supporting the acquisition of digital competences, digital literacies competences, eSkills and the reduction of digital divide
Integration of the project with standards and guidelines for digital competences, digital literacies and eSkills	Integration of the project with standards and guidelines for digital competences, digital literacies and eSkills
Number of outputs/activities developed by the project aiming at the inclusion of persons at risk of social exclusion	Number of outputs developed by the project aiming at the inclusion of persons at risk of social exclusion
Project self-evaluation of its attention to gender equality issues	Project self-evaluation of its attention to gender equality issues

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
Specific Gender Equality Actions carried out under the project	Presence of activities dedicated to Gender Equality
Project self-assessment of the success of activities dedicated to Gender Equality	Project self-assessment of the success of activities dedicated to Gender Equality
Activities performed by the project aiming at adjusting/customizing its outputs to specific local needs	Activities performed by the project aiming at adjusting/customizing its outputs to specific local needs
Number of employees moving from one organisation to another for carrying on specific tasks	Number of employees moving from one organisation to another for carrying on specific tasks
Number and quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Number of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project
Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project
Number and quality of new collaboration links established by project partners with research actors thanks to the participation in the project	Number of new collaboration links established by project partners with research actors thanks to the participation in the project
Project self-evaluation of the quality of new partnership established with research actors	Project self-evaluation of the quality of new partnership established with research actors
Project self-evaluation of its capability to support network creation/ collaboration for its users	Project self-evaluation of its capability to support network creation/ collaboration for its users
Project self-evaluation of its capability to support network creation/ collaboration among citizens	Project self-evaluation of its capability to support network creation/ collaboration among citizens
Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries
Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?	Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?
Project self-evaluation of its capability to increase trust among users	Project self-evaluation of its capability to increase trust among users
Project self-evaluation of its capability to provide sustainable access to content in a meaningful and usable manner	Project self-evaluation of its capability to provide sustainable access to content in a meaningful and usable manner
	Description of process allowing more sustainable access to content in a meaningful and usable manner
Project self-evaluation of its capability to improve access to high volumes of digital content	Project self-evaluation of its capability to improve access to high volumes of digital content
	Description of processes improving access to high volumes of digital content

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
Number of resources made available by the project	Number of resources made available by the project
	Typology of resources made available
Project self-evaluation of the project capability to allow life-cycle management	Project self-evaluation of the project capability to allow life-cycle management
	Description of processes allowing content life-cycle management
Project self-evaluation of project capability of improving the collecting, sharing and distribution of digital content in collaborative environments	Project self-evaluation of project capability of improving the collecting, sharing and distribution of digital content in collaborative environments
Project self-evaluation of its capability to improve personalised distribution, presentation and consumption of digital content	Project self-evaluation of its capability to improve personalised distribution, presentation and consumption of digital content
Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques
	Description of processes allowing reduction of information loss
Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used
Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes
	Description of processes improving digital preservation processes
Project self-evaluation of its capability to enhance workflows of digital preservation	Project self-evaluation of its capability to enhance workflows of digital preservation
	Description of processes enhancing digital preservation processes
Project self-evaluation of its capability to ensure authenticity of digital contents	Project self-evaluation of its capability to ensure authenticity of digital contents
	Description of processes/instruments ensuring authenticity of digital contents
Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects
	Description of processes ensuring long-term usability of digital resources
Project self-evaluation of its capability to support users to re-use cultural and scientific content	Project self-evaluation of its capability to support users to re-use cultural and scientific content
	Description of processes supporting the re-use of cultural and scientific resources
Project self-evaluation of its capability of enabling the design of more participative and communicative forms of content	Project self-evaluation of its capability of enabling the design of more participative and communicative forms of content
	Description of processes supporting the design of more participative and communicative forms of content

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
Project self-evaluation of its capability of providing adaptive creative experiences offering guidance and interpretation	Project self-evaluation of its capability of providing adaptive creative experiences offering guidance and interpretation
	Description of processes and instruments providing adaptive creative experiences offering guidance and interpretation
Project self-evaluation of outputs capability of provide more collaborative experience for users	Project self-evaluation of outputs capability of provide more collaborative experience for users
	Description of processes and instruments providing more collaborative experience for users
Project self-evaluation of outputs capability of providing more interactive experience for users	Project self-evaluation of outputs capability of providing more interactive experience for users
	Description of processes and instruments providing more interactive experience for users
Project self-evaluation of outputs capability of improving the use of digital resources in multilingual and multidisciplinary contexts	Project self-evaluation of outputs capability of improving the use of digital resources in multilingual and multidisciplinary contexts
	Description of processes and instruments improving the use of digital resources in multilingual and multidisciplinary contexts
Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users
	Description of processes and instruments improving content sharing/remixing by non-expert users
	Description of project application area
Implementation of open standards	Implementation of open standards
	Description of open standards used
Implementation of open source	Implementation of open source
Project self-evaluation of the project outputs made available as open source	Project self-evaluation of the project outputs made available as open source
Number of core developers contributing to open source	Number of core developers contributing to open source
Number of external developers contributing to open source	Number of external developers contributing to open source
Number of downloads of project open source outputs	Number of downloads of project open source outputs
Existence of API	Existence of API
Access through API	Access through API
Project output tested in large scale test-beds	Project output tested in large scale test-beds
Project self-evaluation of test beds to be applicable to the project outputs	Project self-evaluation of test beds to be applicable to the project outputs
	Description of applicability of test-beds to the project output
	Description of technological readiness level of the outputs
Project self-evaluation on the maturity of the outputs	Project self-evaluation on the maturity of the outputs

OUTPUT INDICATORS AND VARIABLES	
Indicators	Variable
	Description of the nature of innovation of the output
	Typology of innovation for each output
Project self-evaluation of developing new product offerings	Project self-evaluation of developing new product offerings
Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings
Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings
Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings
Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings
Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs
Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems
Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making
Project self-evaluation of engaging users in the development of the output	Project self-evaluation of engaging users in the development of the output
Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities
Project self-evaluation of improving methods of promoting the project	Project self-evaluation of improving methods of promoting the project
Project self-evaluation of improving methods of interacting with project users	Project self-evaluation of improving methods of interacting with project users

Table 14 - Output indicators and variables

OUTCOMES/IMPACTS INDICATORS AND VARIABLES	
Indicators	Variable
Value chains	Value chains
New market opportunities for partners	New market opportunities for partners
	Type of collaboration
	Description of the collaboration
Estimation of the increase of turnover that can be enabled by the project results	Estimation of the increase of turnover that can be enabled by the project results
Number of New Businesses created thanks to the project	Number of New Businesses created thanks to the project
	Country Represented in New Business created thanks to the project
Project self-evaluation of its impact on employment	Project self-evaluation of its impact on employment
Number of new job places generated by the project outputs	Number of new job places generated by the project outputs
Project self-evaluation of its capability to have an influence on the percentage of people employed in the cultural and creative sector	Project self-evaluation of its capability to have an influence on the percentage of people employed in the cultural and creative sector
Project self-evaluation of its capability to contribute to improving the working practices of cultural domain institutions	Project self-evaluation of its capability to contribute to improving the working practices of cultural domain institutions
Project self-evaluation of its capability to contribute to improving the working practices of other organisations	Project self-evaluation of its capability to contribute to improving the working practices of other organisations
Project self-evaluation of project capability of having an impact on the different segments of the CCLs	Project self-evaluation of project capability of having an impact on the different segments of the CCLs
	Description of sectors of cultural and creative industries effected by the project
Project self-evaluation of its capability to improve reciprocal understanding between ICT experts and cultural heritage experts	Project self-evaluation of its capability to improve reciprocal understanding between ICT experts and cultural heritage experts
Project self-evaluation of project impact on access to finance for CCLs	Project self-evaluation of project impact on access to finance for CCLs
	Typologies of financial support increased by the project for CCLs
	Description of processes leading to the provision of financial support for CCLs
Impact on access to market for CCLs	Impact on access to market for CCLs
	Typology of increase of impact on access to market for CCLs
Project self-evaluation of its impact on region attractiveness	Project self-evaluation of its impact on region attractiveness
	Region of impact and increment in overnight stays foreseen
Project self-evaluation to its capability to change the way citizens experience culture heritage	Project self-evaluation to its capability to change the way citizens experience culture heritage
	Description of the processes leading to change the way citizens experience cultural heritage

OUTCOMES/IMPACTS INDICATORS AND VARIABLES	
Indicators	Variable
Project self-evaluation to its capability of improving collaborative creation of cultural experience at community level	Project self-evaluation to its capability of improving collaborative creation of cultural experience at community level
	Description of the processes improving collaborative creation of cultural experience at community level
Average impact factor of project publications per researcher	Number of papers with impact factor published at project level
	Number of researches in the project
Number of peer reviewed articles	Number of peer reviewed articles
Number of non-self citation of the works published	Number of non-self citation of the works published
Number of patents derived from the output	Number of patents derived from the output
Number of IPRs derived from the output	Number of IPRs derived from the output
Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content
	Description of processes supporting the creation of cultural and scientific content by citizens and/or communities/organisations
Project self-evaluation of its impact on students' performance	Project self-evaluation of its impact on students' performance
Project self-evaluation of its capability to support the personal development of its users	Project self-evaluation of its capability to support the personal development of its users
Project self-evaluation of its capability to improve personal and organisational creativity	Project self-evaluation of its capability to improve personal and organisational creativity
	Description of processes supporting personal and organisational creativity
Project self-evaluation of its capability to improve the skills of people already employed within or outside the consortium	Project self-evaluation of its capability to improve the skills of people already employed within or outside the consortium
Project capability to contribute to the reduction of digital divide and the promotion of digital competencies and eSkills	Project self-evaluation of its capability to contribute to the reduction of digital divide and the promotion of digital competencies and eSkills
Project self-evaluation of its capability to promote changes in university/specialisation curricula	Project self-evaluation of its capability to promote changes in university/specialisation curricula
	Description of processes changing universities/specialisation curricula
Project self-evaluation of its capability to contribute to the social inclusion of categories at risk	Project self-evaluation of its capability to contribute to the social inclusion of categories at risk
Project self-evaluation of its capability to contribute to the creation of a European culture and support the cultural integration of the various national identities	Project self-evaluation of its capability to contribute to the creation of a European culture and support the cultural integration of the various national identities
Project self-evaluation of its capability to have an influence on European policies in the area of DigiCult domain	Project self-evaluation of its capability to have an influence on European policies in the area of DigiCult domain

OUTCOMES/IMPACTS INDICATORS AND VARIABLES	
Indicators	Variable
	Description of processes leading to influence European policies in the area of DigiCult domain
Project self-evaluation of its capability to have an influence on European policies in the area of cultural heritage and creativity	Project self-evaluation of its capability to have an influence on European policies in the area of cultural heritage and creativity
	Description of processes leading to influence European policies in the area of cultural heritage and creativity
Project self-evaluation of its capability to have an influence on national policies in the area of cultural heritage and creativity	Project self-evaluation of its capability to have an influence on national policies in the area of cultural heritage and creativity
	Description of processes leading to influence national policies in the area of cultural heritage and creativity
Project self-evaluation of its capability to have an influence on the local/national expenditure on culture	Project self-evaluation of its capability to have an influence on the local/national expenditure on culture
	Description of processes leading to influence on local/national expenditure on culture
Project self-evaluation of the project output to improve existing the technological state of the art	Project self-evaluation of the project output to improve existing the technological state of the art
	Description of improvement of the technological state of the art
Project self-evaluation of having an impact on product innovation	Project self-evaluation of having an impact on product innovation
	Description of typologies of product innovation
	Project self-evaluation of having an impact on process innovation
	Description of typologies of process innovation
	Description of product and process innovation having an impact on organisational innovation
Additional impact	Additional impact
Unexpected impact	Unexpected impact

Table 15 - Outcome/impact indicators and variables

3.7 From variables to indicators and indices

The variables listed in the previous paragraphs represent the information that is collected with the highest level of granularity also gathering some descriptive information that do not concur to the assessment calculation but that are useful for the qualitative analysis of the projects. In other terms, the qualitative information, such as the description of the activities performed and the tool developed are used for commenting the quantitative data and the result at the index level. So, no information is missed or non-used, but only numerical data can concur to the indexes that are automatically produced by the SAT and shown to the projects. The information contained into each variable may flow:

- directly into an indicator that we call “simple indicator” (i.e. number of project publications) or,
- indirectly into “complex indicator” since it needs to be associated to the information provided by other variables (i.e. ENPV, publications weighted according to journals impact factors).

The indicators considered have different measurement units such as monetary value, years, yes/no, relative values, 1 to 6 points Likert scale. As regards the Likert scale, existing literature [Colman A. et al., 1997; Dawes J., 2008; Jamieson S., 2004] tested the usage of 5 to 7 points Likert scales showing that these scales are almost indifferent in terms of statistical meaning even wider scales are slightly preferable because the data can have a higher variability. Within this assessment model we decided to use a 6+1 Likert scale approach because with the 6 points scale we want to avoid the case where the respondent uses the choice in the middle (3 in a 5 points scale) when she/he is undecided on the right value.

The additional option “Not Applicable” is used (also for non Likert indicators) in order to allow projects to decide whether or not the question is applicable to its specific case; if not the variable/indicator does not concur to the assessment calculation. Indeed, even the tool questionnaire is tailored on projects specificities (action type, stage of development etc.) questions (i.e. variable) not ap-

plicable may still be present and it is worthwhile that the project may exclude them from the assessment.

The indicators for each subcategory of vertical impacts contributes to build an index (per subcategory) that itself contribute to build the category index. In the same way the indicators selected for building the transversal impacts produce the related aggregated indices.

As mentioned, as indicators come with different measurement units they need to be treated before their aggregation into indices. Indeed, the final goal of the assessment methodology is to synthesize the vertical (per category or subcategory) or transversal impacts in indices expressed in a 0-1000 scale in order to make projects easily comparable.

Therefore, in order to pass from variables to indices we need to implement the following actions [Nardo M. et al., 2008]:

- 1 selection of variables as described in the previous paragraphs;
- 2 selection and construction of indicators;
- 3 normalisation of indicators;
- 4 aggregation of indicators into indices and weighting.

3.7.1 Selection and construction of indicators

Open text and service variables are used only for the qualitative aspects of the aggregated analysis while, as described in previous paragraphs, most of the variables collected through the SAT flow directly into the assessment model providing simple indicators ³⁰.

On the other hand, some variables are aggregated in formulas in order to build complex indicators also through the use of external proxy values such as the ones derived from official database and statistics (i.e. hourly cost of labour, average expenditure per night for tourist, journal impact factors etc.). Once the proxy value of each impact has been identified, it is possible to calculate the related socio-economic benefit by multiplying the quantity of the indicator by its value. In this way, we obtain the quantification of efficiency with reference to a unitary time frame.

The complex indicators calculated for the economic impact in the assessment are the following:

³⁰ This is also the case of the results of the Likert-scale kind of questions. The score attributed by the project to eachzz Likert-scale question is summed up in the indexes.

- Economic Net Present Value offered and perceived (ENPV and ENPV*): the difference between the discounted total benefits and discounted costs generated by project outputs. The benefits will be evaluated in terms of
 - willingness to pay (i.e. the users' average willingness to pay multiplied by the total number of users), or
 - the average time savings (in hours) per user multiplied by the average labour cost (22.4€/h) multiplied by the total number of users.

Consistent with the principles of multi-criteria analysis, when the monetary estimation of project impacts is not possible, it is better to express them in their most suitable metric, providing a multidimensional, disaggregated description of project performance.

Monetary estimation will be possible using two quantitative values: the willingness to pay and the (estimated) time saving generated by the use of the service, both gathered from the users. The willingness to pay is expressed in Euro per year. Time saving will be evaluated considering the average labour cost in EU27 equal to 22.4€ per hour³¹.

- Benefits/Costs Ratio offered and perceived (BCR and BCR*): the ratio between discounted economic benefits and costs (as above). The BCR ratio measure what is the generated by the expense for the project (for example, if the BCR ratio is 2, this means that the expense of 1 € in the project generates 2 € (economic) benefits.
- Discounted Payback Period offered and perceived (DPP and DPP*): gives the number of years needed to break even from undertaking the initial expenditure. Also in this case cost and benefits are discounted to time "zero".
- Willingness to Pay over Costs ratio (WTP/C*): the Willingness to Pay is evaluated by the project users and it can be compared to the costs of the project. The users' Willingness to Pay indicates how much a user is willing to pay for that service. If the total Willingness to Pay (WTP calculated by multiplying the average declared by the users to the number of total users in-

³¹ EUROSTAT news release 54/2013 - 10 April 2013

indicated in the project scenario) is greater than the cost of the project, i.e. the ratio $WTP/C^* > 1$, this means the services can be commercially sold on the market or at the very least considered. When, $WTP/C^* < 1$ this means it is most unlikely the project can sell this service and so it would be necessary to investigate alternative business models or at least think about mixed business models (finance and marketing).

- Reliability Indicator (RI): is the ratio between the number of the project users who have filled in the information in the Users Data Gathering Interface and the number of users declared by the project within the scenarios. A ratio that is considered acceptable is of the order of 10%, with 1 user response for every 10 declared. The more this ratio approaches 1, the greater the reliability of indices is as well as the ENPV*, BCR*. DPP* and WTP/C*.

In analytical terms, the indicators can be expressed as follows:

$$ENPV = \sum_{t=0}^n (\sum_{t=TBS}^{T+5} \frac{OB_t}{(1+i)^t} - \sum_{t=0}^{T+TC} \frac{OC_t}{(1+i)^t}) \quad ENPV = \sum_{t=0}^n (\sum_{t=TBS}^{T+5} \frac{OB_t}{(1+i)^t} - \sum_{t=0}^{T+TC} \frac{OC_t}{(1+i)^t}) \quad (1)$$

$$BCR = \sum_{t=0}^n \frac{\sum_{t=TBS}^{T+5} OB_t (1+i)^{-t} B/C}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}} = \sum_{t=0}^n \frac{\sum_{t=TBS}^{T+5} OB_t (1+i)^{-t}}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}} \quad (2)$$

$$DPP = \sum_{t=0}^n \frac{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}}{\sum_{t=TBS}^{T+5} \frac{OB_t (1+i)^{-t}}{T+5-TBS}} \quad DPP = \sum_{t=0}^n \frac{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}}{\sum_{t=TBS}^{T+5} \frac{OB_t (1+i)^{-t}}{T+5-TBS}} \quad (3)$$

$$ENPV^* = \sum_{t=0}^n (\sum_{t=TBS}^{T+5} \frac{OPB_t}{(1+i)^t} - \sum_{t=0}^{T+TC} \frac{OC_t}{(1+i)^t}) \quad ENPV^* = \sum_{t=0}^n (\sum_{t=TBS}^{T+5} \frac{OPB_t}{(1+i)^t} - \sum_{t=0}^{T+TC} \frac{OC_t}{(1+i)^t}) \quad (4)$$

$$BCR^* = \sum_{t=0}^n \frac{\sum_{t=TBS}^{T+5} OPB_t (1+i)^{-t} B/C^*}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}} = \sum_{t=0}^n \frac{\sum_{t=TBS}^{T+5} OPB_t (1+i)^{-t}}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}} \quad (5)$$

$$DPP^* = \sum_{t=0}^n \frac{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}}{\sum_{t=TBS}^{T+5} \frac{OPB_t (1+i)^{-t}}{T+5-TBS}} \quad DPP^* = \sum_{t=0}^n \frac{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}}{\sum_{t=TBS}^{T+5} \frac{OPB_t (1+i)^{-t}}{T+5-TBS}} \quad (6)$$

$$WTP/C^* = \sum_{t=0}^n \frac{\sum_{t=TBS}^{T+5} WTP_t (1+i)^{-t}}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}} \quad WTP/C^* = \sum_{t=0}^n \frac{\sum_{t=TBS}^{T+5} WTP_t (1+i)^{-t}}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}} \quad (7)$$

$$RI = \sum_{t=0}^n \frac{U_{ad}}{U_{d0}} \quad (8)$$

where

- O is the number of outputs generated by a project
- TBS (Timing of the benefit) is the time t when project output O starts to produce some benefits. We assume that this can happen in the period between the end of the project T (with $TBS \Rightarrow T$) and $T+5$
- TC is the time frame after the end of the project (with $TC \leq 5$) during which cost for updating/maintaining the output may occur
- OB is total amount of economic benefits at time t generated by the project output O . Economic benefits can be measured directly through revenues (do we have these?) or indirectly through individual cost/time yearly savings multiplied by the number of output end/users
- OPB is total amount of economic benefits at time t perceived by the users of each output O . Economic benefits can be measured directly through Willingness To Pay or indirectly through individual cost/time yearly savings multiplied by the number of output end/users
- OC is the cost of development + updating/maintaining the output after the end of the project at time t
- U_a and U_d are respectively the number of actual users answering to the user questionnaire and the number of users declared by the project.

The complex indicators calculated for the social impact in the assessment are the following:

$$PLI = DR * SRIA \quad (9)$$

where

- PLI is the project level of interdisciplinarity
- DR is the number of disciplines represented
- $SRIA$ is the project self-evaluation of the relevance of interdisciplinary activities

$$\text{CLA}=\text{CL}*\text{QCL} \quad (10)$$

where

- CLA is the number and quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project DR is the number of disciplines represented
- CL is the number of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project
- QCL is the Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project

$$\text{CRA}=\text{CR}*\text{QCR} \quad (11)$$

where

- CRA is the number and quality of new collaboration links established by project partners with research actors thanks to the participation in the project
- CR is the number of new collaboration links established by project partners with research actors thanks to the participation in the project
- QCR is the Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project

$$\text{AIFR}=\text{PIF}/\text{R} \quad (12)$$

where

- PIF is the total number of papers with impact factor published at project level³²
- R is the number of researchers in the project

$$\text{NSO}=\text{NSA}+\text{TV} \quad (13)$$

where

- NSO is the number of non-scientific dissemination outputs

³² The question is addressed at partner level

- NSA is the number of articles published on non-specialised magazines and newspapers
- TV is the number of TV appearances

3.7.2 Outliers identification

Projects may have different dimensions and generate impacts of extremely different magnitudes. It is then necessary to identify the statistical outliers. An outlier in a distribution is a number that is more than 1.5 times the length of the box away from either the lower or upper quartiles.

After having ordered the series of values, for calculating the outliers we use the Inter Quartile Range (IQR) algorithm where, if

$$n < Q_1 - 1.5 \times IQR$$

or

$$n > Q_3 + 1.5 \times IQR$$

is an outlier.

In descriptive statistics, the interquartile range (IQR) is a measure of statistical dispersion, being equal to the difference between the third quartile (Q3) and first quartile (Q1), that is

$$IQR = Q_3 - Q_1$$

The first quartile, also called lower quartile, is equal to the data at the 25th percentile of the data. The third quartile, also called upper quartile, is equal to the data at the 75th percentile of the data. Consequently, to this exercise the absolute value of the indicator is aligned to the ceiling or to the floor obtained through the IQR algorithm but it will maintain its significance by scoring the highest or lowest value after the normalisation described in the following paragraph.

3.7.3 Normalisation of indicators

Considering that the indicators considered will have different measurement units as well as relative or absolute values, before the aggregation of indicators into indices we need to put in place a mechanism that avoids of “adding up apples and oranges”. Therefore, normalisation is required prior to any data aggregation as the indicators in a data set often have different measurement units. According to Freudenberg (2003) and Jacobs et al. (2004) the existing methods of normalisation can be listed as follows:

- 1 Ranking
- 2 Standardisation (or z-scores)
- 3 Min-Max
- 4 Distance to a reference
- 5 Categorical scales
- 6 Indicators above or below the mean
- 7 Cyclical indicators
- 8 Balance of opinions (EC)
- 9 Percentage of annual differences over consecutive years

The methods of Min-Max and of the Categorical scales better fits with the approach used to build the synthetic indices.

- Min-Max normalises indicators to have an identical range (0-1, 0-100, etc.) by subtracting the minimum value and dividing by the range of the indicator values. If extreme values/or outliers could distort the transformed indicator, statistical techniques can neutralise these effects. On the other hand, Min-Max normalisation could widen the range of indicators lying within a small interval, increasing the effect on the composite indicator. The calculation is performed as follows

$$I_{qp}^t = \frac{x_{qp}^t - \min_p(x_q^t)}{\max_p(x_q^t) - \min_p(x_q^t)}$$

where

x_{qp}^t is the value of indicator q for projects p at time t .

$\min_p(x_q^t)$ and $\max_p(x_q^t)$ are the minimum and the maximum value of x_q^t across all projects p at time t .

In this way, the normalised indicators I_{qp}^t have values lying between 0 (laggard, $x_{qp}^t - \min_p(x_q^t)$) and 1 (leader, $x_{qp}^t - \min_p(x_q^t)$).

Categorical scale assigns a score for each indicator. Categories can be numerical, such as one, two or three stars, or qualitative, such as 'fully achieved', 'partly achieved' or 'not achieved'. Often, the scores are based on the percentiles of the distribution of the indicator across projects. For example, the top 5% receive a score of 100, the units between the 85th and 95th percentiles receive 80 points, the values between the 65th and the 85th percentiles receive 60 points, all the way to 0 points, thereby rewarding the best performing projects and penalising the worst. Since the same percentile transformation is used for different years, any change in the definition of the indicator over time will not affect the transformed variable. However, it is difficult to follow increases over time. Categorical scales exclude large amounts of information about the variance of the transformed indicators. Besides, when there is little variation within the original scores, the percentile bands force the categorisation on the data, irrespective of the underlying distribution. A possible solution is to adjust the percentile brackets across the individual indicators in order to obtain transformed categorical variables with almost normal distributions.

$$I_{qp}^t = \begin{cases} 0 & \text{if } x_{qp}^t < P^{15} \\ 200 & \text{if } P^{15} \leq x_{qp}^t < P^{25} \\ 400 & \text{if } P^{25} \leq x_{qp}^t < P^{65} \\ 600 & \text{if } P^{65} \leq x_{qp}^t < P^{85} \\ 800 & \text{if } P^{85} \leq x_{qp}^t < P^{95} \\ 1000 & \text{if } P^{95} \leq x_{qp}^t \end{cases}$$

3.7.4 Aggregation of indicators into indices and weighting

After having normalised the indicators in a 0-1000 scale, it is possible to simply calculate the aggregated index for each impact subcategory by using the arithmetic mean of that indicators. Recursively, in this same way, it is possible to pass from subcategory impact indices to impact area indices and to the overall project index score. This simple method implies that all the indicators and indices for impact areas are equally weighted. This essentially considers that all variables are “worth” the same in the compound index, but it could also disguise the absence of a statistical or an empirical basis, e.g. when there is insufficient knowledge of causal relationships or a lack of consensus on the alternative. In any case, equal weighting does not mean “no weights”, but implicitly implies that the weights are equal. Moreover, if indicators are grouped into dimensions and those are further aggregated into the composite index, then applying equal weighting to the variables may imply an unequal weighting of the dimension (the dimensions grouping the larger number of variables will have higher weight). This could result in an unbalanced structure in the composite index.

The methodology allows to consider equally weighted indicators or alternatively to build the indices considering the relative weights of indicators. The methodology then allows that experts or policy makers to assign an index of relevance from 1 to 6 (1 is not applicable and not relevant, 2 is applicable but not relevant, 3 is applicable but not very relevant, 4 is applicable and relevant, 5 is applicable and very relevant, 6 is applicable and must have) to each variable of the model in order to create the connected weight that also determines the weight of indicators and indices.

The weighting system is applied to the assessment model according to the following analytical rules

A Number of Impact categories



B Number of variables/indicators per impact category

$$\prod_{j=1}^N N_j$$

C Total number of variables/indicators

$$NN = \sum_{j=1}^N N_j$$

D Weights (absolute) [1...6] assigned from each expert to the indicators

$$\prod_{p=1}^P \prod_{j=1}^N \prod_{k=1}^{N_j} F_{j,k}^p$$

E Scores (relative) [0...1000] obtained by projects for each indicator

$$\prod_{g=1}^G \prod_{j=1}^N \prod_{k=1}^{N_j} w_{j,k}^g$$

F Average Weights (absolute) of each impact category

$$\prod_{p=1}^P \prod_{j=1}^N \bar{F}_j^p = \frac{1}{N_j} \sum_{k=1}^{N_j} F_{j,k}^p$$

G Average Weights (relative) of each impact category among the impact categories

$$\prod_{p=1}^P \prod_{j=1}^N \bar{f}_j^p = \frac{\bar{F}_j^p}{\sum_{i=1}^N \bar{F}_i^p} = \frac{\frac{1}{N_j} \sum_{k=1}^{N_j} F_{j,k}^p}{\sum_{i=1}^N \frac{1}{N_i} \sum_{k=1}^{N_i} F_{i,k}^p} \quad \prod_{p=1}^P \sum_{j=1}^N \bar{f}_j^p = 1$$

H Weight (relative) of each indicator among each impact category

$$\prod_{p=1}^P \prod_{j=1}^N \prod_{k=1}^{N_j} f_{j,k}^p = \frac{F_{j,k}^p}{\sum_{h=1}^{N_j} F_{j,h}^p} = \frac{1}{\bar{F}_j^p} F_{j,k}^p \quad \prod_{p=1}^P \prod_{j=1}^N \sum_{k=1}^{N_j} f_{j,k}^p = 1$$

I Weight (relative) of each indicator among the entire set of indicators

$$\prod_{p=1}^P \prod_{j=1}^N \prod_{k=1}^{N_j} ff_{j,k}^p = \bar{f}_j^p f_{j,k}^p = \frac{\bar{F}_j^p}{\sum_{i=1}^N \bar{F}_i^p} \frac{1}{N_j} F_{j,k}^p = \frac{1}{N_j} \frac{F_{j,k}^p}{\sum_{i=1}^N \frac{1}{N_i} \sum_{h=1}^{N_i} F_{i,h}^p} \quad \prod_{p=1}^P \sum_{j=1}^N \sum_{k=1}^{N_j} ff_{j,k}^p = 1$$

J Projects synthetic assessment indices [0...1000]

$$\prod_{g=1}^G \prod_{p=1}^P \beta^{g,p} = \sum_{j=1}^N \sum_{k=1}^{N_j} \omega_{j,k}^g ff_{j,k}^p = \frac{\sum_{j=1}^N \frac{1}{N_j} \sum_{k=1}^{N_j} \omega_{j,k}^g F_{j,k}^p}{\sum_{j=1}^N \frac{1}{N_j} \sum_{k=1}^{N_j} F_{j,k}^p}$$

K Project global index calculated [0...1000]

$$\prod_{g=1}^G \beta^g = \frac{1}{P} \sum_{p=1}^P \beta^{g,p} = \frac{1}{P} \sum_{p=1}^P \sum_{j=1}^N \sum_{k=1}^{N_j} \omega_{j,k}^g ff_{j,k}^p = \frac{1}{P} \sum_{p=1}^P \frac{\sum_{j=1}^N \frac{1}{N_j} \sum_{k=1}^{N_j} \omega_{j,k}^g F_{j,k}^p}{\sum_{j=1}^N \frac{1}{N_j} \sum_{k=1}^{N_j} F_{j,k}^p}$$

In order to explain how the weighting system is working we use the following example with 3 projects (x,y,z) evaluated against the 3 vertical impact categories (1,2,3), a small set of variables (6) each one of them evaluated from 2 experts (a and b):

- A Number of impact categories 3
- B Number of variables/indicators per impact category 1, 2, 3
- C Total number of variables/indicators 6 = 1+2+3
- D Weights (absolute) [1...6] assigned from each expert to the indicators

Impact category		1		2			3			
Indicator		1.1	Tot	2.1	2.2	Tot	3.1	3.2	3.3	Tot
Experts	A	6	6	1	4	5	1	2	3	6
	B	2	2	3	2	5	1	4	4	9

E Scores (relative) [0...1000] obtained by projects for each indicator

Impact category		1	2		3		
Indicator		1.1	2.1	2.2	3.1	3.2	3.3
Project	X	1000	250	750	330	500	770
	Y	500	200	500	100	400	100
	Z	100	900	700	300	200	100

In order to build the weighting system to be associated to the projects' indicators, it is needed to derive the following quantities:

F Average Weights (absolute) of each impact category (arithmetic mean of indicators' weights in table D)

Impact category		1	2	3	Tot
Expert	A	$6=6/1$	$2.5=(1+4)/2$	$2=(1+2+3)/3$	10.5
	B	$2=2/1$	$2.5=(3+2)/2$	$3=(1+4+4)/3$	7.5

G Average Weights (relative) of each impact category among the impact categories (ratio between Average Weights (absolute) and their sum in table F)

Impact category		1	2	3	Tot
Expert	A	$0.571=6/10.5$	$0.238=2.5/10.5$	$0.190=2/10.5$	1
	B	$0.267=2/7.5$	$0.333=2.5/7.5$	$0.400=3/7.5$	1

H Weight (relative) of each indicator among each impact category (ratio between indicator absolute weight and the sum of all weights in the impact category in table D)

Impact category		1	2		3		
Indicator		1.1	2.1	2.2	3.1	3.2	3.3
Expert	A	$1=6/6$	$0.2=1/5$	$0.8=4/5$	$0.167=1/6$	$0.333=2/6$	$0.500=3/6$
	B	$1=2/2$	$0.6=3/5$	$0.4=2/5$	$0.111=1/9$	$0.444=4/9$	$0.444=4/9$

- I Weight (relative) of each indicator among the entire set of indicators (product between Average Weights (relative) of each impact category in table G and the Weight (relative) of each indicator among the impact category in table H)

Impact category		1	2		3			Tot
Indicator		1.1	2.1	2.2	3.1	3.2	3.3	
Expert	A	$0.571=0.571*1$	$0.0476=0.238*0.2$	$0.1904=0.238*0.8$	$0.03173=0.190*0.167$	$0.06327=0.190*0.333$	$0.095=0.190*0.500$	1
	B	$0.267=0.267*1$	$0.200=0.333*0.6$	$0.133=0.333*0.4$	$0.044=0.400*0.111$	$0.178=0.400*0.444$	$0.178=0.400*0.444$	1

- J The calculation of synthetic assessment indices (scale 0-1000) weighted according to the experts opinion can be now obtained by multiplying and sum the scores obtained by the project for each indicator (table E) with the relative weight of each indicator (table I)

		Projects		
		X	Y	Z
Expert	A	$842=1000*0.571$ $+250*0.0476$ $+750*0.1904$ $+330*0.03173$ $+500*0.06327$ $+770*0.095$	$457=500*0.571$ $+200*0.0476$ $+500*0.1904$ $+1000*0.03173$ $+400*0.06327$ $+100*0.095$	$265=100*0.571$ $+900*0.0476$ $+700*0.1904$ $+300*0.03173$ $+200*0.06327$ $+100*0.095$
	B	$657=1000*0.267$ $+250*0.200$ $+750*0.133$ $+330*0.044$ $+500*0.178$ $+770*0.178$	$373=500*0.267$ $+200*0.200$ $+500*0.133$ $+1000*0.044$ $+400*0.178$ $+100*0.178$	$367=100*0.267$ $+900*0.200$ $+700*0.133$ $+300*0.044$ $+200*0.178$ $+100*0.178$

- K Project global index calculated on the arithmetic mean of the value per expert in table J

Projects		
X	Y	Z
$749=(842+657)/2$	$415=(457+373)/2$	$316=(265+367)/2$

This methodology can be used in order to build aggregated indices in every level of the assessment (impact subcategory, impact category, project level). This option is implemented in the Self-Assessment Toolkit but it has not been used because the opinion of the experts implies value judgements; another option in this case is to use as a weighting system the policy maker priorities (see European Commission) according to its strategic objectives.

The SAT also proposes another possible weighing system, in which each project can declare the relevance of each area of impact so that data related to more relevant areas have a higher weight in the assessment. Considering the reduced number of projects that participated in the assessment and considering the necessity to allow a comparison among them, we decided not to use this weighting system in the SAT. However, the relevance attributed by projects to the different areas of impact has been considered in analysing the project results and this information is available for each project and at aggregated level.

3.7.5 Comparisons and benchmarking

At the end of the assessment exercise each project is able to visualise:

- A global performance index
- 8 impact indices (4 vertical and 4 transversal indices)
- 17 impact indices for the vertical subcategories

The projects can “drill down” each index and visualise the results of the constituting indicators (see paragraph 3.8.2.2).

The results are shown with comparative benchmarks (i.e. mean, variance) that consider the project peculiarities and the belonging to the groups identified in chapter 2 and adjusted according to projects and experts’ feedback. The groups are:

- Instrument typology (STREP, IP, NoE, CSA, CIP-PSP)
- Total cost projects (lower than 2 million €, between 2 and 5 million €, higher than 5 million €).
- Project development stage (Research, prototyping, commercialisation)
- Direct users (Libraries and archives Museum and curators Researchers, academia and field experts, Training sector Citizens)

and end users, Creative sector including media institutions and other industries, EU projects, ICT providers or developers, Policy makers or government bodies, Other)

- Technological tools developed (innovative tools and methods for 3D processing, capture and manipulation techniques, tools for preservation and security, digitisation and access of archives and library techniques, augmented and mixed reality techniques).

3.8 Data gathering process and instruments

This paragraph introduces a new topic related to the methodology, e.g. how the information needed for the impact assessment can be collected using the tools developed. Ad-hoc tools - that converge in the online toolkit - have been developed. The self-assessment toolkit is not merely constituted by different data gathering instruments, but it also supports the analysis of the data allowing the automatic impact self-assessment of DigiCult projects. By using the toolkit, projects are not only able to enter data, but can also see the results of their assessment in real time. They can save the results and compare them with their own previous assessment and with other projects with similar characteristics (starting date, budget, activity focus, etc.).

This paragraph describes the data gathering process and the interactions with DigiCult projects' representatives, their users and the research team. Annex B will further detail all the functionalities of the SAT, the process followed for developing the toolkit and the reason why an online toolkit has been preferred to a simpler online questionnaire.

3.8.1 Data gathering process

The actors engaged in the data gathering are:

- Project coordinators
- Project partners
- Project users (i.e. users of project outputs).

In order to access the dedicated online tool for data gathering, projects coordinators receive a username and a password. With

these credentials they access the dedicated tool in which they are asked to enter required information and answer questions. From previous experiences (EU funded support actions ERINA+³³ and SEQUOIA ³⁴) we learned that project coordinators do not always have all the requested information to reply to all questions. For some information they need to contact other persons in their consortium, such as e.g. the exploitation expert, the financial coordinator or the scientific coordinator. For other information, is necessary to contact all partners and gather data from them, i.e. a list of scientific papers submitted to journals with impact factors. In order to support them, the tool enables project coordinators to assign specific questions to specific project partners (which receive the credential for entering the data) and ask partner to fill-in questions addressing them directly.

When project partners enter information in the web tool, the project coordinator is then able to validate the data and to save the information in the system.

We believe in the necessity of engaging projects users in the self-assessment. With the term “projects users” we refer both to direct users engaged by the project in its pilots and proof-of-concept activities, as well as potential users that the projects consider relevant for its sustainability and exploitation strategy. Users can access another tool that gathers their evaluation of the projects outputs and collect information about the benefit derived by using a specific project output. The data are gathered in an anonymous way and the project coordinator only see the aggregated assessment made by their users. This assure projects’ users the maximum freedom of expression.

The data gathered through the SAT were used by the DigiCult projects for their self-assessments and by us for:

- Analysing the DigiCult domain at aggregated level.
- Analysing each project.

The results of these analysis are reported in chapter 4 and 5.

³³ <http://www.erinaplus.eu/>

³⁴ <http://www.sequoiaproject.eu/>

3.8.2 Project Self-Assessment Tool (Tool 1)

The first tool allows the acquisition of project information. It has been structured to guide the users in gathering the information with simple wizard (a guided procedure). We designed and developed the tool by dedicating particular attention to user experience in order to make the tool as simple and intuitive as possible.

3.8.2.1 Why a Self-Assessment Tool?

Starting from the needs identified in the previous paragraphs, we analysed different tools and instruments to gather data from the users. The simplest choice would have been to create a questionnaire, but we understand that especially for the data collection made by the coordinator and partners, they need a more evolved tool. For these reasons, we have taken into consideration to develop a toolkit, a web based application, for the data collection process.

In the table below, the pros and cons of the two solutions are reported.

	PRO	CON
Questionnaire	<ul style="list-style-type: none"> • It is simple • The user has the knowledge of the system and is accustomed to use it 	<ul style="list-style-type: none"> • Low flexibility • It does not allow the delegation of the settlement of the information • It does not provide different levels of access for users • It does not provide a tool for real-time reporting and data analysis is generally done when the questionnaire is closed
Toolkit	<ul style="list-style-type: none"> • Flexibility and scalability • Can provide different levels of user access • It allows to provide a real-time output • It can be designed to allows the users to collect the information in different time frames (snapshots) on which can be made different statistics • It can include a reporting system 	<ul style="list-style-type: none"> • The users will need to be trained in order to use the tool in an effective way • The tool development requires a considerable amount of time

Table 16 - Questionnaire vs. Toolkit

The choice was to adopt a Toolkit to collect the information about the projects. During the selection process it was analysed the user experience with complex toolkit and we decided to make it similar to a questionnaire.

Since we evaluate the project at different phase of its development, in order to analyse the perceived efficiency of the users, the Toolkit has been created for freezing and saving snapshots. This feature allows the users and projects to save the data entered by users up to a certain time frame, use them in current evaluations and mark the beginning of the collection of new data when the project is changing lifecycle phase or when it reaches a new milestone.

3.8.2.2 The platform in detail

The platform for data gathering and project assessment, outlined and described at a high level in the precedent paragraphs is shown in the figure below. It consists of different web applications, with different users grants. The framework is based on Linux and Apache web server. The programming language used for the development of the toolkit and users questionnaire is PHP. The user authentication has been done using LDAP system, in order to manage big number of users and group membership (projects and roles on the project) in an easy manner.

Data are stored in a mySQL database system. Two different databases are created to store users' data and projects data.

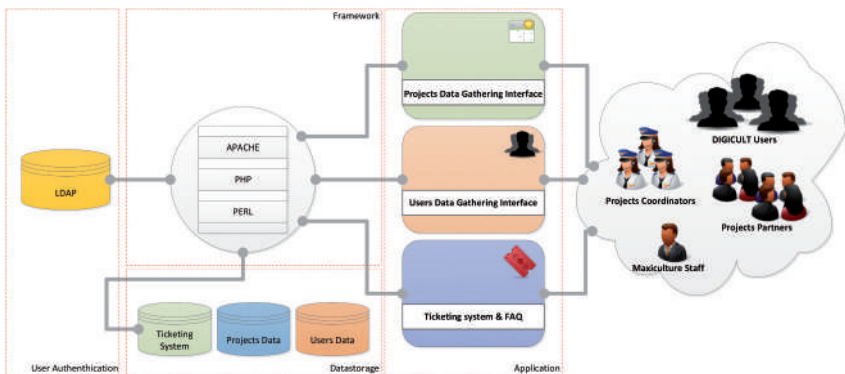


Figure 17 - The MAXICULTURE platform

Login procedures

The accessing page of the Toolkit is the login page, where each collaborating project insert username and password provided by MAXICULTURE technical staff (on request). Username and password are given firstly to the Project Coordinator, but also to one representative for each partner that has to fill in the questions specifically addressing the partners. The project coordinator request to the technical staff to provide username and password to the partners by providing the following information:

- Name of the company/research institution
- Name of the representative
- Representative email

Figure 18 - MAXICULTURE Login page

Welcome page

By entering username and password in the login page, the user is directed to the Welcome page of the Toolkit that shows the general information about the Toolkit. On the left of the page, there are the 9 sections of the Toolkit: Project Information, Start your assessment, Economic Impact, Impact on Society, Impact on DigiCult &

Creativity, Impact on Technology, Last Section, Assessment and Reports.

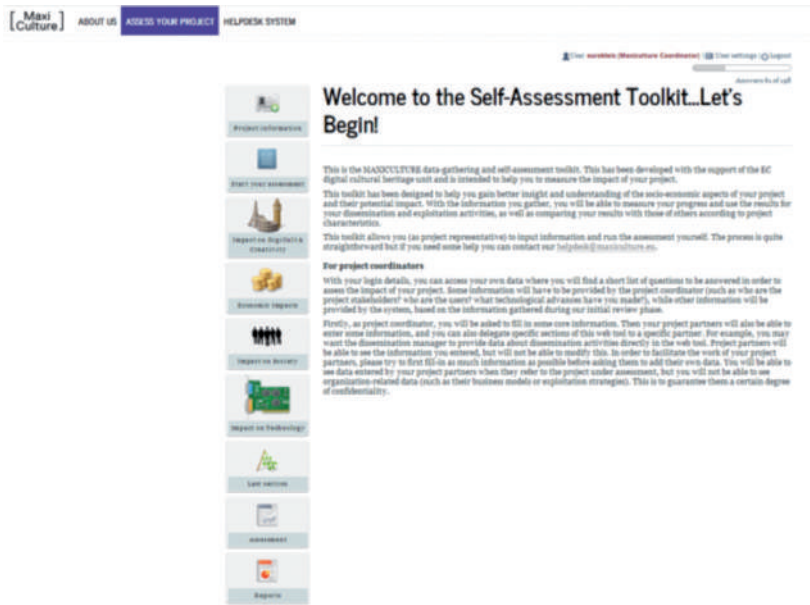


Figure 19 - MAXICULTURE Welcome page

How to use the sections

By clicking on a section (on the left column, Figure 20), the Toolkit automatically opens a drop down menu with other sub-sections. The user has to click on all the sub-sections in order to access one by one to all the questions and reply to them. For example, as showed by the following figure, by clicking on the Project Information section, the Toolkit will show several sub-sections: general information, duration and maturity, consortium, collaboration with other projects, additional information about partners, main focus, stakeholders, management and monitoring. As mentioned earlier, the user is requested to put in order of relevance the three area of impact (economic impact, impact on society and impact on DigiCult and technology), similarly the user is also requested to put

into order the different subcategories of Impact on society. By doing this the use, not only attribute a different weight to the corresponding section, but also modify the order in which the section (and the related questions will appear). In this way, if a user decides to prioritize economic impact on impact on society, the questions related to economic impact will appear at the beginning of the tool and the question related to impact on society will follow. The section about the Assessment aims to gather the final information to proceed with the assessment of the project, such as the assessment type (up to date or considering the entire duration of the project). The final section of the Toolkit, named Reports shows the assessment of each project that are then compared to other projects results and/or on a time basis analysing all the results obtained by the project on a specific timeframe. The information about the perceived efficiency collected through the Users Data Gathering Interface is included in the reports.

The screenshot shows the 'MAXICULTURE' Self-Assessment Toolkit interface. At the top, there are navigation links: 'ABOUT US', 'ASSESS YOUR PROJECT', and 'HELP/FAQ SYSTEM'. The main content area is titled 'Welcome to the Self-Assessment Toolkit...Let's Begin!'. Below the title, there is a navigation menu on the left with the following items: 'Project Information', 'Start your assessment', 'Impact on Digital Creativity', 'Economic Impact', 'Impact on Society', 'Impact on Technology', and 'User Metrics'. The main content area contains the following text:

This is the MAXICULTURE data-gathering and self-assessment toolkit. This has been developed with the support of the EC digital cultural heritage unit and is intended to help you to measure the impact of your project.

This toolkit has been designed to help you gain better insight and understanding of the socio-economic aspects of your project and their potential impact. With the information you gather, you will be able to measure your progress and use the results for your dissemination and exploitation activities, as well as comparing your results with those of others according to project characteristics.

This toolkit allows you (as project representative) to input information and run the assessment yourself. The process is quite straightforward but if you need some help you can contact our helpdesk at helpdesk@maxiculture.eu.

For project coordinators

With your login details, you can access your own data where you will find a short list of questions to be answered in order to assess the impact of your project. Some information will have to be provided by the project coordinator (such as who are the project stakeholders? who are the users? what technological advances have you made?), while other information will be provided by the system, based on the information gathered during our initial review phase.

Firstly, as project coordinator, you will be asked to fill in some core information. Then your project partners will also be able to enter some information, and you can also delegate specific sections of this web-tool to a specific partner. For example, you may want the dissemination manager to provide data about dissemination activities directly to the web tool. Project partners will be able to see the information you entered, but will not be able to modify this. In order to facilitate the work of your project partners, please try to first fill in as much information as possible before asking them to add their own data. You will be able to see data entered by your project partners when they refer to the project under assessment, but you will not be able to see organization-related data (such as their business model or exploitation strategies). This is to guarantee them a certain degree of confidentiality.

Figure 20 - MAXICULTURE sections explanation

The tool can be used by project coordinators and by project partners. Project coordinators enter the information needed, and are able to ask to specific partners (one or more) to fill-in specific sections. For example, about scientific production, the coordinator can ask to each partner to indicate, in the dedicated section, the papers with impact factor published in the last year. In this way the coordinator is able to have all the information in a single place, without collecting the information before entering in the SAT. The project coordinator is able to view all information inserted by project partners, with the exception of specific information that can raise issues of privacy and commercial issues (for example, questions related to the business model or growth in turnover generated by the participation to the project). The project partners can insert their specific information, as requested by the tool, and can see all the information of the project inserted by the project coordinator. The wizard interface guides the user through 5 sections of information acquisition, at the end of which the user can set the parameters for the assessment and launch the project assessment. The first two sections are the focal point of the tool. They enable and give shape to all the other sections. In the first session the user has to provide basic information about the project (project budget, start date, end date, previous experience in the DigiCult domain, etc.). In the second session the user (project coordinator) has to rate the relevance of the three areas of impacts for the project. The project coordinator will do it by ranking in order of relevance the "icons" related to the impacts: economic impact, impact on society and impact on DigiCult domain and technology. She/he will also list the main outputs of the project. These two questions are fundamental because they dynamically generate the sections 3, 4 and 5 of the questionnaire, used to gather information about the single impacts. The users can modify the information filled in these sections at any time by adding or removing output, or changing the order of importance of the impacts. This change the results of his assessment. As already mentioned, the relevance the project coordinators attribute to each area of impact can be used

for creating a weighting system that can personalise the methodology to project priorities. In fact, not all the projects expect to have the same degree of impact on all the four areas (social, economic, DigiCult and Creativity and technological).

The screenshot shows the 'Prioritise your impacts' section of the Med4Culture tool. The interface includes a sidebar with navigation options such as 'Project information', 'Start your assessment', and various impact categories. The main content area is titled 'Prioritise your impacts' and displays a message: 'Med4Culture has identified the following areas of DigiCult projects impact'. Below this, there are four numbered circles (1-4) representing different impact areas, each with a corresponding icon and label: 1. Economic Impact (gold coins), 2. Impact on society (people icon), 3. Impact on Technology (circuit board), and 4. Impact on DigiCult & Creativity (building icon).

Figure 21 - SAT second session

Project assessment and reports

The last section of the tool shows the result of the impact assessment, i.e. the expected impact of the project under analysis. The project coordinator can select the type of report that wants to create: she/he specify the required parameters such as periods to be considered and means of comparison, and generate the report. There are two different types of reports, the temporal one, which allows projects coordinators to make a comparison between their assessments over time, useful to look at the evolution of the project, and the intra-project one that allows them to compare their project with other projects. During the generation phase of the

latter report, users are able to select the types of projects with which to compare:

- with similar budget
- belonging to the same typology of funding scheme (STREP, IP, etc)
- with similar users
- developing similar typologies of technology
- that are at the same stage of development (research, prototyping, on the market).

Projects are also able to see the results of the project users' assessment and compare their perception of project impact with the perception of their users. The assessment made by projects users is based on the information gathered from the tool n.2 (User data gathering interface) that is described in the next paragraph.

The self-assessment report visualizes the results of a project accordingly to all the indices and indicators considered by the methodology. Moreover, in the report, the project will be able to see how many of its users filled in Tool 2 and - when a mean of comparison is selected - the number of projects used for the comparison.



Figure 22 - Impact self-assessment report generated by Tool 1

The SAT is able to provide visualisations of data with a deep level of granularity through the following tree structure that is able to show how the indices are composed and which of them are over performing and underperforming with respect to the average. In this way the user is able to clearly understand the strengths and weaknesses of its project and identify the needed actions.

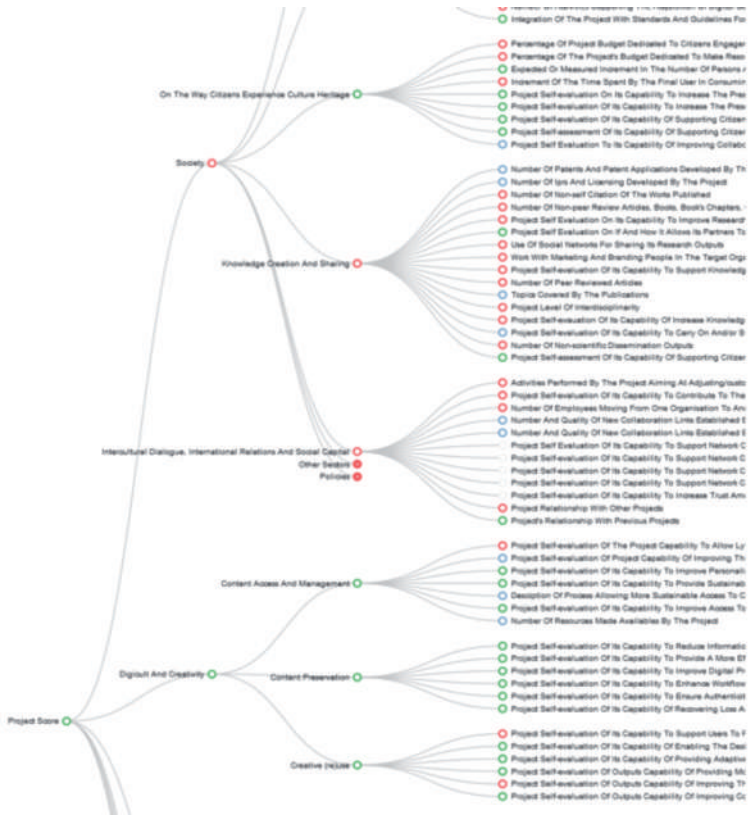


Figure 22 - Impact self-assessment report generated by Tool 1

3.8.3 User data gathering tool (Tool 2)

The user data-gathering tool shows a simple interface. Basically, it appears like is an online questionnaire structured both for single users and organizations. By using this tool, projects users are requested to provide their opinion about the output/services they use and their potential impacts. This second tool gathers also some basic information about projects users (working profile, age, nationality and so forth).

DigiCult projects will be able to contact their users autonomously by sending them an invitation by email and by providing a link for accessing the user data-gathering tool if they prefer to engage their users on their behalf.

The information gathered by this tool is used during the assessment of the projects and are shown, when available, in the assessment report.

3.9 Social Network Analysis

The above-mentioned evaluation techniques and the related literature on have focused on how the information about costs, returns, risk, efficiency, and legitimacy influences the extent of innovation diffusion. These theories largely ignore, however, the possibility that this information is channelled by social networks only to certain potential adopters [Abrahamson and Rosenkopf, 2007]. Consequently, we still know little about when and how the structure of social networks can influence the extent of an innovation's diffusion by determining which network participants can become aware of information about this innovation and adopt it [Granovetter 1985, 1992]. As introduced in par. 1.3.4. it is also important to capture the effects in terms of knowledge circulation and sharing generated by the innovation activities carried out by DigiCult projects. The use of Social Network Analysis in innovation research has been mainly motivated by the need to explain or simply describe causal mechanisms related to innovation that may

produce effects at the level of an innovation system such as the DigiCult one.

It is not the objective of this paragraph to discuss what innovation is according to Schumpeter's definition (par. 1.1) nor the different possible definitions of causal mechanisms. A causal mechanism is a theory or an explanation, and what it explains is how one event causes another [Mouw, 2006]. Thus, a causal mechanism related to innovation is the study of the process by which "social proximity" has an effect on "knowledge spillovers" or, another example, the process by which "network structure" shape or affect "innovative output." What is meant by the words between quotes depends on the theory chosen to formulate the research question relative to the causal mechanism under study. In many studies, the causal mechanisms are the process by which interaction(s) or relation(s) between agents, products, or pieces of knowledge (patents, individuals, firms, organisations, or sectors) causes another event such as the creation of something new, e.g., new knowledge, new organisations, new sectors, and new combinations. From this point of view, statistical analysis cannot help for studying these interactions or relations between agents because it is an analysis based on the inputs and outputs of the causal mechanism under study but not the causal mechanism itself and statistics tend to consider the causal mechanism under study as a black box.

3.9.1 SNA: main concepts

We briefly introduce the main concepts that we will use for the SNA that will be developed in chapter 4 on the base of data gathered through the SAT.

- 1 Betweenness. The extent to which a node lies between other nodes in the network. This measure considers the connectivity of the node's neighbours, giving a higher value for nodes which bridge clusters. The measure reflects the number of people who a person is connecting indirectly through their direct links.

- 2 Bridge. An edge is said to be a bridge if deleting it would cause its endpoints to lie in different components of a graph.
- 3 Centrality. This measure gives a rough indication of the social power of a node based on how well they "connect" the network. "Betweenness", "Closeness", and "Degree" are all measures of centrality.
- 4 Centralization. The difference between the number of links for each node divided by maximum possible sum of differences. A centralized network will have many of its links dispersed around one or a few nodes, while a decentralized network is one in which there is little variation between the number of links each node possesses.
- 5 Closeness. The degree an individual is near all other individuals in a network (directly or indirectly). It reflects the ability to access information through the "grapevine" of network members. Thus, closeness is the inverse of the sum of the shortest distances between each individual and every other person in the network. The shortest path may also be known as the "geodesic distance".
- 6 Clustering coefficient. A measure of the likelihood that two associates of a node are associates themselves. A higher clustering coefficient indicates a greater 'cliquishness'.
- 7 Cohesion. The degree to which actors are connected directly to each other by cohesive bonds. Groups are identified as 'cliques' if every individual is directly tied to every other individual, 'social circles' if there is less stringency of direct contact, which is imprecise, or as structurally cohesive blocks if precision is wanted.
- 8 Degree. The count of the number of ties to other actors in the network.
- 9 (Individual-level) Density. The degree a respondent's ties know one another/ proportion of ties among an individual's nominees. Network or global-level density is the proportion of ties in a network relative to the total number possible (sparse versus dense networks).

- 10 Flow betweenness centrality. The degree that a node contributes to sum of maximum flow between all pairs of nodes (not that node).
- 11 Eigenvector centrality. A measure of the importance of a node in a network. It assigns relative scores to all nodes in the network based on the principle that connections to nodes having a high score contribute more to the score of the node in question.
- 12 Local bridge. An edge is a local bridge if its endpoints share no common neighbours. Unlike a bridge, a local bridge is contained in a cycle.
- 13 Path length. The distances between pairs of nodes in the network. Average path-length is the average of these distances between all pairs of nodes.
- 14 Prestige. In a directed graph prestige is the term used to describe a node's centrality. "Degree Prestige", "Proximity Prestige", and "Status Prestige" are all measures of Prestige. See also degree (graph theory).
- 15 Radiality. Degree an individual's network reaches out into the network and provides novel information and influence.
- 16 Reach. The degree any member of a network can reach other members of the network.
- 17 Structural cohesion. The minimum number of members who, if removed from a group, would disconnect the group.
- 18 Structural equivalence. Refers to the extent to which nodes have a common set of linkages to other nodes in the system. The nodes don't need to have any ties to each other to be structurally equivalent.
- 19 Structural hole. Static holes that can be strategically filled by connecting one or more links to link together other points.

The software used for carrying out the SNA on DigiCult domain was UCINET6³⁵.

³⁵ <https://sites.google.com/site/ucinetsoftware/home>

The Assessment of the DigiCult domain

In this chapter we describe the main characteristics of the DigiCult and Creativity domain. As mentioned, the analysis that follows is an overview of the results achieved by the projects in the DigiCult and Creativity programme and do not represent an assessment of this area.

The following table lists the projects that we were able to invite to perform the socio-economic impact assessment. They are divided by Call and main research topic and included in the DigiCult domain. 19 projects completed the self-assessment exercise and the following paragraphs report the aggregated results of the analysis performed on this sample. Even though this analysis is limited to the projects that agreed to participate to the self-assessment it can provide useful indications on future actions also at the programme level.

	Call 1	Call 3	Call 6	Call 7	Call 8	Call 9	Europeana
Digitisation technology	IMPACT PAPHYRUS	3D-COFORM		RE@CT SCENE		3D-PITOTI INSIDDE PRESIOUS RePlay Rovina tranScriptorium I-Treasures	
Digital Cultural Experience		V-City	CHESS CULTURA DECIPHER PATHS AXES			CULTAR PHENICX TAG CLOUD EEXCESS meSch	
Support Activities	Treble-CLEF	DL.ORG	V-Must.net DigiBIC	GameArch MiRes		4C eCultvalue SUCCEED MAXICULTURE Prelida Presto4U	
Intelligent environments stimulating and enhancing human creativity					IdeaGarden Collage		
Europeana							EFG1914 ED Local EU Screen EU Screen XL ECLAP
Human-computer interfaces for the Cultural and Creative industries							TOSCA-MP VENTURI

Table 17 - DigiCult projects identified for participating in the self-assessment

4.1 General information about DigiCult and Creativity projects

Considering the instruments of funding offered by the EC in the calls under analysis, 48% of the projects are STREP (small and medium-size research projects), 26% are CSA (coordination and support actions), 17% are IP (large research and development projects) and 5% are Network of excellence (NoE)³⁶.

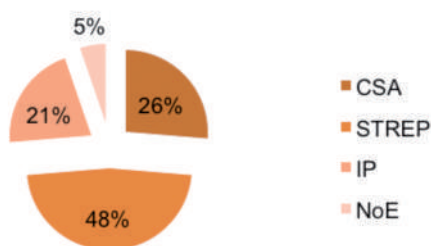


Figure 24 - Instrument of funding

The EU funds allocated to the 19 projects considered amount to 52.475.448 Euro, for an average budget for each project of 2.761.866, which reflects the sample that is mainly represented by medium-size projects (STREPs) and support actions (CSAs).

Projects can be grouped also accordingly to their research topics. For this reason, respondents were requested to select their main area of research by using the categories offered by the EC (http://cordis.europa.eu/fp7/ict/creativity/creativity-projects_en.html). The figure below shows that the majority of the respondents is working on Digital cultural experience and virtual heritage (selected by 9 projects), 4 projects focus on digitisation technologies and 4 on Digital preservation. Two projects focus on Intelligent environments and stimulating and enhancing, while 5 are support actions.

³⁶ In our sample there are also two Europeana projects (ECLAP and EUScreenXL) that do not belong from any specific instrument. According to their characteristics we have considered them respectively as a STREP and as an IP.

4.2 Duration and stage of development

We asked the projects to indicate the development stage in which they were at the time of the assessment. The possible options were: research, prototype and product development. This information is important in order to have an idea of the expected impacts. In fact, there are more impacts related to the research phase (such as scientific papers). Economic impacts only emerge when project outputs are fully developed and commercialised or sufficiently defined to make possible an estimation of the market exploitation.

The large majority within the sample are in the research phase (58%), 21% of them are developing or have developed prototypes and 21% are in the product development stage. Considering the absolute values, we have 11 projects in the research stage, 4 in the prototype stage and only 4 in the product development stage.

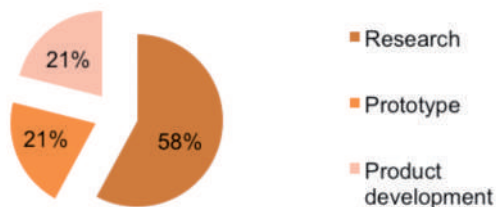


Figure 27 – Projects' stage of development

This data can be, at least partially, explained by the fact that the majority of the respondents are still on-going.

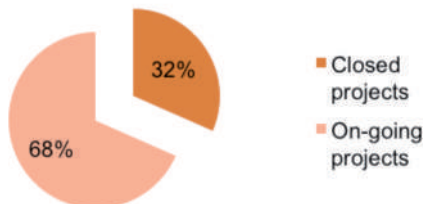


Figure 28 – On-going and closed projects

The figure below shows the duration and the timing of the projects. Most of the projects entered their information in the SAT in September 2014, so that only one of them was actually close to the end of the activities. The Table 18 shows the timeline of the projects that were still ongoing during the evaluation phase or that concluded their activities after 2012 (Treble-CLEF ended the activities in 2009).

	1st semester 2013	2nd semester 2013	1st semester 2014	2nd semester 2014	1st semester 2015	2nd semester 2015	1st semester 2016	2nd semester 2016	1st semester 2017
3D-PITOTI									
4C									
CHESS									
CULTAR									
DECIPHER									
ECLAP									
eCultValue									
EEXCESS									
EUScreen XL									
INSIDDE									
i-Treasures									
Maxiculture									
meSch									
PHENICX									
Prelida									
SUCCEEDD									
TOSCA-MP									
tranScriptorium									

Table 18 - DigiCult project starting and closing date

4.3 Projects Consortia and collaborations

Considering the 19 projects, 185 organisations participated to DigiCult and creativity projects. This indicated large consortium had an average number of participants of 9 organisations. The large majority belong to the EU 12 member states³⁷ (80%), 17% represent countries of the enlarged Union and 3% are extra-European countries. As shown in the table that follows, UK, Italy and Germany are the most represented countries.

³⁷ Italy, United kingdom, Germany, The Netherlands, Spain, Greece, France, Belgium, Denmark, Portugal, Luxemburg and Ireland

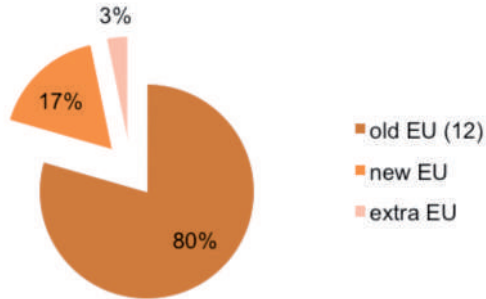


Figure 29 - Typologies of countries represented in the analysed consortia

57% of the organisations participating in DigiCult and creativity projects come from the education and research sector, 11% is represented by SME, 5% by large enterprises and 27% aggregates other typologies of actors. The presence of numerous education and research organisations is coherent with the fact that most of the projects consider themselves as mainly research projects.

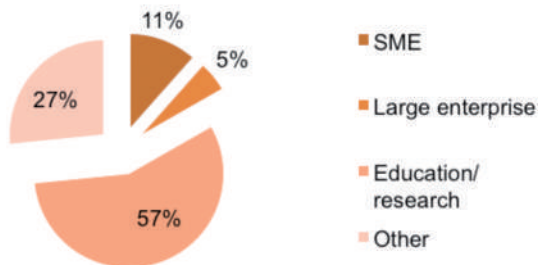


Figure 30 - Projects partners for typology of institution

44% of the respondents participated in previous DigiCult and creativity projects. Therefore, the majority of organizations are new to the sector, indicating that the DigiCult domain is open to new actors and new project partners. 10 out of 19 project coordinators have in their consortium at least one partners with whom they already collaborated in previous projects. In other terms, half of the consortia considered build on pre-existing collaboration networks. 8 projects build on previous projects that can be considered pre-

decessors of the actual ones.

We will see in the section dedicated to the network analysis the collaborations among projects (see paragraph 4.6.2.5); here it is sufficient to say that 16 projects indicated at least one project with whom they are collaborating; few projects – among which the support actions – mentioned 5 or more collaboration links. We also asked to project coordinator if they were connected to any regional growth or innovation cluster.

4.4 Stakeholders and end-users

Considering now projects' stakeholders (i.e. organisations, groups or individual which have interest for the projects' outputs without being the direct final users) 11 projects indicated – not surprisingly – cultural heritage institutions as main stakeholders whereas 6 projects indicated equally research and field experts, ICT providers, developers and other ICT-related actors, other EU projects, library and archives and university and research centres. Policy makers/government and are indicated by 4 projects. The creative sector is mentioned only by 2 projects, the same for the option “citizens”.



Figure 31 - Project stakeholders

Considering now the end-users, we can see that citizens are mentioned by 8 out of 19 projects, and, together with curators and museums, they represent the main users of the assessed projects. Also the creative sector, underrepresented in the stakeholders' figure, compare it as a relevant end-user for 6 projects.



Figure 32 - Project end-users

4.5 Prioritisation of DigiCult projects impacts

Projects were asked to prioritise their expected impact. The prioritisation system allows to order the four impacts allowing them to give the same position (for example 2 impact at the first place, 1 at the second and 1 at the third). According to this exercise, the result was:

- 13 projects declared to expect a primary impact on DigiCult and Creativity domain;
- 5 projects declared to expect a primary impact on Society;
- 4 projects declared to expect a primary impact on Economy;
- 1 project declared to expect a primary Technological impact.

This exercise is useful for comparing the actual results described in the following paragraphs against projects expectations.

4.6 Domain assessment according to the 8 vertical and transversal indices

The overall average score obtained by project is 282,99. The value is expressed in a 1-1000 scale, therefore there are surely margins for the improvement of the overall domain performance. On the other hand, it is necessary to point out that the statistical techniques used to normalise the values of projects having different dimension and magnitudes (for example hundreds vs millions of users) may have flatten the scores. These results must be always read in a comparative manner. The continuation of the assessment exercise and the enlargement of the sample could then provide even more interesting results.

Looking at the data with a breakdown among the identified cluster, the projects that are the most promising in terms of aggregated impact have these characteristics since they:

- are in their research phase;
- have a budget higher than 5 million euros;
- are STREPs;
- focus on “Intelligent environments”.

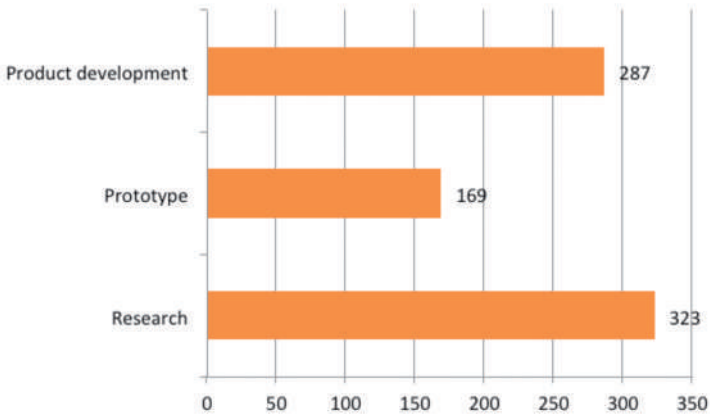


Figure 33 - Aggregated assessment by project phase

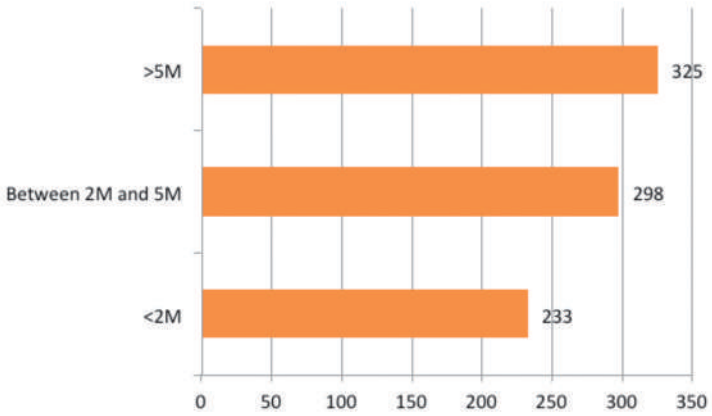


Figure 34 - Aggregated assessment by budget class

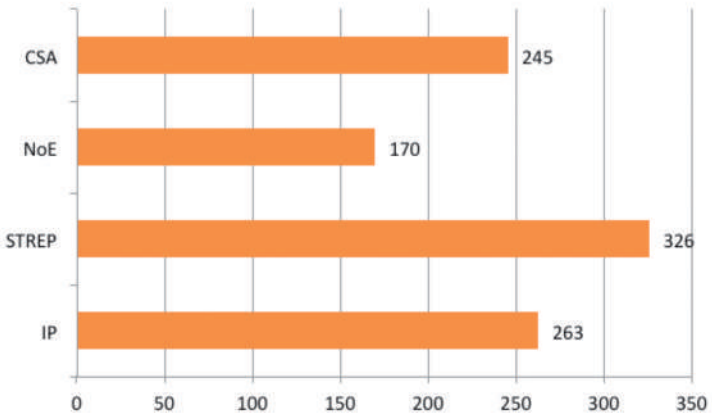


Figure 35 - Aggregated assessment by instrument type

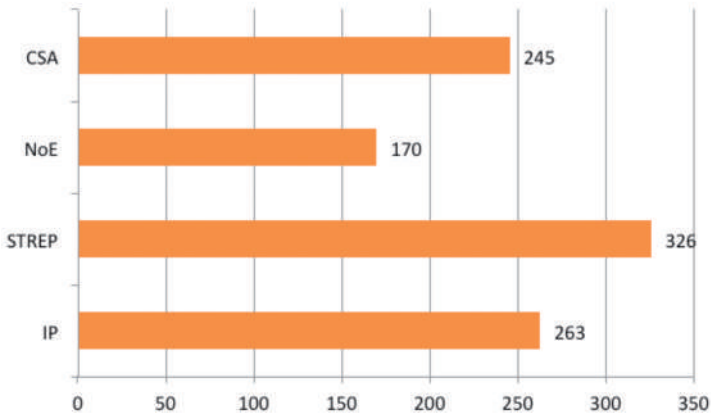


Figure 36 - Aggregated assessment by project focus

In the following paragraphs, the same kind analysis will be broken down at the level of single impact and transversal indicator.

4.6.1 Economic impact

The average score obtained by the projects for the impact on economy is 296,56 (on a 1-1000 scale.)

Among the sub-indices that form the Economic impact, the domain obtains a quite high value on the capacity to improve the Business performance (526,67) and on the impact on Employment (442,22). Rather low values are scored by the indices on Competitiveness, Regional attractiveness and tourism and Impact on Cultural and Creative Industries.

The projects that are the most promising in terms of economic impact have the following characteristics. They:

- are in their research phase;
- have budget less than 2 million euros;
- are Coordination and Support Actions;
- focus on support activities even if also the focus “Intelligent environments” is quite promising.

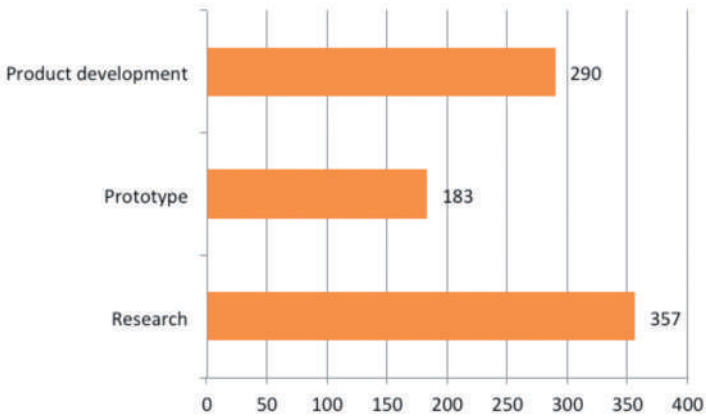


Figure 37 - Economic impact by project phase

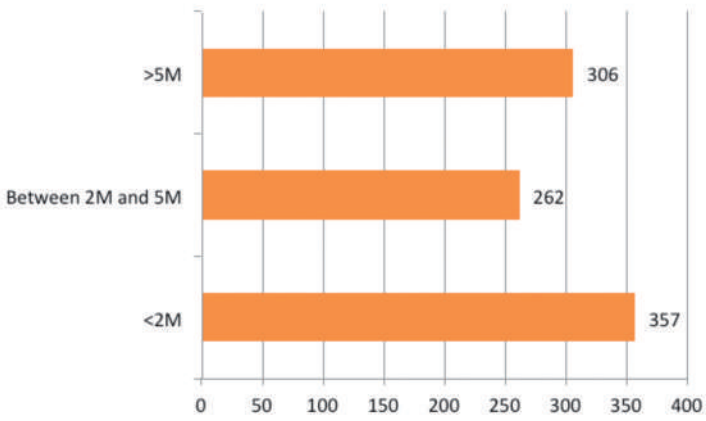


Figure 38 - Economic impact by budget class

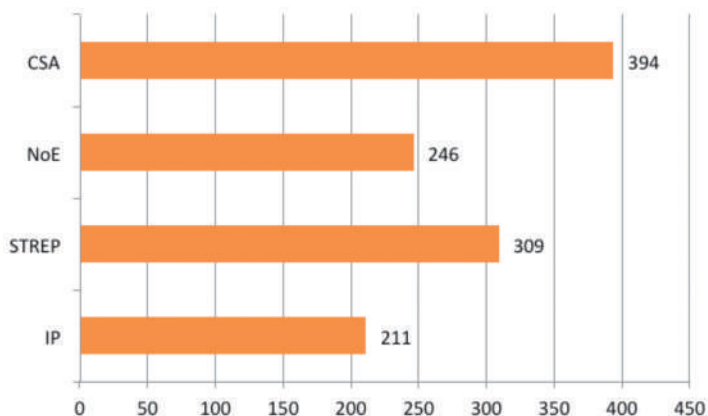


Figure 39 - Economic impact by instrument type

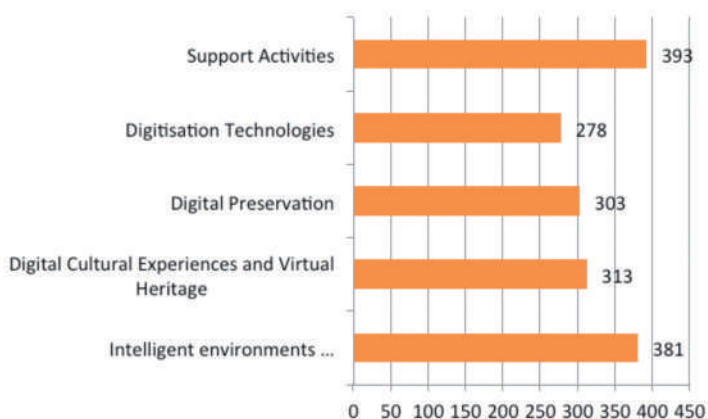


Figure 40 - Economic impact by project focus

These results look coherent considering the nature and the size of CSA projects.

4.6.1.1 Impact on Regional Attractiveness and Tourism

Only 3 projects declared to have an Impact on Regional Attractiveness and Tourism; these three projects have an impact on 10 regions in Europe. Only 1 project declared to have the highest impact on regional attractiveness and tourism and another one indicated to have a medium impact on regional attractiveness and tourism

4.6.1.2 Impact on CCIs

Within the framework of Cultural and Creative Industries, 3 projects declared to have the highest Impact on CCIs (mainly on increasing the access to Finance, the access to market for CCIs, by actively involving CCIs professionals in the development of digital tools) and other 4 projects declared to have a medium impact on CCIs and the main work is on developing more innovative tools for CCIs.

4.6.1.3 Impact on employment

Only 2 projects declared to have the highest Impact on employment (mainly on increasing the percentage of people employed in the domain, improving the working practices of CCIs and of other organisations, improving the reciprocal understanding between ICT experts and CH experts). In total these projects hired 5 researchers, 3 young researchers, 2 people were recruited specifically for the project under assessment and have generated a new job place. Moreover, 5 projects declared to have a medium impact on employment and they mainly improve the working practices of CCIs and of other organisations as well as the reciprocal understanding between ICT experts and CH experts. In total these projects hired 14 researchers, 17 young researchers, 11 people were recruited specifically for the project under assessment and have generated 8 new job places

4.6.1.4 Impact on business performance

Within the context of business performance, 7 projects declared to have an impact on improving existing services, 8 projects will

better target stakeholders' needs. Furthermore, 7 projects declared to have an impact on innovation transfer. Finally, 6 projects have an impact on creating new products, on keeping pace with competitors and on reducing the time needed to deliver a service. 17 young researchers, 11 people were recruited specifically for the projects under assessment and have generated 8 new long-term job places.

4.6.1.5 Impact on competitiveness

Only 6 projects declared to have developed a business model for the project, 3 projects declared that the R&D activities helped the consortium to create new market opportunities (such as informal and collaborations, new products for SMEs) and 5 projects have developed a business plan for the project.

4.6.2 Impact on Society

The average score obtained by the projects for the impact on society is 274,27 (on a 1-1000 scale.)

Looking in detail the areas composing the impact on society (see figure below), it appears that the areas in which the projects have the major impact are "Learning and Human Capital", followed by "Policies", while the areas with the lower impact are "Social Inclusion" and "Knowledge Creation and Sharing". Even if the results in terms of social inclusion are not surprising considering that this is not considered priority topic, we were expecting higher results in terms of knowledge creation and sharing, considering the research nature of the majority of the assessed projects.



Figure 41 - Average impact of DigiCult projects on the various areas of social impact

The figure below presents the number of projects (out of 17 projects which responded to the questions related to social impacts), which selected the various sub-category of social impact as areas in which they foresee to have an impact. As a consequence, it is reasonable to expect a higher impact in terms of knowledge creation and sharing. We will better analyse this result in the next paragraph.



Figure 42 - Areas of impact in which DigiCult projects expect to have an impact

In the next paragraphs, we will report the results related to the sub-categories of social impact.

4.6.2.1 Impact on Social Inclusion

Only 2 projects declared that their outputs might contribute to the inclusion of categories of people at risk, which explains the low results obtained by DigiCult projects in this area.

Moreover, 7 projects declared to pay attention to gender equality issues, but only 1 project carried out a specific Gender Equality Action (linked to actions realized at national level for public bodies' employees). This topic is almost absent by the work of DigiCult projects. As already mentioned, attention towards these aspects were not requested but, nevertheless, the high potentialities of art and new technology of reducing the gaps between those who participate in social life and those excluded (or risk to be excluded) deserve a greater attention in future projects.

4.6.2.2 Impact on Learning and Human Capital

As presented above, Learning and Human Capital is the area in which DigiCult projects have the major impact.

Overall, 11 projects organised training activities, for a total of 2.275 hours. A project declared 1.800 hours of training and if we consider it an outlier and we eliminate it, the average of training hours amounts to 47,5 hours, and 594 persons were trained. An average of 54 persons per project have been trained.

Besides the training activities, 14 projects declared that their outputs improve the skills of people already employed within or outside the consortium, 7 projects that they support the personal development of their users and 5 projects that they support faster and more efficient acquisition of competencies.

Regarding the competencies linked to creativity, only 4 projects declared that they support the acquisition of specific skills in the context of creative professionals and 3 that they support personal and organizational creativity (see figure below).

In synthesis, it is possible to say that the assessed projects pay at-

tention to transferring their output through training activities but more have to enhance to link such activities with the needs of the creative sectors and of the creative professionals.

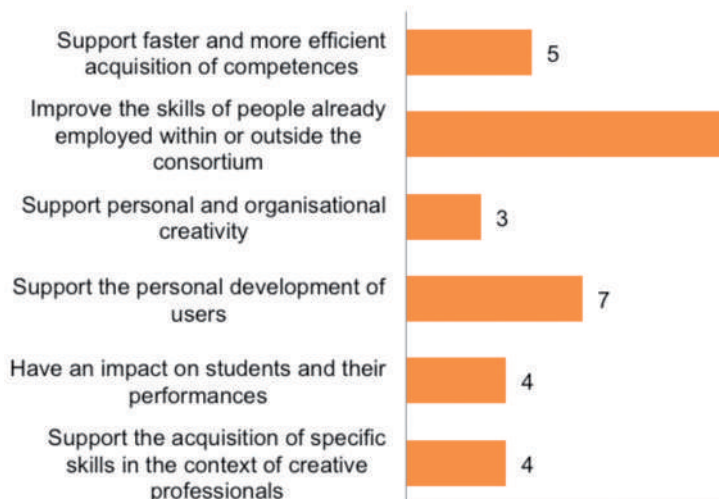


Figure 43 - Impact of DigiCult projects on learning and human capital

Finally, while 16 projects declared that their outputs are integrated with standards/guidelines for digital competences, digital literacy and eSkills, only 3 projects consider that they will contribute to the reduction of digital divide and the promotion of digital competences and eSkills. The attention to the digital divide was not explicitly requested by the EC call; nevertheless, it can be suggested to projects to invest in the reduction of digital divide: a wider ICT uptake at social level is the condition sine qua non for the increase of ICT services in the cultural heritage sector.

4.6.2.3 Impact on the Way Citizens Experience Culture

This dimension is a crucial one as it is related to a core expected impacts of DigiCult projects. 7 projects declared that they change the ways citizens experience culture, mostly thanks to the use of advanced technologies to gather or to present cultural heritage,

providing access to knowledge/heritage normally non accessible to citizens and engaging citizens in the creation of content.

In particular, 4 projects dedicate 80% or more of their budget to make resources available in a more personalized/adaptive way, while in average, projects focusing on this issue dedicate 34,25% of their budget on these activities.

Regarding more precisely the access to cultural resources, 9 projects will contribute to increase the number of people accessing cultural resources, with an average increase of 30,4% in the number of people accessing cultural resources, and an average increase of 22,2% in the time spent consuming cultural resources. These results are promising, even if limited to a relatively small number of projects.

4 projects declared that they will increase the consumption of cultural heritage of persons belonging to categories at risk of social exclusion, and 8 will increase the consumption of cultural heritage by children and young people. The attention for children and categories at risks of social exclusion is important to diversify and enlarge the audiences for cultural heritage events and institutions. Regarding the interpretation and creation of cultural and scientific content, 8 projects declared that they support citizens and organizations in the interpretation of cultural and scientific content. These projects provide an easier access to information about cultural resources and their interpretation, and facilitate the analysis of these resources, the organization of exhibitions and the visualization of cultural content.

Moreover, 6 projects declared that they support citizens and organizations in the creation of cultural and scientific content. In particular, they provide tools that enable end users to comment, interact and re-interpret cultural content. They also consider that the wider access to a major education on different and new cultural content provided by the projects, can be a source of inspiration for the creation of new content.

4.6.2.4 Impact on Knowledge Creation and Sharing

The relatively low score obtained by projects in terms of knowledge production and sharing (207,2) is explained, first of all, by the fact that no project indicated publications in journal with impact factor. If on one hand, this may indicate the need to spend a higher effort in order to produce publications on journal with impact factors, on the other hand, it is also true that most projects are far from the end of their activities and this kind of publication - which ask for a big investment in terms of effort and time - is usually done when projects results are available, i.e. at the end of the project.

Regarding the number of peer-reviewed articles, the projects under analysis published 160 peer-reviewed articles, for an average of 8,4 articles per project. Considering the number of 78 researchers involved in the project activities, the average number of peer-reviewed article per researcher is 2, that is quite low. The projects indicated also a total of 71 other scientific publications (non-peer reviewed articles, books, book chapters, conference proceedings and other electronically published or printed scientific outputs), for an average of 3,74 publications per project.

As already mentioned, considering these results, it is important to take into consideration also the fact that 11 projects out of 19 are still on going and have not yet finished their research activities. It is likely that the projects scientific production will increase in the coming months after the completing of their research phase.

Regarding research activities, 8 projects declared that they improve research processes. For example, their outputs will facilitate the analysis of content thanks to the interaction between technology and people, they will promote the creation of links between different research sectors and they will provide a better understanding of research costs. Moreover, 7 projects declared that they allow research activities that would have been otherwise impossible.

9 projects consider that interdisciplinary activities are very relevant in their project and 7 projects carry out or stimulate an inter-

disciplinary use of cultural contents and resources. The number of projects that consider interdisciplinary activity as relevant is positive, but more should be done in this direction as DigiCult is, per se, an interdisciplinary sector so that all projects should be more aware of this and include in their consortia non-ICT experts.

Finally, regarding the transfer of knowledge to wider audiences, 9 projects published articles on non-specialized magazines and on newspapers, for an average of 8,9 articles by project. 6 projects appeared on TV at least once. However, only 5 projects developed tools to support citizens and/or communities in the creation of cultural and scientific content.

4.6.2.5 Impact on Intercultural Dialogue, International Relations and Social Capital

Regarding Intercultural dialogue and relations within the European Union, only 9 projects declared that they contribute to the creation of a European culture and support the integration of the various national identities. This result is rather low considering the role culture could potentially play in strengthening the European Union construction and citizenship.

This is confirmed by the fact that only 6 projects established collaborations with local actors. This data demonstrate that the projects did not develop many relationships with actors outside the research sector and remain little connected to the local European realities.

In parallel, DigiCult projects have a positive impact on the social capital of its actors.

DigiCult collaborations and Social Capital was analysed by applying the Social Network Analysis (SNA) approach, considering firstly the collaborations declared among the 19 projects under assessment. The figure below visualises such relationships excluding relationships with projects others than DigiCult projects.

As evident, MAXICULTURE plays a relevant role in terms of number of collaborations and in terms of centrality. However, few projects (exactly 4) indicated MAXICULTURE as a project with whom

they are collaborating. The question proposed in the SAT left the concept of collaboration open, indicating any kind of formal or informal collaboration so that it is likely that many projects did not consider the testing of SAT and the provision of data for the self-assessment as a form of collaboration.

This network has 30 nodes; the network density is low and is equal to 0,078 (the network density varies from 0 to 1 were 1 indicated a network in which all the nodes are reciprocally connected). The network is quite centralized, around MAXICULTURE, and the centrality coefficient is 0,766 (it also varies from 0 to 1 were one is a network fully centralised around a single node).



Figure 44 - Collaboration network with MAXICULTURE

After having eliminated MAXICULTURE we see a different picture, where eCultValue, another support action, is able to link some projects and where some pairs of projects emerge (Figure 45).

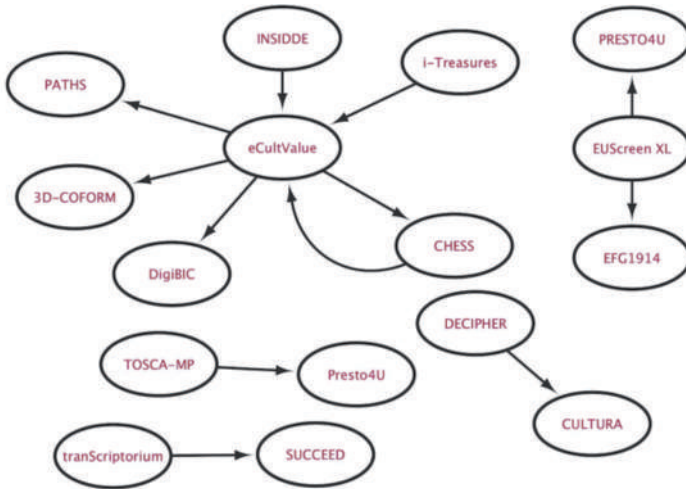


Figure 45 - Collaborations without MAXICULTURE

In this second network the number of nodes is 16, the network density is 0,092 (it is higher than in the previous network only because the number of nodes decreased) and the network centrality is 0,352. The level of collaboration among DigiCult projects appears low if compared with similar analysis run in other ICT domain (in SEQUOIA, ERINA+ and IA4SI projects). This situation should be improved: thanks to more effective collaboration projects could avoid duplications, reduce their costs (for example, co-organising events and test-beds) and maximise their impacts by combining and exchanging resources and outputs. In this sense, the EC can have an active role by organising ad hoc meetings among project and by asking them to converge on selected activities and topics. We will now consider the predecessors of the 19 projects under assessment, i.e. projects that pave the way to the actual ones. The

arrows indicate the identified predecessors (Figure 46). 8 projects out of 19 indicated a predecessor; this information per se is not positive neither negative. It can be used in further analyses for investigating how European funded projects live after the end of the funding period and how many projects are needed before a certain output is able to enter the market.

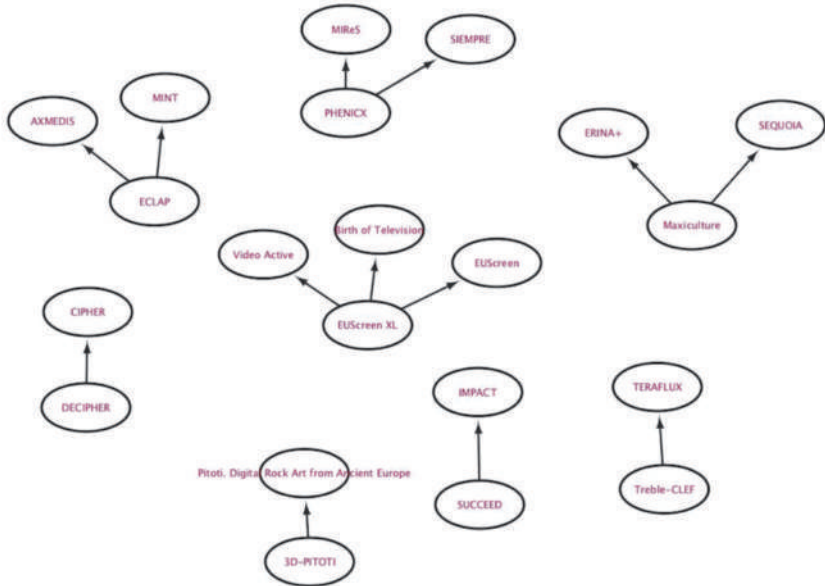


Figure 45 - Collaborations without MAXICULTURE

Finally, we now consider the collaborations of the 19 projects with all typology of projects, not limiting our analysis to DigiCult projects as in the first part of this paragraph. This network is more complex and diversified, it has 62 nodes, the density index is 0,038 and the centrality index is 0,367. The main gatekeepers in this network are, again, MAXICULTURE, eCultValue and EUScreenXL.

In this network it is possible to observe projects about big data, other Network of Excellence not belonging to the DigiCult domain, a project about energy efficiency, a Marie Curie project and va-

Considering now the relationship of DigiCult projects with actors outside European projects, we can see that 10 projects established new collaboration links with research actors, with an average of 7,7 new collaboration links by project. The quality level of these new collaborations is good, with an average rate of 4,45 on a 1 to 6 scale. This could indicate that project prefer to look for collaboration outside the EC funded projects domain. This could be due to lack of information about on-going projects, and should be further investigated.

4.6.2.6 Impact on Policies

Impact at policy level is another area in which DigiCult projects have a positive impact.

Overall, 7 projects declared that they have an influence on European policies in the DigiCult domain and on European policies in the area of cultural heritage and creativity.

They have a lower impact on policies at national level: 5 projects declared that they have an influence on national policies in the area of cultural heritage and creativity and 6 projects that they have an influence on the local/national expenditures on culture (expenditures on final goods and services).

In both cases the qualitative answers were very limited in contents so that it is not easy to understand how the project will reach this impact. Further investigation in tis respects could be useful.

4.6.2.7 Impact on Other Sectors: creativity, social innovation and others

12 projects declared to have impacts on sectors other than DigiCult. The sectors mentioned by the projects include: ICT sector in general (software and hardware), medicine, design, transports, tourism, education and social innovation.

4.6.2.8 Projects impact on society according to their characteristics

Considering project typologies, we can see that the typology of projects with a higher social impact is Integrated projects (IPs),

followed by support and coordination actions (CSAs) and medium-size projects (STREP). Network of excellence have a lower social impact, probably due to their research and academic networking nature.

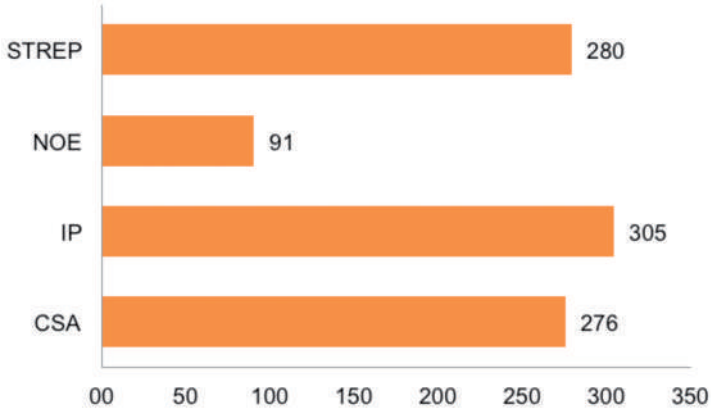


Figure 48 - Impact on society by instrument type

Considering the total cost of the projects, we can see that the projects with the higher impact on society are the projects with a medium budget (between 2 and 5 millions of euros) and not the ones with the highest budget (above 5 million of euros).

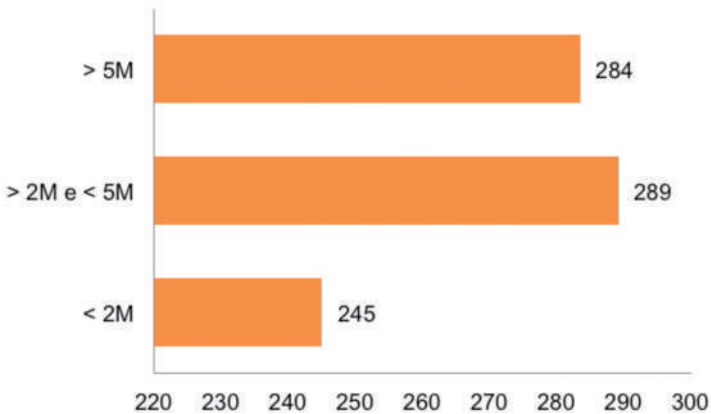


Figure 49 - Impact on society by budget class

Analysing the impact on society according to the projects end users, it appears that the projects which consider research actors as their end users (University & Research Centres as well as Research & Field Experts) are the ones with the major impact on society. On the contrary, projects considering ICT enterprises as well as museums and curators as their end users tend to have a lower impact on society.



Figure 50 - Impact on society of DigiCult projects according to the project end users

Considering the different phases of the projects, the projects currently in the commercialisation phase (Product Development) have a higher impact of society than the projects in the research or prototyping phase. This result can be explained by the fact that when the projects develop their products, they have a more direct contact with their end-users and stakeholders and are more likely to produce an impact.

Moreover, projects in the prototype phase have an impact on society slightly lower than the projects in research phase. This could be due in part to the fact that during the research phase projects have a higher impact in some specific areas such as on knowledge creation and sharing as well as on social capital (as the research phase is usually a moment in which researchers strongly collaborate among themselves and with stakeholders).



Figure 51 - Impact on society by project phase

Finally, the analysis of the impact on society of the projects grouped according to the typology of technological outputs presents very homogeneous results, so this variable does not seem to have an influence on the projects social impact. The only cluster with a strongly different result is the one composed by projects with technical outputs aiming at intelligent environments stimulation and enhancement. However, we must take into consideration that only 2 projects under analysis are part of this cluster, one of which has the second highest score for this index. Therefore, the data available is not sufficient to give a meaningful interpretation of the results obtained.

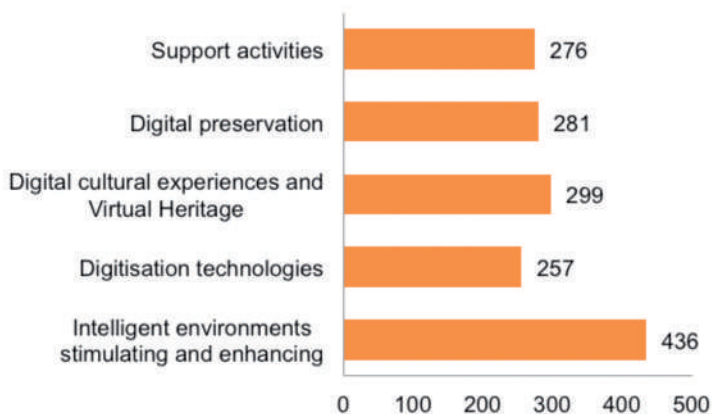


Figure 52 - Impact on society by project focus

4.6.2.9 Scientific outputs of the projects according their characteristics

We will now analyse the projects knowledge production and sharing according to their various clusters.

Considering the projects development phase, projects in the research and commercialization phases have in average published a little more than 10 peer reviewed articles, while projects in the prototyping phase have only published 1 peer reviewed articles. However, projects in the prototyping phase produce a higher number of other typologies of scientific outputs, such as non-peer reviewed articles, books or conference proceedings (the average number of other scientific outputs produced by projects in the prototyping phase amounts to 4,75, against 4,18 for projects in the research phase and 1,5 for projects in the product development phase).

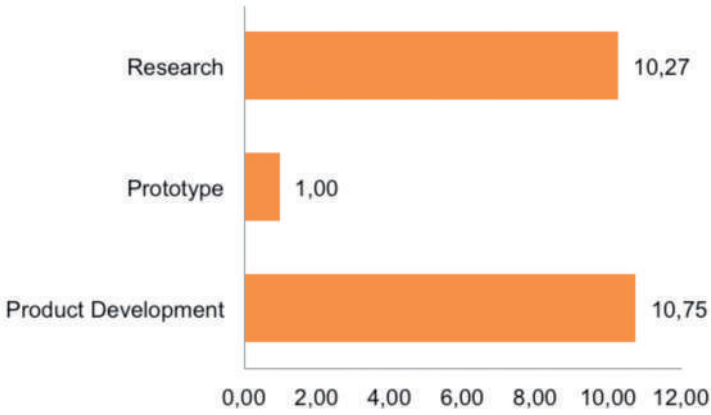


Figure 53 - Average number of peer reviewed articles published by DigiCult projects by project development phase

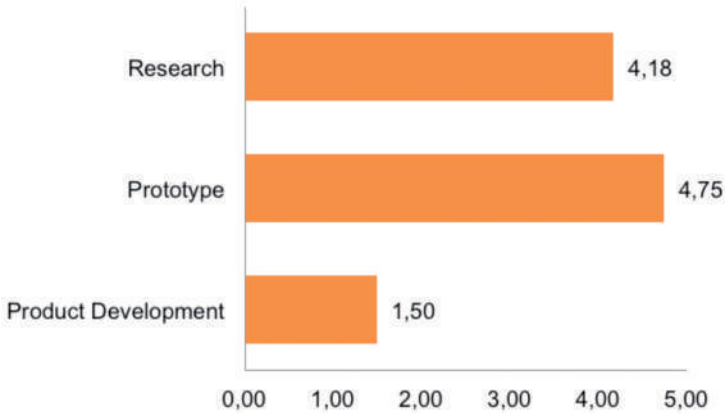


Figure 54 - Average number of other scientific outputs produced by DigiCult projects by project development phase

Considering the projects total cost, we can see that the projects with a lower budget have a very low number of scientific outputs (an average of 0,33 peer reviewed articles and no other scientific output). This is linked to the fact that the projects with a low budget are all support actions (CSA).

Compared to projects with a medium budget, projects with a high

budget tend to produce less peer reviewed articles (with an average of 2,75 against 6,44) but produce more scientific outputs of other kinds (with an average of 15 against 11).

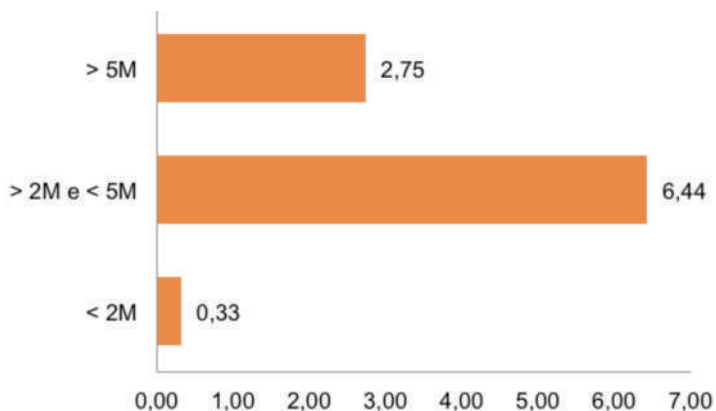


Figure 55 - Average number of peer reviewed articles published by DigiCult projects by project budget class

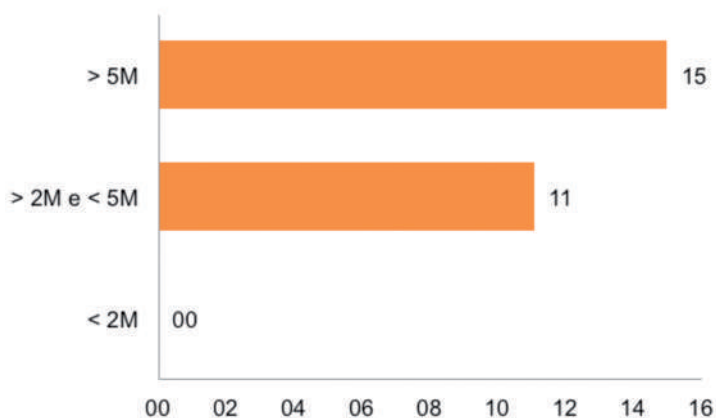


Figure 56 - Average number of other scientific outputs produced by DigiCult projects by project budget class

Considering projects instrument type, we can see that medium-size projects (STREP) have published in average 11,89 and 6,67 other scientific output (such as non-peer review articles, books, book's chapters, conference proceedings) and Integrated projects (IPs) an

average of 13,25 peer reviewed articles and 2,25 other scientific outputs. Support actions (CSA) have a much lower scientific production, with no peer reviewed articles and an average of 0,4 other scientific output. This result is coherent with the objectives of support actions, which are not focused on research activities. Finally, we do not have any information about the scientific production of the network of excellence, as the only project belonging to this category (Treble-CLEF) did not fill this section of the SAT.

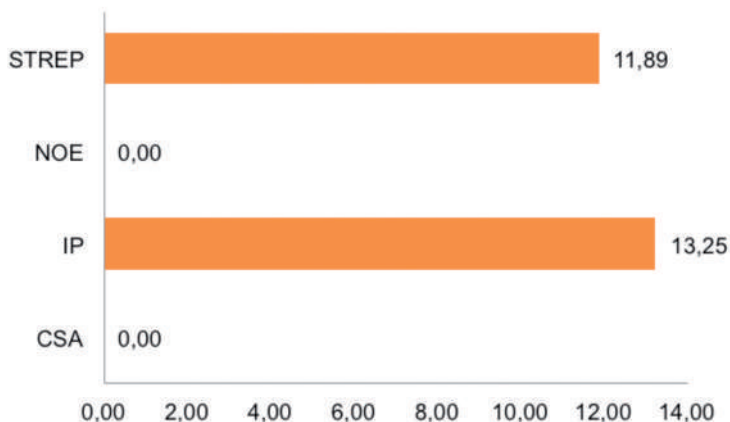


Figure 57 - Average number of peer reviewed articles published by DigiCult projects by instrument type

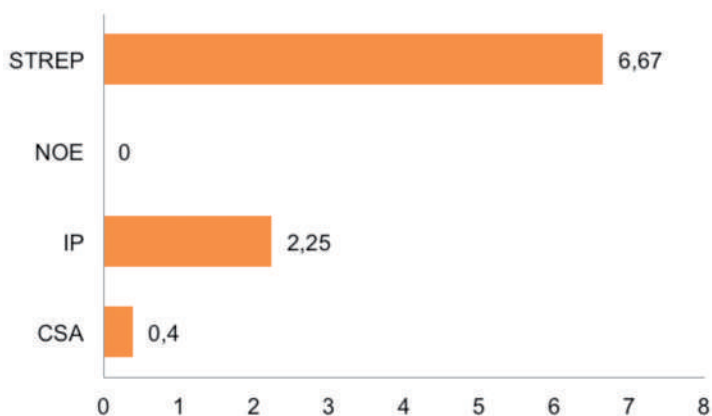


Figure 58 - Average number of other scientific outputs produced by DigiCult projects by instrument type

Concerning the projects end users, we can see that the projects which consider European projects, Libraries & Archives, University & Research Centres as well as Research & Field Experts have published a high number of peer reviewed articles (the average number are respectively 13,2, 10,5, 10 and 8,6). On the contrary, projects which consider Enterprises and Policy Makers as their end users have published few or no peer reviewed articles. Considering other kinds of scientific outputs, the results are completely different: the projects which produced the highest number of less scientific outputs are those who consider as their end users the Creative Sector, Citizens, Cultural Heritage Institutions, Curators and Museums (respectively with an average of 6,3, 5,3, 5, 4,5 and 4,5). Only projects that consider Libraries and Archives as their end users produced a high number of other scientific outputs as well. These results put in evidence the fact that projects tend to produce the typology of scientific outputs that are more likely to reach and interest their categories of end users: peer reviewed articles for the research actors and non-peer reviewed articles and conferences for actors of the creative and cultural sectors.

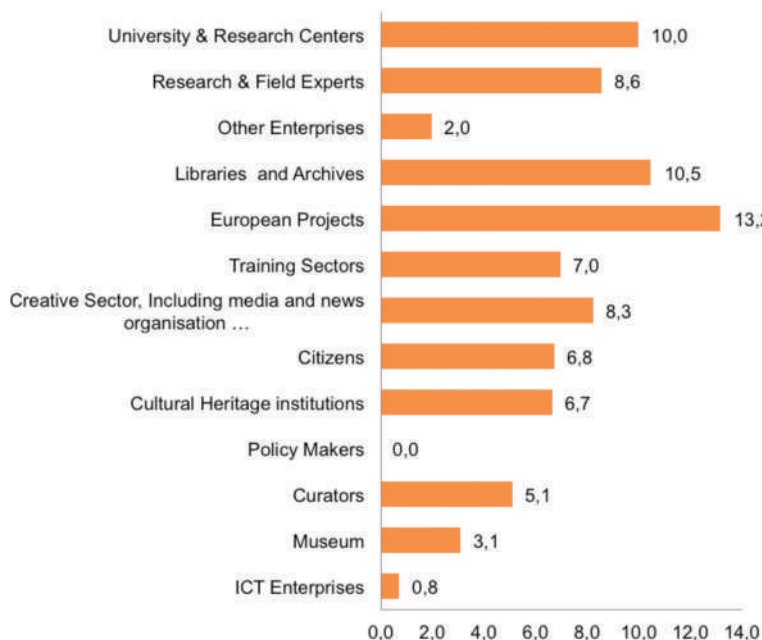


Figure 59 – Average number of peer reviewed articles published by DigiCult projects by project end users



Figure 60 - Average number of other scientific outputs produced by DigiCult projects by project end users

Finally, considering the project focus, we can see that the projects belonging to the cluster Support activities (which are all CSA) did not publish any scientific output. This result is coherent with the typology of activities carried out by these projects.

The other clusters have homogeneous results on this aspect, except for the high number of peer reviewed articles published by the projects focused on Intelligent environment stimulation and enhancement. However, as we explained above, the composition of this cluster does not enable a meaningful explanation.

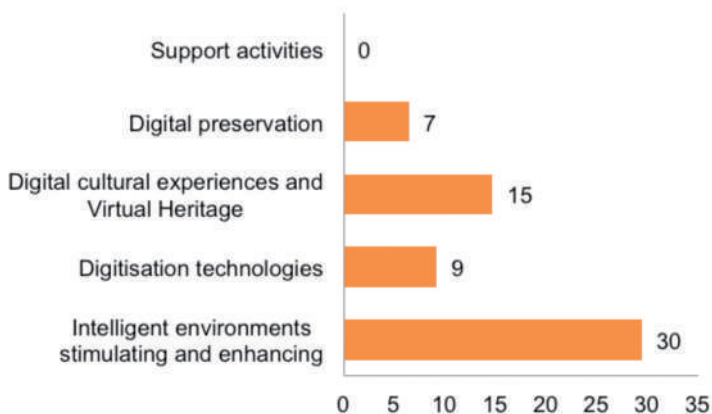


Figure 61 - Average number of peer reviewed articles published by DigiCult projects by project focus

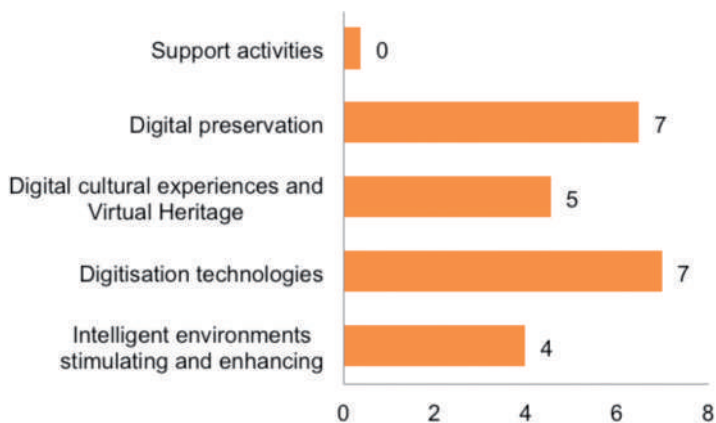


Figure 62 - Average number of other scientific outputs produced by DigiCult projects by project focus

4.6.3 Impact on DigiCult & Creativity

The average score obtained by the projects for the impact on DigiCult and Creativity is 407,63 (on a 1-1000 scale.) This represents the highest score among the impact areas and the transversal in-

dices.

Among the sub-indices that form the impact DigiCult and Creativity, the domain obtains a rather relevant value on the Creative (re)use (543,28) and Content Preservation (409,72) while the Content Access and Management scores 230,58 and this is an element that might be explored also from the policy perspective.

The projects that are the most promising in terms of Impact on DigiCult & Creativity:

- are in their research phase;
- have a budget between 2 and 5 million euros;
- are Coordination and Support Actions but also STREP and IP score more than 400 points;
- focus on “Intelligent environments” with a score of 600 but also the “Digitization technologies” and the “Support activities” score more than 400.

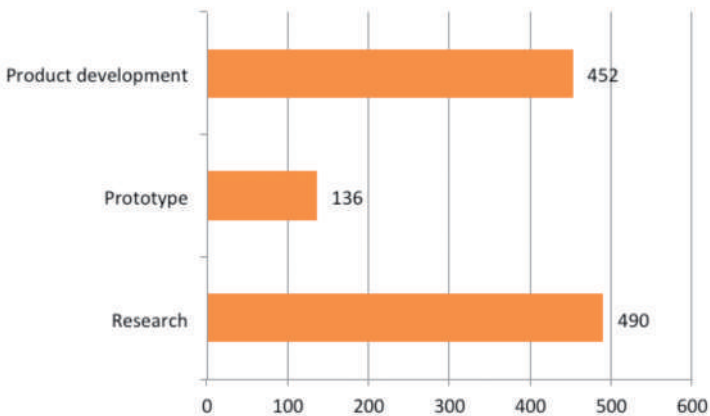


Figure 63 - Impact on DigiCult & Creativity by project phase

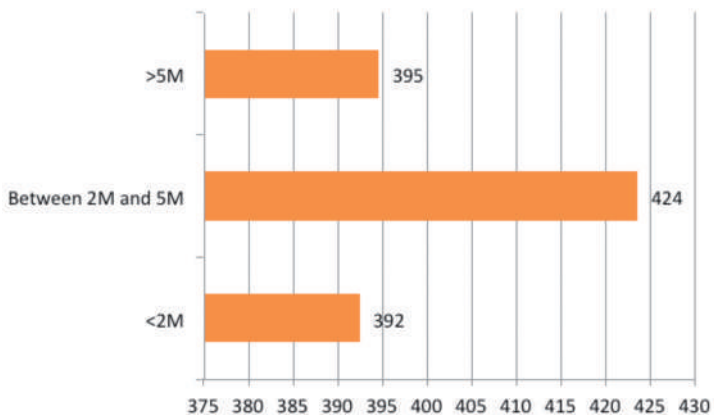


Figure 64 - Impact on DigiCult & Creativity by budget class

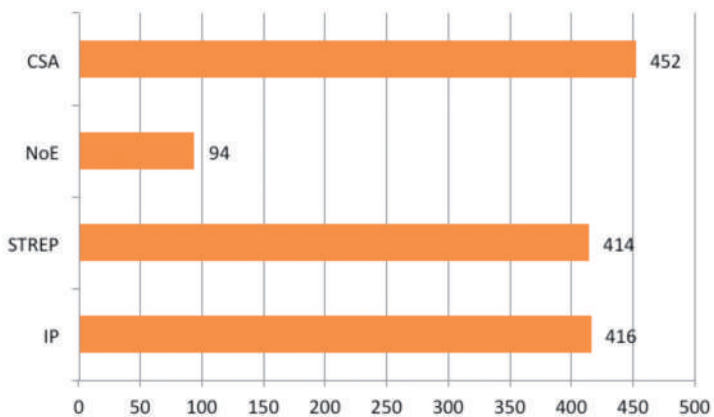


Figure 65 - Impact on DigiCult & Creativity by instrument type

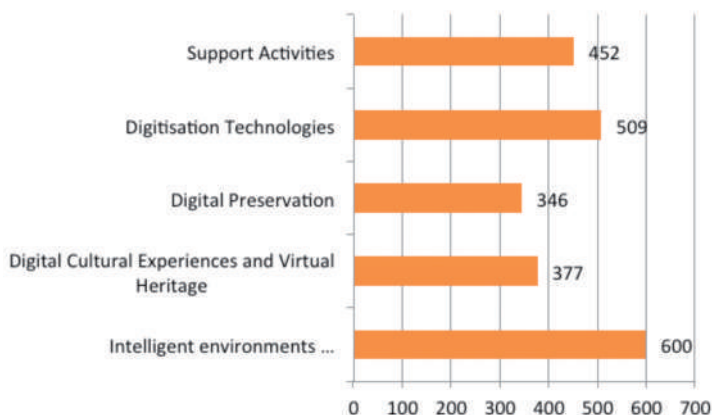


Figure 66 - Impact on DigiCult & Creativity by project focus

4.6.4 Technological impact

The average score obtained by the projects for the technological impact is 315,84 (on a 1-1000 scale.) This represents the second best score among the impact areas and the transversal indices. Among the sub-indices that form the Technological impact, the domain obtains a rather relevant value on the Output Technological Innovation (350,82) while the Technological Readiness scores 280,84 and this is an element that might be explored also with the perspective of Horizon 2020.

The projects that are the most promising in terms of technological impact:

- are in their research phase;
- have a budget over 5 million euros;
- are STREP;
- focus on “Intelligent environments” even though all the foci score more than 300.

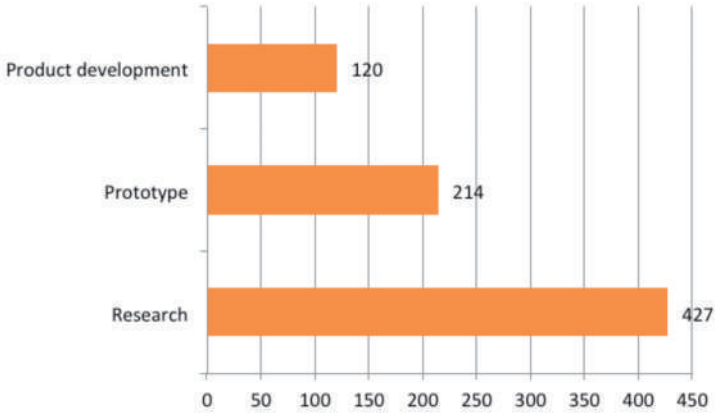


Figure 67 - Technological impact by project phase

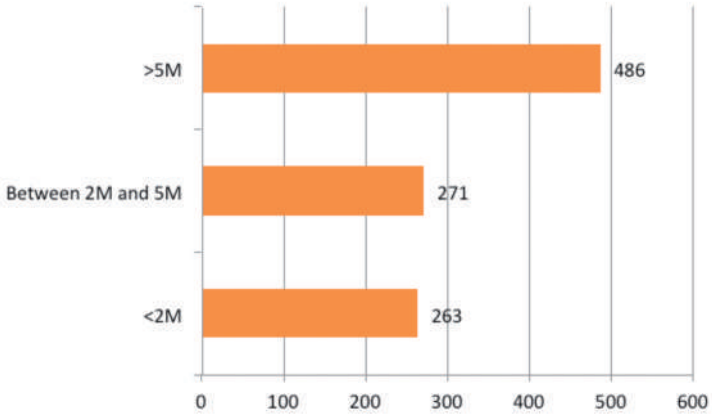


Figure 68 - Technological impact by budget class

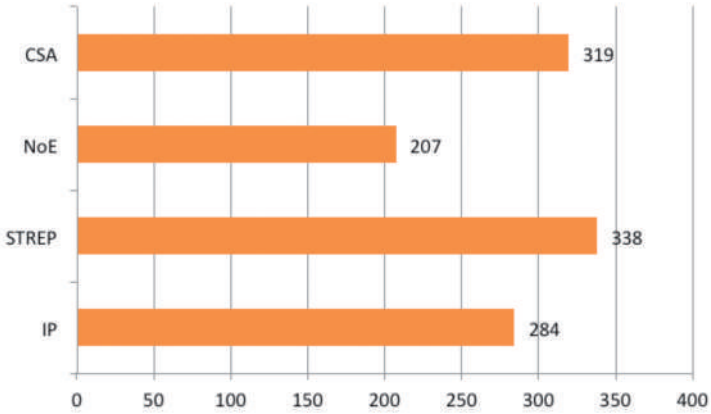


Figure 69 - Technological impact by instrument type

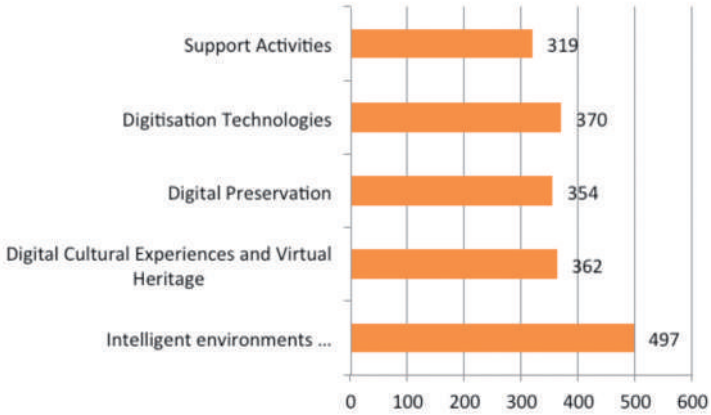


Figure 70 - Technological impact by project focus

It is worth to mention the evidence that projects that aim to produce a technological impact need to mobilize an important amount of resources being to enhance the research state of the art in different sectors.

4.6.5 Efficiency

The average score obtained by the projects for the impact on efficiency is 310,60 (on a 1-1000 scale.)

The projects that are the most promising in terms of Efficiency:

- are in their research phase;
- have a budget over 5 million euros;
- are STREP;
- focus on “Intelligent environments” with a score of 608 but also the “Digitization technologies” and the “Digital Cultural Experience” score more than 400.

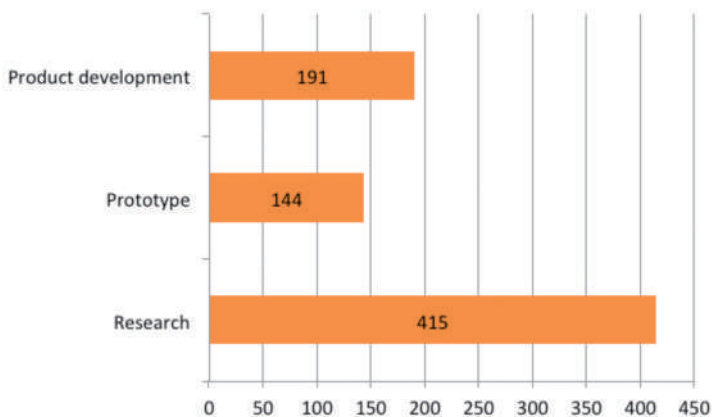


Figure 71 - Efficiency by project phase

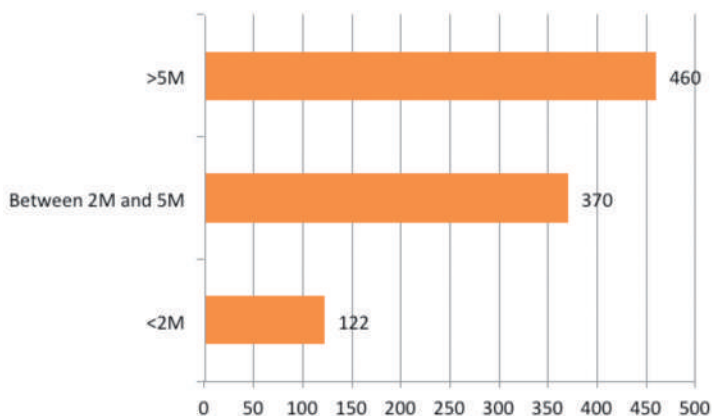


Figure 72 - Efficiency by budget class

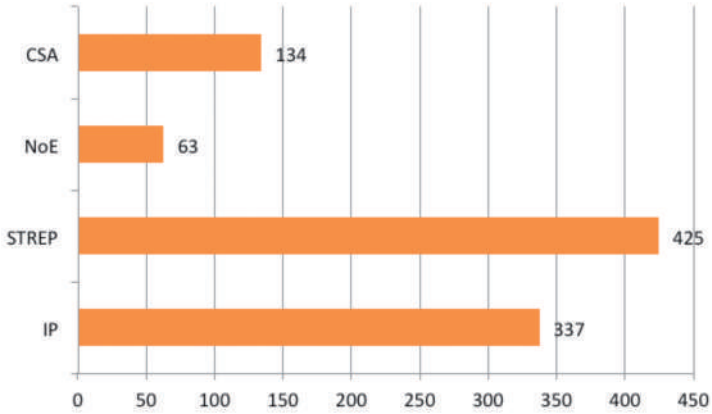


Figure 73 - Efficiency by instrument type

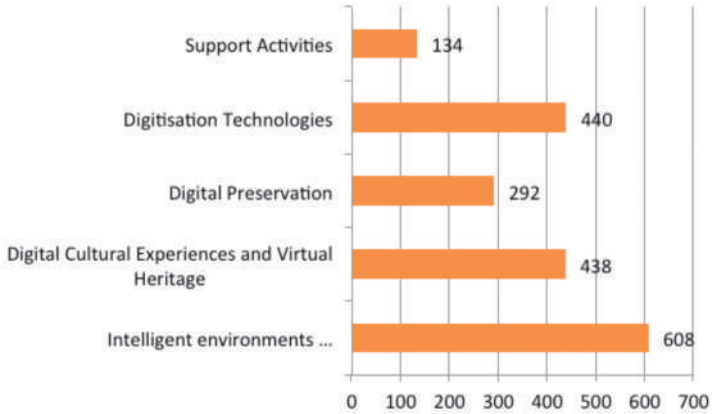


Figure 74 - Efficiency by project focus

From the analysis emerges that projects with a higher budget are more efficient and efficiency enabler than the others. This is probably due to the economies of scale and scope. This can be also explained through a common character that emerges from the analysis: STREP with quite high budget are in general more performant.

4.6.6 Effectiveness

This transversal index aims to evaluate to what extent the projects outputs are aligned to their objectives and will produce an effect, in particular after the end of the projects. To create this index, we analysed the instruments established by the projects to assure the achievements of their goals.

The average score obtained by DigiCult projects for the index on effectiveness amounts to 205,57 on a 0-1000 scale.

Looking into the composition of the index, we can see that while 79% of the projects have an internal monitoring system, this data decreases to 42% when asked about an internal risk assessment system.

Regarding the technological outputs, half of the projects which expect to have an impact on technology tested their outputs in large-scale testbeds, with good results (in average the testbeds confirmed the applicability of the outputs for a score of 4,4, on a scale from 1 to 6).

Only 4 projects (representing 21% of the sample) developed outputs, which will provide more efficient and effective selection of resources to be preserved and/or used.

Finally, regarding the economic aspects of these indices, while almost half of the projects (43%) which expects to have an impact on economy considered likely business models, only 19% created an actual business plan.

The overall score obtained by projects on effectiveness is therefore not very high. However, looking at the details we can see that this result can be in part explained by the fact that a large number of projects are still in the middle of their lifetime and have not yet implemented all the activities to ensure their outputs effectiveness (such as testing in large-scale test-beds or elaborating business plans). It would be necessary to analyse the situation of the project again at a later stage.

As shown by the figure below, the Support Actions (CSA) and the medium-size projects (STREP) tend to have a higher effectiveness than Integrated Projects (IP). As explained before, we cannot ana-

lyse the data about the Network of Excellence as it reflects the score obtained by only one project.

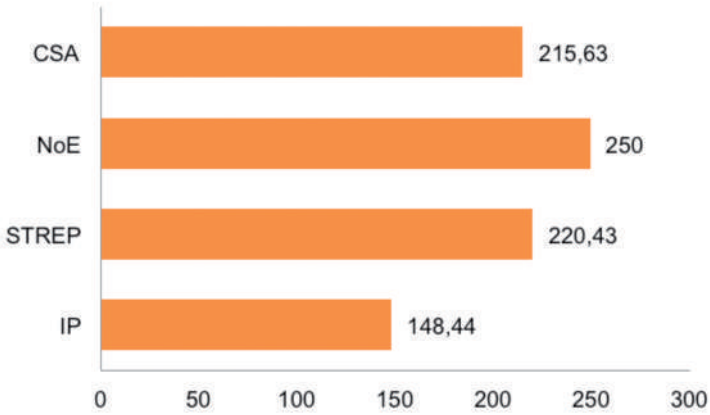


Figure 75 - Effectiveness by instrument type

Considering the total cost of DigiCult projects, we can see that projects with a medium and lower budget have a higher effectiveness than the projects with a high budget. This result shows that projects with a high budget tend to establish less tools and mechanisms to ensure the achievement of their goals at the end of the project.

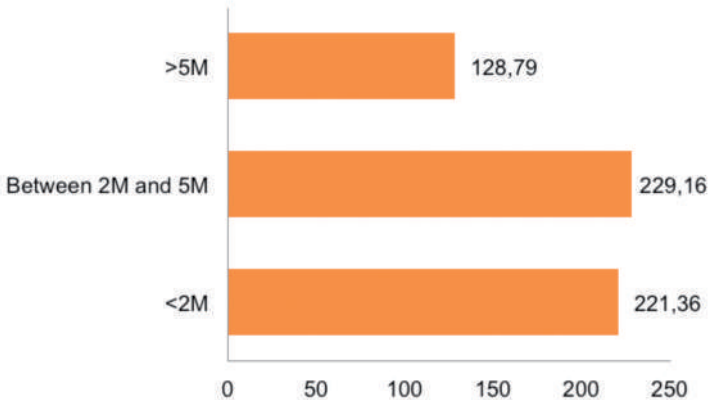


Figure 76 - Effectiveness by budget class

Considering the development phase of the projects, we can see that projects in the product development phase have a higher effectiveness than the others. This result is not surprising considering that at this stage the projects should have already tested their outputs and be developing business plans for the commercialisation of their outputs.

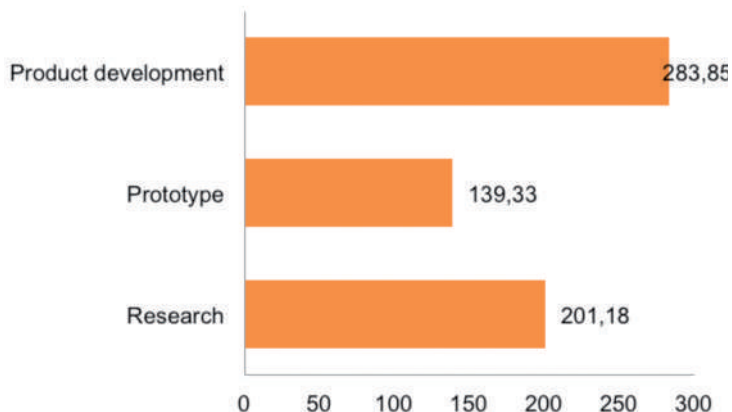


Figure 77 - Effectiveness by project phase

Looking at the projects effectiveness according to the typology of end users they identified, we can see that projects developing outputs aimed at research actors (Research and Field experts as well as University and Research Centers), Libraries and Archives and European projects obtained a higher score. Projects, which consider ICT enterprises as their end users obtained an average score (210,9), while the ones considering Other Enterprises obtained a low score (145,8). Finally, projects, which consider cultural actors (Museums, Cultural Heritage Institutions, Curators) and the training sector as their send-users have a low effectiveness.



Figure 78 - Effectiveness of DigiCult projects according to the project end users

The figure below shows that projects working on digital preservation and digitisation technologies have a higher effectiveness, while projects working on digital cultural heritage experiences and virtual heritage tend to have a lower effectiveness.

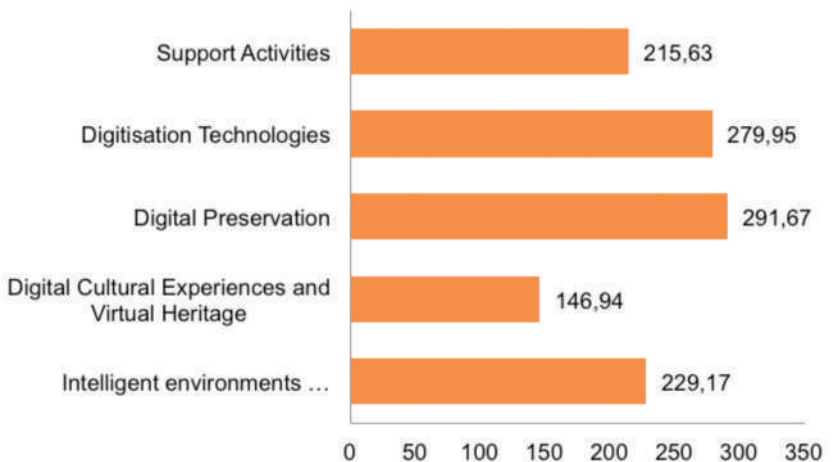


Figure 79 - Effectiveness by project focus

4.6.7 Innovativeness

The average score obtained by the projects for the impact on innovativeness is 234,53 (on a 1-1000 scale.)

This index covers product, process and organizational innovation related both to technological and non-technological outputs of the DigiCult projects. The average score obtained by DigiCult projects for the index amounts to 234,53 on a 0-1000 scale.

In the analysis of this index, it is important to take into consideration the fact that most of the variables used to create this index belong to the category “Impact on Technology” inside the SAT. For all the projects indicating that they will not have an impact on technology (overall 5 projects, so 26% of the sample), their innovativeness has been evaluated on the basis of 2 variables only: the number of peer reviewed articles and their self-evaluation about the development of more innovative tools for Cultural and Creative Industries. Therefore, the score of these projects tends to be very low, except for one project, which published a high number of peer-reviewed articles.

Regarding the innovativeness of technological outputs, it appears that the projects will have an impact more in terms of product innovation than process or organizational innovation.

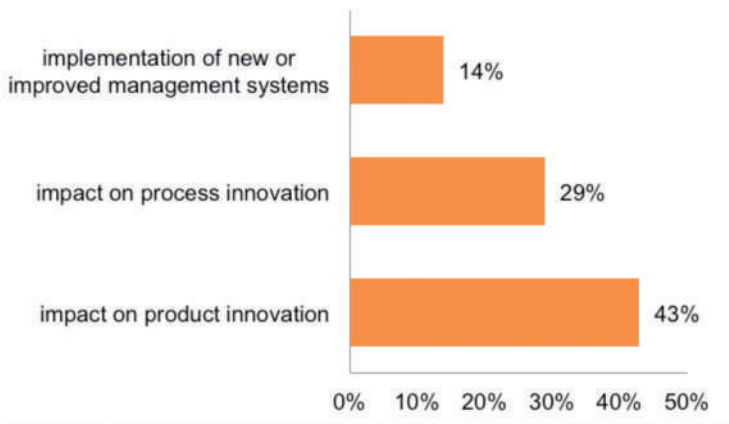


Figure 80 -Impact on innovation of technological outputs of DigiCult projects

43% of the projects (we consider here the number of projects which selected a value of 4 or more on a scale from 1 to 6, compared to the total number of project which consider that they will have an impact on technology) declared that they will have an impact on product innovation and 29% work with specific management strategies or business practices in developing new product offerings. 36% of the projects consider that their new product offering will reduce the actual delivery time. Only 2 projects developed patents (respectively 2 and 3 patents), which is not surprising. In fact, from our previous experience we can say that only few EU projects develop patent or patent application during the life-time for a number of reasons, including the fact that software (which is the main outputs of this kind of projects) is not allowed to be patented in Europe. However, the fact that only 4 projects indicated IPRs created by the project, for an average of 8,22 IPRs per project, is more unexpected. It seems likely that some projects did not understand the importance of IPR and therefore could not enter the right information. Again, the IPR-related question is in the technological impact section in the SAT, which many project did not fill not providing then the information about IPRs.

Regarding process innovation, 29% of projects expect to have an impact on this aspect. 14% of the projects have routinized processes to capture and use new ideas and 36% introduced a new or significantly improved service offering that will reduce the actual delivery time. Finally, 14% of the projects are implementing new or improved management system and the same percentage improves logistic system for their input. None of the projects is implementing improved methods to organize work responsibilities, decision making or supporting activities.

Concerning the innovation of non-technological outputs, 3 projects, representing 19% of the whole sample, are producing innovative tools for the Cultural and Creative Industries.

The projects that show a higher level of innovativeness are the medium-size projects (STREP), the Network of Excellence (NoE) and the Integrated projects (IP). Support actions (CSA) present a

lower level of innovativeness. This result is explained by the fact that most of the support actions do not foresee any impact on technology in their self-assessment.

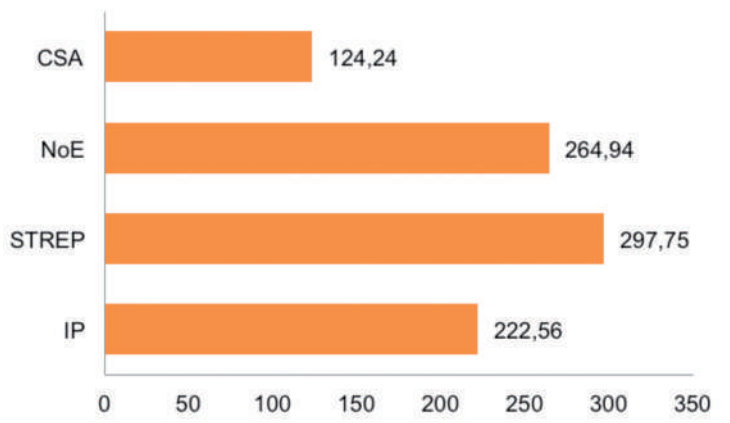


Figure 81 - Impact on innovativeness by project instrument

As presented in the figure below, projects with a high budget have a higher level of innovativeness, while projects with a lower budget have a lower level of innovativeness. Here again, in analysing this result we must take into consideration the fact that two third of the projects with a low budget do not expect to have an impact on technology.

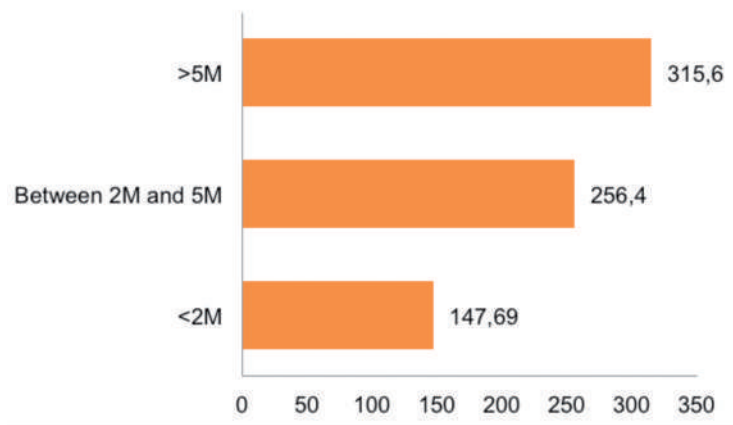


Figure 82 - Impact on innovativeness by project cost

The development phase of the projects does not seem to have a strong influence on their innovativeness as they obtained quite homogeneous scores on this index. Projects in a research phase obtained slightly more positive results, while projects in the prototype phase obtained lower results.

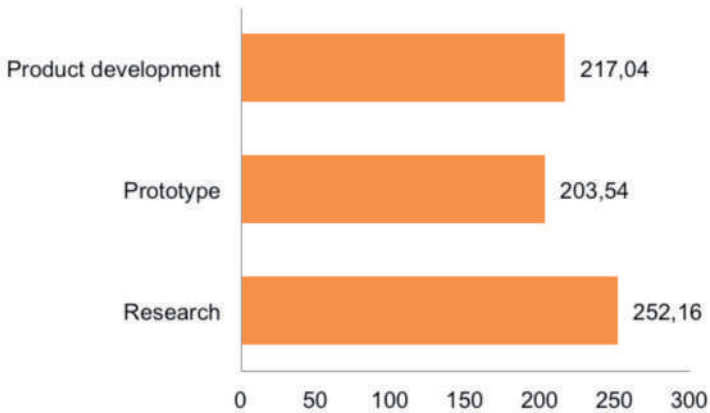


Figure 83 - Effectiveness by project phase

The projects with the higher level of innovativeness are those that consider as their end users' libraries and archives, citizens, actors of the cultural and creative domain (cultural heritage institutions, museums, creative sector) and European projects. On the opposite, projects developing outputs aimed at enterprises (ICT and other sectors) appear to have a low level of innovativeness. The data about policy makers is linked only to MAXICULTURE without an impact on technology.



Figure 84 - Impact on innovativeness of DigiCult projects according to the project end users

Projects whose technological outputs belong to the cluster “Intelligent environments” obtained the highest score regarding their innovativeness, followed by those belonging to the cluster “Digital Cultural Experiences and Virtual Heritage”. The projects focused on Support Activities have a low score in terms of innovativeness.

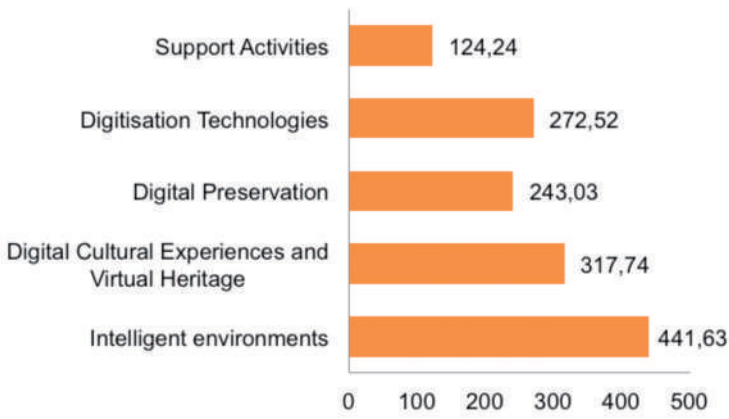


Figure 85 - Impact on innovativeness by project focus

4.6.8 Sustainability

The average score obtained by the projects for the impact on Sustainability is 272,78 (on a 1-1000 scale.)

The projects that are the most promising in terms of Sustainability:

- are in their research phase but also the product development phase is over the average score;
- have a budget over 5 million euros;
- are STREP;
- focus on Intelligent environments.

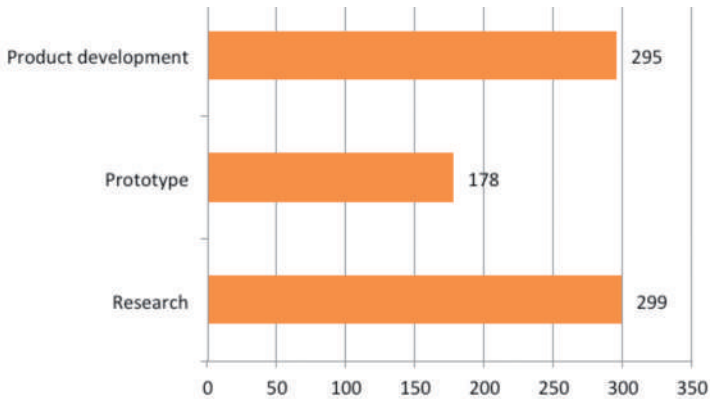


Figure 86 - Sustainability by project phase

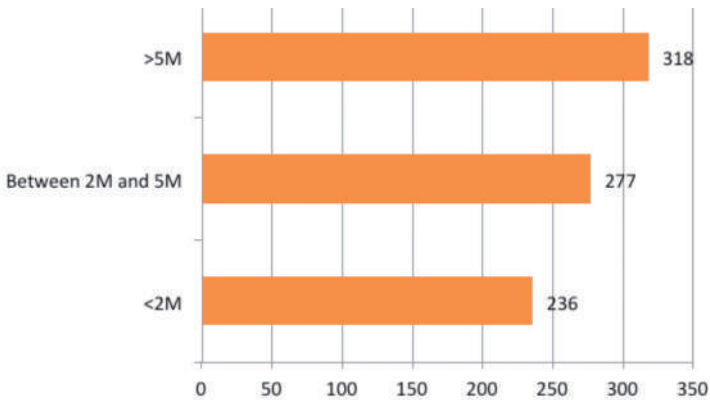


Figure 87 - Sustainability by budget class

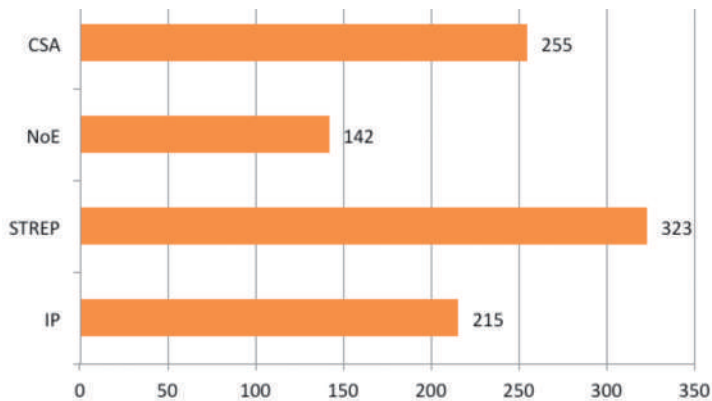


Figure 88 - Sustainability by instrument type

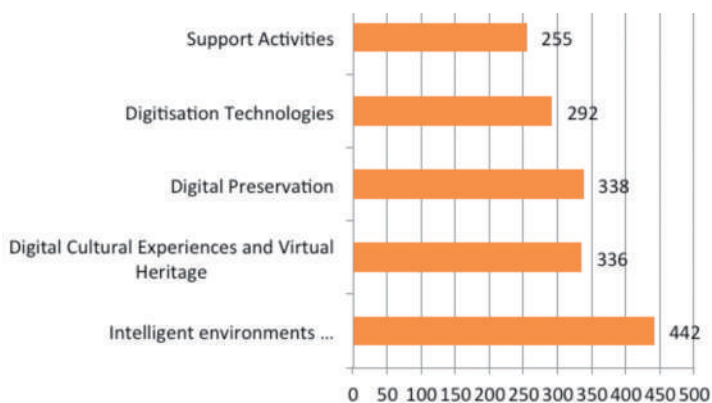


Figure 89 - Sustainability by project focus

Looking at the typical economic and sustainability indicators, the SAT calculates the Economic Net Present Value (ENPV) for each project. It was possible to calculate these indicators only for some projects that provided the needed information. These projects are:

- CHES
- ECLAP

- EEXCESS
- EUScreen XL
- Maxiculture
- SUCCEED
- tranScriptorium
- Treble-CLEF

Four projects registered a negative ENPV and consequently an almost null BCR. The other four projects obtained positive value and it is worthwhile to notice that 3 of them are the “product development” phase where the exploitation phase is already started. In general, the sum of the ENPVs is highly positive as well as the BCR but a larger sample would improve the quality of this data.

In general terms it is worth to notice that projects put a scarce attention in their sustainability plans both in terms of exploitation plans and involvement of users and stakeholders.

Conclusions and recommendations

In conclusion, we have to acknowledge that, as stated in the Eval-
sed guide (2012) “Linking policies, programmes, priorities and specific
interventions or projects is a perennial problem in evaluation”
(p.10). Anyway, “project evaluation is one input into programme
evaluation” [Ibidem] and, even when it does not cover the full uni-
verse interested by a programme, is still a valid input into a wider
evaluation picture.

Consequently, an impact assessment methodology can be useful
among the different stages of the innovation project development:

- before a project starts in which case it is an ex-ante assessment;
or
- during the life of a project in which case it is an on-going (in
itinere) impact assessment; or
- at the end or, after the end of a project in which case it is an
ex-post assessment.

The approach presented here has been developed with the pur-
pose to be an on-going impact assessment methodology and to
be used, at regular time intervals, during the different stages of
project development. The methodology can also be used for an
ex-post impact assessment and we tested also this usage by en-
gaging projects that were already finished at the time of the as-
sessment. However, as already described, EU funded projects
show a peculiarity as a “target” of an impact assessment. In fact,
differently from companies or research centres, a consortium im-
plementing an EU funded project can be seen as a temporary or-
ganisation: a group of persons from various institutions and
countries working on a shared objective and developing a shared
working culture, but for a limited timeframe. After the end of the
project, the temporary organisation disappears and this makes the
involvement of finished projects very difficult. Besides, the com-

mitment of former consortia is low, as the project has been already assessed by the EC through the final review and, finally, there is no budget available for the assessment activities that might be time-consuming, especially if the requested data was not collected during the life-time of the project. For this reason, the on-going nature of the methodology should be stressed in future applications.

5.1 Stakeholders of the self-assessment methodology and tools

Another aspect to explore is the motivation of a project to use the methodology and to implement a socio-economic impact self-assessment. As stated in the EVALSED guide “The resource for the evaluation of Socio-Economic Development” (2012), “evaluation is not an end in itself”, but has to justify the difference it makes for its stakeholders. In our case, three main stakeholders can be identified: DigiCult projects, the EC and more precisely the DG Connect, Unit G2 and the European citizens intended also as final users.

DigiCult projects can now benefit of a free instrument to conduct an impact self-assessment, designed by independent experts through a participatory process that allowed the projects themselves to follow the methodology development process, understand it and suggest changes and improvements. Moreover, the methodology allows projects to monitor their progress by repeating the assessment over time. It is also possible for projects to compare their results with similar projects in terms of budget, research focus, stage of development and instruments. In this way, the methodology and the SAT, being an instrument for on-going impact assessment, can support projects in:

- a) Re-orienting their activities in order to maximise their impact; indeed, the SAT provides the detail for each indicator showing which are the strengths and the weaknesses that need to be improved.

- b) Better communicating their results and impacts to potential investors and to the EC.
- c) Becoming more self-reflective by paying more attention to impacts and opening a learning process that can potentially lead to new project proposals designed with more concrete targets in terms of desired impacts.

For the EC and DG Connect- UNIT G2, the tools can be the instruments for on-going impact assessment that should be linked and aligned to the ex-ante evaluation and ex-post evaluation of the Di-giCult programme implemented at higher programme level (ICT programme) by external experts.

According to the Evaled Guide (2012) there are four main common acknowledged reasons of impact assessment. We adapted this classification as follows:

- Planning-efficiency: ensuring that the resources are used in an efficient way.
- Accountability: showing the results of a project/programme, how well the resources have been used and what are their impacts.
- Implementation: improving the performance of projects and of the programme and the effectiveness of how they are managed.
- Knowledge production: understanding if the expectation of the project/programme have been met, what worked well and what did not, what can be learned from the project/programme, how project/programme design and management can be improved.
- Institutional strengthening: improving and developing capacity among programme/project participants.

Of course, different stakeholders have different purposes and can also have more than a single objective when running an impact assessment, as we already described. The table below synthesises the relation between stakeholders and the impact assessment purposes:

	Planning- efficiency	Accountability	Implementati on	Knowledge production	Institutional strengthening
DigiCult projects	X	X	X		
EC and DG Connect- UNIT G2	X	X	X	X	X
EU Citizens (Users)		X	X		

Table 38 –Methodology and SAT stakeholders and their purpose in running the impact assessment

5.2 The Hype Cycle of the DigiCult domain

The aggregate analysis of the DigiCult and Creativity domain has highlighted interesting and relevant findings in terms of adoption of the technology and results achieved by the domain. More specifically, by analysing the current phase of the projects participating in the final self-assessment, it emerged that most of the projects are in the research phase, when the technology is still not available and not mature. This is confirmed by the fact that during this stage the project are more willing to invest on the technology for its future development. In the prototype phase, the projects usually achieve lower results than expected in terms product/process development. Hence, during the product development phase, they have more realistic expectations about the actual product/service potential. When the projects are in the product development phase, the total score of the domain tends to increase even if it remains lower than the score of the research stage.

Indeed, the aggregate analysis shows that the investments of the DigiCult and Creativity projects and the development of their technologies follow a Hype Cycle trend. As from the Gartner definition: “Hype Cycles provide a graphic representation of the maturity and adoption of technologies and applications, and how they are potentially relevant to solving real business problems and

exploiting new opportunities”³⁸.

The projects in the research phase are in the technology trigger stage, the platform/software is still not available, but the projects are yet promoting their outputs. The projects in the prototype phase fall from the peak of inflated expectations to the trough of disillusionment because they have developed a prototype that in several cases can be a success, but also a failure. The projects are not willing to invest more in outputs that are not yet a final product and cannot be sold on the market. The projects in the product development phase are in the Slope of the enlightenment/Plateau of productivity. These projects have already developed the final product, which has been validated and is ready for the commercialization. The following image shows how the Hype Cycle fits within the DigiCult and Creativity domain, as identified through the assessment results at aggregate level.

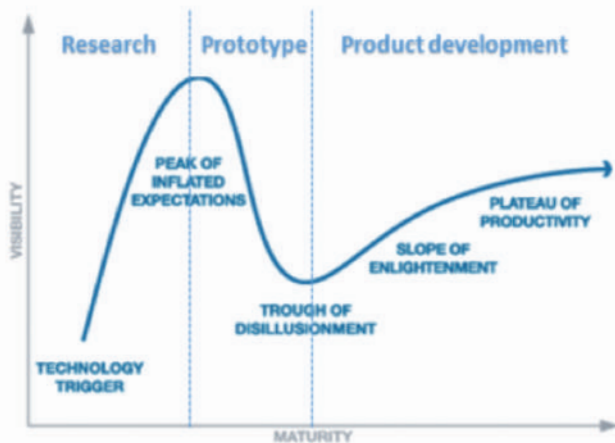


Figure 173 - Hype Cycle of the DigiCult and Creativity domain

³⁸ <http://www.gartner.com/technology/research/methodologies/hype-cycle.jsp>

5.3 Conclusions and recommendations for the DigiCult & Creativity Projects

From the assessment of the DigiCult and Creativity projects at aggregate and at project level, we detected that the SAT well supported them in identifying potential impacts that were not originally expected. Indeed, several projects have selected some areas of impacts as less relevant (for example i-Treasures assigned less important to the Economic Impact), but the through the SAT they realised that they could be able to achieve a high impact on these areas. In this sense, the SAT has proved to be a useful tool for exploring the actual and potential impacts that can be developed by the project not only in the DigiCult and Creativity domain, but also in other sectors.

Moreover, it is evident that projects which enter more data obtain also a more detailed and useful report; we expect that this will motivate on-going and future project in spending more time on the SAT in order to best deploy the tool.

In terms of impact on the domain, the projects have achieved relevant results especially in the development of innovative ways to experience culture, to reuse digital cultural content through creativity and to retrieve it through new digital preservation techniques.

However, it also emerged that the projects should work more on involving not only cultural heritage institutions but also CCIs, universities, research centres and field experts as their main stakeholders. More in detail, the projects do not consider at all policy makers/governments and citizens as stakeholders.

The Content Access and Management subcategory of the impact on DigiCult & Creativity is the one that should be improved by the projects in order to increase sustainable access to content in a meaningful and usable manner, by improving the access to high volumes of digital content, supporting content lifecycle management, improving sharing and personalised presentation/consumption of digital content.

In terms of Technological Impact, the Technological Readiness Level of the technologies developed by the projects is only slightly considered. The projects should consider from the beginning in the analysis of the output, the potential exploitation that the specific technology has and could achieve. Indeed, the assessment shows that only the projects in the product development phase evaluate the TRL of the outputs.

The analysis of the Economic Impact showed that most of the DigiCult & Creativity projects have difficulties in providing an increase of the Economic results for their stakeholders and end-users. Indeed, the lowest results have been achieved by the projects on Competitiveness, Regional attractiveness and tourism and Impact on Cultural and Creative Industries. This result is surprising, considering that the DigiCult & Creativity domain should provide relevant impacts on improving the economic result of CCIs and Regions through the platform and the activities developed. For this reason, we can suggest to the projects to pay more attention to increase market opportunities, in particular for the benefit of business partners, to provide business models and business plan of each project and of each commercial partner in the consortia. In terms of improvement of the impact on Regional Attractiveness, the projects should support the European tourism to increase the value created by the resources available and to provide financial resources to the tourism industry. In terms of impact on supporting CCIs, the projects should increase the access to finance of the sector, the market and developing collaborative business environments. Finally, the projects should actively involve creative industry professionals in the development of these tools/platforms since the beginning of the project.

In terms of Innovativeness, it emerged that the projects in the DigiCult & Creativity domain will have a higher impact in terms of product innovation than on process or organizational innovation. On the other hand, project aim to improve product but they reserve few attentions to the user needs (see paragraph 6.4).

With reference to the impact on society, this area is underestima-

ted by the projects so that their impacts are low. Clearly, the social impact is mainly related to indirect impacts, which may need more time for becoming visible. Nevertheless, the projects should pay more attention in targeting different social groups, in exploiting the potentialities of the ICT domain and of the cultural heritage, in order to support local, national and European identity for including people at risk of social exclusion, in fostering intercultural relations and in empowering local communities. More activities should also be done in terms of knowledge production and sharing and in fostering more interdisciplinary research activities. The low result is also confirmed by the fact that the projects declared to have not developed a relevant number of patents, IPR and peer-reviewed articles.

5.4 Conclusions and recommendations for the stakeholders and end users of the projects

Stakeholders and end-users of the projects should be more involved in the definition of the requirements for the technology/platform that are under development. The origination of innovation in the DigiCult domain seems to be mainly following the “science push” linear model (scientific discovery → invention → manufacturing → marketing) rather than a having a right mix with the “demand pull” approach where unmet customer needs are explored (customer suggestions → invention → manufacturing) [Nelson & Winter, 1977; Kamien and Schwartz, 1982]. Only by implementing a collaborative and active process among the projects and the end-users, the outputs can be economically sustainable over time, as they consider the actual needs of the stakeholders.

Another point is related to the impact of projects on the way citizens experience cultural heritage. Only 7 projects declared that they change the ways citizens experience culture. More can be done in this regard, once again, by putting the needs of the final users at the centre of the development activities. In order to make

progresses, more attention should be paid to the interdisciplinary nature of the DigiCult & Creativity domain.

Finally, the impact assessment of projects is required for the stakeholders and end-users in order to make the project accountable and it is useful in order to communicate the project results to them.

5.5 Conclusions and recommendations for the European Commission

The assessment work was useful for the European Commission in order to gather results about a set of projects in the DigiCult & Creativity domain. The results clearly showed that there are some areas of impact that are often absolutely not considered by the projects. These areas are mainly Economic Impact and Impact on Society. The DigiCult & Creativity projects are mainly focused on the development of a technology (especially Research projects), but they are not including an analysis of the users' needs at the beginning of the project. Through this approach, the projects are missing the relevant opportunity to provide a greater impact to all the categories of their stakeholders and end-users.

In terms of Economic impact, most of the projects are not interested in developing technologies that are able to successfully access the market in the short time. Several ended projects have not developed a business plan and not considered business models. In order to provide a higher economic impact, the European Commission should request to projects to include the users engagement since the beginning of the project for the development of its technology and to include market analysis and business plan development since the first year of the project development.

In terms of Impact on Society, the projects are providing mainly indirect impacts, however, the analysis detected a difficulty for the projects to identify societal impacts. A relevant negative result is related to the fact that the projects in the DigiCult & Creativity domain score low on impact on knowledge production and sharing,

differently from other domains. For this reason, project should be invited by EC to work more on this subcategory of impact through the development of papers and patents.

This is also strictly related to the fact that projects in the DigiCult & Creativity domain have shown a higher impact in terms of product innovation rather than on process or organizational innovation. The European Commission should support more the projects to invest also on process and organisational innovation, which allows the projects to increase also their Economic impact and the Impact on Society.

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List of acronyms

Acronym	Definition
BCR	Benefit Cost Ratio
CBA	Cost-Benefit Analysis
CCI	Cultural and creative industries
CEA	Cost-Effectiveness Analysis
CIP-PSP	Competitiveness and Innovation Framework Programme - Policy Support Programme
CSA	Coordination and Support Actions
EC	European Commission
ENPV	Economic Net Present Value
ERA	European Research Area
ERR	Economic Rate of Return
FET	Future Emerging Technologies
FNPV	Financial Net Present Value
FP6	Sixth Framework Programme
FP7	Seventh Framework Programme
IAIA	International Association for Impact Assessment
ICT	Information and Communication Technologies
IP	Integrated Projects
IST	Information Society Technologies
MCA	Multi-Criteria Analysis
NoE	Networks of Excellence
SAT	Self-Assessment Toolkit
SNA	Social Network Analysis
STREP	Specific Targeted Research Projects
TPP	Technological product and process
TRL	Technological Readiness Level

Annex A

Variables, indicators and indices

Economic impact

Subcategories	Number	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
	E1	Project self-evaluation of its capability to improve its product/service/system quality	Project self-evaluation of its capability to improve its product/service/system quality	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E2	Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E3	Project self-evaluation of its capability to support a better targeting of stakeholders' needs	Project self-evaluation of its capability to support a better targeting of stakeholders' needs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E4	Project self-evaluation of its impact on the capability of keeping pace with research competitors	Project self-evaluation of its impact on the capability of keeping pace with research competitors	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E5	Numerical of persons able to be dedicated to exploitation and innovation transfer	Numerical of persons able to be dedicated to exploitation and innovation transfer	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E6	Numerical of activities for the transfer of project outputs	Numerical of activities for the transfer of project outputs	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	E7	Project self-evaluation of its capability to stimulate the creation of new services	Project self-evaluation of its capability to stimulate the creation of new services	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	

Business performance	E8	Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	AVERAGE
	E9	Project self-evaluation of its capability to improve its product/service/system quality	Project self-evaluation of its capability to improve its product/service/system quality	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E10	Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E11	Project self-evaluation of its impact on the capability of keeping pace with research competitors	Project self-evaluation of its impact on the capability of keeping pace with research competitors	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E12	Project self-evaluation of its capability to support a better targeting of stakeholders' needs	Project self-evaluation of its capability to support a better targeting of stakeholders' needs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E13	Numerical of persons able to be dedicated to exploitation and innovation transfer	Numerical of persons able to be dedicated to exploitation and innovation transfer	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E14	Numerical of activities for the transfer of project outputs	Numerical of activities for the transfer of project outputs	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	E15	Project self-evaluation of its capability to stimulate the creation of new services	Project self-evaluation of its capability to stimulate the creation of new services	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	E16	Project self-evaluation of developing more innovative tools for CCIs	Project self-evaluation of developing more innovative tools for CCIs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E17	Project self-evaluation of project capability of having an impact on the different segments of the CCIs.	Project self-evaluation of project capability of having an impact on the different segments of the CCIs.	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	

Impact on Cultural and Creative Industries	E18	Project self-evaluation of developing more innovative tools for CCLs	Project self-evaluation of developing more innovative tools for CCLs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	AVERAGE
	E19	Numerical of collaborative business environments (cluster or incubator) developed for CCLs	Numerical of collaborative business environments (cluster or incubator) developed for CCLs	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	E20	Project self-evaluation of project impact on access to finance for CCLs	Project self-evaluation of project impact on access to finance for CCLs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E21	Project self-evaluation of developing more innovative tools for CCLs	Project self-evaluation of developing more innovative tools for CCLs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E22	Project self-evaluation of project capability of having an impact on the different segments of the CCLs.	Project self-evaluation of project capability of having an impact on the different segments of the CCLs.	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E23	Project self-evaluation of developing more innovative tools for CCLs	Project self-evaluation of developing more innovative tools for CCLs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E24	Project self-evaluation of project impact on access to finance for CCLs	Project self-evaluation of project impact on access to finance for CCLs	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E25	Project self-evaluation of its capability to have an influence on the percentage of people employed in the cultural and creative sector	Project self-evaluation of its capability to have an influence on the percentage of people employed in the cultural and creative sector	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E26	Project self-evaluation of its impact on employment	Project self-evaluation of its impact on employment	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E27	Numerical of researchers working in the project	Numerical of researchers working in the project	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	

Impact on employment	E28	Numerical of young researchers working in the project	Numerical of young researchers working in the project	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	AVERAGE
	E29	Numerical of persons recruited specifically for the project under assessment	Numerical of persons recruited specifically for the project under assessment	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	E30	Numerical of new job places generated by the project outputs	Numerical of new job places generated by the project outputs	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	E31	Project self-evaluation of its capability to contribute to improving the working practices of cultural domain institutions	Project self-evaluation of its capability to contribute to improving the working practices of cultural domain institutions	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E32	Project self-evaluation of its capability to contribute to improving the working practices of other organisations	Project self-evaluation of its capability to contribute to improving the working practices of other organisations	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	E33	Project self-evaluation of its capability to improve reciprocal understanding between ICT experts and cultural heritage experts	Project self-evaluation of its capability to improve reciprocal understanding between ICT experts and cultural heritage experts	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
Impact on regional attractiveness and tourism	E34	Project self-evaluation of its impact on region attractiveness	Project self-evaluation of its impact on region attractiveness	N/A - Simple Variable	Numerical	Min-Max for normalisation	AVERAGE
	E35	Percentage of budget for improving region attractiveness	Percentage of budget for improving region attractiveness	N/A - Simple Variable	Numerical	Min-Max for normalisation	
	E36	Region of impact and increment in overnight stays foreseen	Region of impact and increment in overnight stays foreseen	N/A - Simple Variable	Numerical	Min-Max for normalisation	

Social impact

Sub-categories	Number	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
Impact on the way citizens experience culture	S1	Percentage of project budget dedicated to citizens engagement and to dissemination activities addressing this specific target	Percentage of project budget dedicated to citizens engagement and to dissemination activities addressing this specific target	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	AVERAGE
	S2	Project self-evaluation to its capability to change the way citizens experience culture heritage	Project self-evaluation to its capability to change the way citizens experience culture heritage	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S3		Description of the processes leading to change the way citizens experience cultural heritage	N/A - Simple Variable	Text		
	S4	Percentage of the project's budget dedicated to make resources available in a more personalised/adaptive way	Percentage of the project's budget dedicated to make resources available in a more personalised/adaptive way	N/A - Simple Variable	Percentage	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S5	Expected or measured increment in the number of persons accessing the cultural resources addressed by the project	Expected or measured increment in the number of persons accessing the cultural resources addressed by the project	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S6	Increment of the time spent by the final user in consuming cultural resources virtually and physically	Increment of the time spent by the final user in consuming cultural resources virtually and physically	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S7	Project self-evaluation on its capability to increase the presence of persons belonging to categories at risk of social exclusion in exhibitions and their access/consumption of cultural heritage	Project self-evaluation on its capability to increase the presence of persons belonging to categories at risk of social exclusion in exhibitions and their access/consumption of cultural heritage	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S8	Project self-evaluation of its capability to increase the presence of children and young people in exhibitions and their access/consumption of cultural heritage	Project self-evaluation of its capability to increase the presence of children and young people in exhibitions and their access/consumption of cultural heritage	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	

S9	Project self-evaluation of its capability of supporting citizens an communities/organisations in the interpretation of cultural and scientific content	Project self-evaluation of its capability of supporting citizens an communities/organisations in the interpretation of cultural and scientific content	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S10		Description of the processes supporting citizens an communities/organisations in the interpretation of cultural and scientific content	N/A - Simple Variable	Text	
S11	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S12		Description of the processes supporting citizens and/or communities/organisations in producing cultural and scientific content	N/A - Simple Variable	Text	
S13	Project self-evaluation to its capability of improving collaborative creation of cultural experience at community level	Project self-evaluation to its capability of improving collaborative creation of cultural experience at community level	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S14		Description of the processes improving collaborative creation of cultural experience at community level	N/A - Simple Variable	Text	
S15	Average impact factor of project publications per researcher	Indicate the number of papers with impact factor published at project level	S15/S16	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S16		Indicate the number of researchers in the project			
S17	Number of peer reviewed articles	Indicate the number of peer reviewed articles your project has produced	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S18	Number of non self-citation of the works published	Indicate the number of non self-citation of the works published	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S19	Number of non-peer review articles, books, book's chapters, conference proceedings and other electronically published of printed scientific outputs (excluding deliverables)	Indicate the number of non-peer review articles, books, book's chapters, conference proceedings and other electronically published of printed scientific outputs (excluding deliverables)	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation

Impact on knowledge creation and sharing	S20	Topics covered by the publications	Topics covered by the publications	N/A - Simple Variable	Text	
	S21	Project self-evaluation on its capability to improve research processes	Project self-evaluation on its capability to improve research processes	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
	S22		Description of the processes improving research	N/A - Simple Variable	Text	
	S23	Project self-evaluation on if and how it allows its partners to perform research activities that would otherwise have been impossible	Project self-evaluation on if and how it allows its partners to perform research activities that would otherwise have been impossible	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
	S24		Description of the processes enabling partners to perform research activities that would otherwise have been impossible	N/A - Simple Variable	Text	
	S25	Project level of interdisciplinarity	N. of disciplines represented	N/A - Simple Variable	Numerical	Min-Max for normalisation
	S26		Project self-evaluation of the relevance of interdisciplinary activities	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
	S27		Description of interdisciplinary work	N/A - Simple Variable	Text	
	S28	Project self-evaluation of its capability of increase knowledge about creativity and creative processes	Project self-evaluation of its capability of increase knowledge about creativity and creative processes	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
	S29		Description of processes leading to increased knowledge about creativity and creative process	N/A - Simple Variable	Text	
	S30	Project self-evaluation of its capability to carry on and/or stimulate an interdisciplinary use of cultural contents and resources	Project self-evaluation of its capability to carry on and/or stimulate an interdisciplinary use of cultural contents and resources	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
	S31	Use of social networks for sharing its research outputs	Use of social networks for sharing its research outputs	N/A - Simple Variable	Text	
	S32	Engagement with dissemination, communication and branding professionals	Engagement with dissemination, communication and branding professionals	N/A - Simple Variable	Boolean transformed in: if yes=1, if no=0	Min-Max for normalisation
S33	Project self-evaluation of its capability to support knowledge transfer between universities/research centres and cultural institutions	Project self-evaluation of its capability to support knowledge transfer between universities/research centres and cultural institutions	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
AVERAGE						

S34	Number of non-scientific dissemination outputs	number of articles published on non-specialised magazines and newspapers	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S35		Number of TV appearances	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S36	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	Project self-assessment of its capability of supporting citizens and/or communities/organisations in producing cultural and scientific content	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S37		Description of processes supporting the creation of cultural and scientific content by citizens and/or communities/organisations	N/A - Simple Variable	Text	
S38	Training provided by the project	Number of hours of training provided by the project*	S38*S39	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S39		Number of people trained		Numerical	
S40		Topic covered by the training	N/A - Simple Variable	Text	
S41	Project self-evaluation of its capability to support the acquisition of specific skills in the area of creative professions	Project self-evaluation of its capability to support the acquisition of specific skills in the area of creative professions	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S42	Project self-evaluation of its impact on students' performance	Project self-evaluation of its impact on students' performance	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S43	Project self-evaluation of its capability to support the personal development of its users	Project self-evaluation of its capability to support the personal development of its users	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S44	Project self-evaluation of its capability to improve personal and organisational creativity	Project self-evaluation of its capability to improve personal and organisational creativity	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation
S45		Description of processes supporting personal and organisational creativity	N/A - Simple Variable	Text	

Impact on learning and human capital	S46	Project self-evaluation of its capability to improve the skills of people already employed within or outside the consortium	Project self-evaluation of its capability to improve the skills of people already employed within or outside the consortium	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	AVERAGE
	S47	Project self-evaluation of its capability to support faster and more effective acquisition of competences?	Project self-evaluation of its capability to support faster and more effective acquisition of competences?	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S48		Description of processes supporting faster and more efficient acquisition of competences	N/A - Simple Variable	Text		
	S49	Project capability to contribute to the reduction of digital divide and the promotion of digital competencies and eSkills	Project self-evaluation of its capability to contribute to the reduction of digital divide and the promotion of digital competencies and eSkills	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S50		Number of activities supporting the acquisition of digital competences, digital literacies competences, eSkills and the reduction of digital divide	N/A - Simple Variable	Numerical	Min-Max for normalisation	
	S51		Integration of the project with standards and guidelines for digital competences, digital literacies and eSkills	N/A - Simple Variable	Boolean Transformed If yes=1, if no=0	Min-Max for normalisation	
	S52	Project self-evaluation of its capability to promote changes in university/specialisation curricula	Project self-evaluation of its capability to promote changes in university/specialisation curricula	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S53		Description of processes changing universities/specialisation curricula	N/A - Simple Variable	Text		
Impact on social inclusion	S54	Project self-evaluation of its capability to contribute to the social inclusion of categories at risk	Project self-evaluation of its capability to contribute to the social inclusion of categories at risk	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	AVERAGE
	S55	Number of outputs/activities developed by the project aiming at the inclusion of persons at risk of social exclusion	Number of outputs developed by the project aiming at the inclusion of persons at risk of social exclusion	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S56	Project self-evaluation of its attention to gender equality issues	Project self-evaluation of its attention to gender equality issues	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S57	Specific Gender Equality Actions carried out under the project	Presence of activities dedicated to Gender Equality	N/A - Simple Variable	Boolean Transformed If yes=1, if no=0	Min-Max for normalisation	

Impact on intercultural dialogue, international relations and social capital	S58	Activities performed by the project aiming at adjusting/customize its outputs to specific local needs	Activities performed by the project aiming at adjusting/customize its outputs to specific local needs	N/A - Simple Variable	Boolean Transformed If yes=1, if no=0	Min-Max for normalisation	AVERAGE
	S59	Project self-evaluation of its capability to contribute to the creation of a European culture and support the cultural integration of the various national identities	Project self-evaluation of its capability to contribute to the creation of a European culture and support the cultural integration of the various national identities	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S60	Number of employees moving from one organisation to another for carrying on specific tasks	Number of employees moving from one organisation to another for carrying on specific tasks	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S61	Number and quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Number of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S62	Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Project self-evaluation of the quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S63	Number and quality of new collaboration links established by project partners with research actors thanks to the participation in the project	Number of new collaboration links established by project partners with research actors thanks to the participation in the project	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S64	Project self-evaluation of the quality of new partnership established with research actors	Project self-evaluation of the quality of new partnership established with research actors	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S65	Project self-evaluation of its capability to support network creation/ collaboration for its users	Project self-evaluation of its capability to support network creation/ collaboration for its users	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S66	Project self-evaluation of its capability to support network creation/ collaboration among citizens	Project self-evaluation of its capability to support network creation/ collaboration among citizens	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S67	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	

	S68	Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?	Project self-evaluation of its capability to support network creation/ collaboration between different segments of the cultural and creative industries?	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S69	Project self-evaluation of its capability to increase trust among users	Project self-evaluation of its capability to increase trust among users	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
Impact on Policies	S70	Indicate the percentage of budget used for participatory activities, such as engaging citizens in policy definition or for using participatory design approaches for activities other than the technological development	Indicate the percentage of budget used for participatory activities, such as engaging citizens in policy definition or for using participatory design approaches for activities other than the technological development	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	AVERAGE
	S71	Project self-evaluation of its capability to have an influence on European policies in the area of DigiCult domain	Project self-evaluation of its capability to have an influence on European policies in the area of DigiCult domain	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S72		Description of processes leading to influence European policies in the area of DigiCult domain	N/A - Simple Variable	Text		
	S73	Project self-evaluation of its capability to have an influence on European policies in the area of cultural heritage and creativity	Project self-evaluation of its capability to have an influence on European policies in the area of cultural heritage and creativity	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S74		Description of processes leading to influence European policies in the area of cultural heritage and creativity	N/A - Simple Variable	Text		
	S75	Project self-evaluation of its capability to have an influence on national policies in the area of cultural heritage and creativity	Project self-evaluation of its capability to have an influence on national policies in the area of cultural heritage and creativity	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S76		Description of processes leading to influence national policies in the area of cultural heritage and creativity	N/A - Simple Variable	Text		
	S77	Project self-evaluation of its capability to have an influence on the local/national expenditure on culture	Project self-evaluation of its capability to have an influence on the local/national expenditure on culture	N/A - Simple Variable	Likert Scale (1-6)	Min-Max for normalisation	
	S78		Description of processes leading to influence on local/national expenditure on culture	N/A - Simple Variable	Text		

DigiCult and Creativity impact

Sub-categories	Numerical	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
Content access and management	D1	Project self-evaluation of its capability to provide sustainable access to content in a meaningful and usable manner	Project self-evaluation of its capability to provide sustainable access to content in a meaningful and usable manner	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	AVERAGE
	D2	Description of process allowing more sustainable access to content in a meaningful and usable manner	Description of process allowing more sustainable access to content in a meaningful and usable manner	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	D3	Project self-evaluation of its capability to improve access to high volumes of digital content	Project self-evaluation of its capability to improve access to high volumes of digital content	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D4	Numerical of resources made available by the project	Numerical of resources made available by the project	N/A - Simple Variable	Text		
	D5	Project self-evaluation of the project capability to allow life-cycle management	Project self-evaluation of the project capability to allow life-cycle management	N/A - Simple Variable	Text		
	D6	Project self-evaluation of project capability of Improving the collection, sharing and distribution of digital content in collaborative environments	Project self-evaluation of project capability of Improving the collection, sharing and distribution of digital content in collaborative environments	N/A - Simple Variable	Text		
	D7	Project self-evaluation of its capability to improve personalised distribution, presentation and consumption of digital content	Project self-evaluation of its capability to improve personalised distribution, presentation and consumption of digital content	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
D8	Project self-evaluation on improvement of digital preservation workflows	Project self-evaluation on improvement of digital preservation workflows	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation		
D9	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation		
D10	Project self-evaluation on improvement of digital preservation workflows	Project self-evaluation on improvement of digital preservation workflows	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation		
D11	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation		

Content preservation	D12	Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	AVERAGE
	D13	Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D14	Project self-evaluation on improvement of digital preservation workflows	Project self-evaluation on improvement of digital preservation workflows	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D15	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D16	Project self-evaluation of its capability to enhance workflows of digital preservation	Project self-evaluation of its capability to enhance workflows of digital preservation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D17	Text of processes/instruments ensuring authenticity of digital contents	Text of processes/instruments ensuring authenticity of digital contents	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D18	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D19	Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D20	Project self-evaluation on improvement of digital preservation workflows	Project self-evaluation on improvement of digital preservation workflows	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D21	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D22	Project self-evaluation of its capability to enhance workflows of digital preservation	Project self-evaluation of its capability to enhance workflows of digital preservation.	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D23	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D24	Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	

Creative (re)-use	D25	Project self-evaluation of its capability of supporting users re-use of cultural and scientific content	Project self-evaluation of its capability of supporting users re-use of cultural and scientific content	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	AVERAGE
	D26	Project self-evaluation of its capability of enabling the design of more participative and communicative forms of content	Project self-evaluation of its capability of enabling the design of more participative and communicative forms of content	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D27	Project self-evaluation of its capability of providing adaptive creative experiences offering guidance and interpretation	Project self-evaluation of its capability of providing adaptive creative experiences offering guidance and interpretation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D28	Project self-evaluation of outputs capability of provide more collaborative experience for users	Project self-evaluation of outputs capability of provide more collaborative experience for users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D29	Project self-evaluation of outputs capability of provide more interactive experience for users	Project self-evaluation of outputs capability of provide more interactive experience for users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D30	Project self-evaluation of outputs capability of improving the use of digital resources in multilingual and multidisciplinary contexts	Project self-evaluation of outputs capability of improving the use of digital resources in multilingual and multidisciplinary contexts	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D31	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	D32	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	

Technological impact

Sub-categories	Number	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
	T1	Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T2	Number of patents derived from the output	Number of patents derived from the output	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	T3	Number of IPRs derived from the output	Number of IPRs derived from the output	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	T4	Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T5	Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T6	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T7	Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T8	Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T9	Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T10	Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T11	Project self-evaluation of having an impact on product innovation	Project self-evaluation of having an impact on product innovation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	

Technological Innovation	T12	Project self-evaluation of developing new product offerings	Project self-evaluation of developing new product offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	AVERAGE
	T13	Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T14	Number of patents derived from the output	Number of patents derived from the output	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	T15	Number of IPRs derived from the output	Number of IPRs derived from the output	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	T16	Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T17	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	Project self-evaluation of routinized processes for capturing and using new ideas for new or improved service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T18	Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T19	Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T20	Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T21	Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T22	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T23	Project self-evaluation of engaging users in the development of the output	Project self-evaluation of engaging users in the development of the output	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T24	Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	

	T25	Project self-evaluation of improving methods of interacting with project users	Project self-evaluation of improving methods of interacting with project users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T26	Project self-evaluation of having an impact on product innovation	Project self-evaluation of having an impact on product innovation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T27	Project self-evaluation of developing new product offerings	Project self-evaluation of developing new product offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T28	Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T29	Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T30	Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T31	Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T32	Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T33	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T34	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	T35	Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
Technological readiness	T36	Project self-evaluation of test beds to be applicable to the project outputs	Project self-evaluation of test beds to be applicable to the project outputs	N/A - Simple Variable	Numerical	Min-Max for normalisation	AVERAGE
	T37	Project self-evaluation of improving the technological state of the art	Project self-evaluation of improving the technological state of the art	N/A - Simple Variable	Numerical	Min-Max for normalisation	
	T38	Project output tested in large scale test-beds	Project output tested in large scale test-beds	N/A - Simple Variable	Numerical	Min-Max for normalisation	

Efficiency

Sub-categories	Number	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
Efficiency	EY1	Value chains	Value chains	SUM VALUE CHAINS	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	AVERAGE
	EY2	Project Users	Project Users	SUM OUTPUTS' USERS	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	EY3	Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	EY4	Estimation of the increase of turnover that can be enabled by the project results	Estimation of the increase of turnover that can be enabled by the project results	N/A - Simple Variable	Text		
	EY5	Project self-evaluation of its capability to reduce information loss through better recovery techniques	Project self-evaluation of its capability to reduce information loss through better recovery techniques	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	EY6	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	EY7	Project self-evaluation of its capability to improve digital preservation processes	Project self-evaluation of its capability to improve digital preservation processes	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	EY8	Project self-evaluation of its capability to enhance workflows of digital preservation	Project self-evaluation of its capability to enhance workflows of digital preservation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	EY9	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	Project self-evaluation of its capability of recovering loss and repairing damaged digital objects	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	

	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY10	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	Project self-evaluation of outputs capability of improving content sharing/remixing by non-expert users	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY11	Project self-evaluation of reduction in delivery time of new product offerings	Project self-evaluation of reduction in delivery time of new product offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY12	Project self-evaluation of having an impact on process innovation	Project self-evaluation of having an impact on process innovation	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY13	Project self-evaluation of management strategies or business practices for new or improved service offerings	Project self-evaluation of management strategies or business practices for new or improved service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY14	Project self-evaluation of reduction in delivery time of new service offerings	Project self-evaluation of reduction in delivery time of new service offerings	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY15	Project self-evaluation of improving delivery or logistics systems for your inputs	Project self-evaluation of improving delivery or logistics systems for your inputs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY16	Project self-evaluation of implementing improved management systems	Project self-evaluation of implementing improved management systems	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY17	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	Project self-evaluation of implementing improved methods of organising work responsibilities or decision making	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
EY18	Project self-evaluation of innovating supporting activities	Project self-evaluation of innovating supporting activities	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation

Effectiveness

Sub-categories	Numerical	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
Effectiveness	ES1	Project output tested in large scale test-beds	Project output tested in large scale test-beds	N/A - Simple Variable	Boolean - If yes=1, if no=0	Min-Max for normalisation	AVERAGE
	ES2	Project self-evaluation of test beds to be applicable to the project outputs	Project self-evaluation of test beds to be applicable to the project outputs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	ES3	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used	Project self-evaluation of its capability to provide a more efficient and effective selection of resources to be preserved and/or re-used	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	ES4	Expected Business Models	Expected Business Models	N/A - Simple Variable	Boolean - If yes=1, if no=0	Min-Max for normalisation	
	ES5	Project Business Plan	Project Business Plan	N/A - Simple Variable	Boolean - If yes=1, if no=0	Min-Max for normalisation	
	ES6	Partner Business Plan	Partner Business Plan	N/A - Simple Variable	Boolean - If yes=1, if no=0	Min-Max for normalisation	
	ES7	Internal monitoring/evaluation system adoption	Internal monitoring/evaluation system adoption	N/A - Simple Variable	Boolean - If yes=1, if no=0	Min-Max for normalisation	
	ES8	Internal risk assessment system	Internal risk assessment system	N/A - Simple Variable	Boolean - If yes=1, if no=0	Min-Max for normalisation	

Sustainability

Sub-categories	Number	Indicators	Variables	How to build composite indicators	Output type	Normalisation	Method for creating the Compound (Aggregated) Index
	S1	Project Users	Project Users	Sum output*users	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S2	Numerical of hours of training provided by the project	Numerical of hours of training provided by the project	N° TRAINING HOURS * N° TRAINED PEOPLE	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S3	ENPV	ENPV	$ENPV = \sum_{t=1}^n \left(\sum_{t=T+BS}^{T+5} \frac{OB_t}{(1+i)^t} - \sum_{t=0}^{T+TC} \frac{OC_t}{(1+i)^t} \right)$	Numerical (see page 74)	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S4	BCR	BCR	$BCR = \sum_{t=1}^n \frac{\sum_{t=T+BS}^{T+5} OB_t (1+i)^{-t}}{\sum_{t=0}^{T+TC} OC_t (1+i)^{-t}}$	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S5	Numerical and Quality of new collaboration links established by project partners with research actors thanks to the participation in the project	Numerical and Quality of new collaboration links established by project partners with research actors thanks to the participation in the project	SUM PARTNERS COLLABORATIONS * QUALITY (Likert)	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S6	Numerical and Quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	Numerical and Quality of new collaboration links established by project partners with local actors in a specific context thanks to the participation in the project	SUM CLUSTERS' POSITIVE ANSWERS (variables: DG_StandardDescription, EC_BusinessModel, EC_BusinessPlan, EC_p_MKT, EC_p_TURN)/N° OF ANSWERS (where N/A DOES NOT COUNT)	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	

Sustainability	S7	DPP	DPP	$DPP = \frac{\sum_{i=0}^n \sum_{t=0}^{T+T^C} OC_t (1+i)^{-t}}{\sum_{i=0}^{T+5} \sum_{t=TBS}^{T+5-TBS} OB_t (1+i)^{-t}}$	Numerical (see p. 74)	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	AVERAGE
	S8	Cluster of Yes/No Variables in Sustainability	Cluster of Yes/No Variables in Sustainability	SUM CLUSTERS' POSITIVE ANSWERS	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S9	Project self-evaluation of its capability to improve its product/service/system quality	Project self-evaluation of its capability to improve its product/service/system quality	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	S10	Project self-evaluation of its capability to reduce the time needed to deliver a service	Project self-evaluation of its capability to reduce the time needed to deliver a service	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	S11	Project self-evaluation of its capability to support a better targeting of stakeholders needs	Project self-evaluation of its capability to support a better targeting of stakeholders needs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	S12	Project self-evaluation of its impact on the capability of keep pace with research competitors	Project self-evaluation of its impact on the capability of keep pace with research competitors	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	S13	Project self-evaluation of its capability to stimulate the creation of new services	Project self-evaluation of its capability to stimulate the creation of new services	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	
	S14	Numerical of activities dedicated to transfer the project outputs	Numerical of activities dedicated to transfer the project outputs	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation	
	S15	Numerical of persons able to be dedicated to exploitation and innovation transfer	Numerical of persons able to be dedicated to exploitation and innovation transfer	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation	

S16	Estimation of the increase of turnover that can be enabled by the project results	Estimation of the increase of turnover that can be enabled by the project results	N/A - Simple Variable	Text	
S17	Project self-evaluation of project capability of having an impact on the different segments of the CCIs	Project self-evaluation of project capability of having an impact on the different segments of the CCIs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
S18	Project self-evaluation of developing more innovative tools for CCIs	Project self-evaluation of developing more innovative tools for CCIs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
S19	Project self-evaluation of project impact on access to finance for CCIs	Project self-evaluation of project impact on access to finance for CCIs	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
S20	Impact on access to market for CCIs	Impact on access to market for CCIs	N/A - Simple Variable	Text	
S21	Numerical of collaborative business environments (cluster or incubator) developed for CCIs	Numerical of collaborative business environments (cluster or incubator) developed for CCIs	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation
S22	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	Project self-evaluation of its capability to support network creation/ collaboration within specific segments of the cultural and creative industries	N/A - Simple Variable	Likert Scale (1-5/1-6)	Min-Max for normalisation
S23	Numerical of people trained	Numerical of people trained	N/A - Simple Variable	Numerical	Inter Quartile Range (IQR) for outliers elimination Min-Max for normalisation

Euro 30,00

