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Studying the Underexplored Field of Digital Transformation Strategic Planning in Natural History Museums

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STUDYING THE UNEXPLORED FIELD OF DIGITAL TRANSFORMATION STRATEGIC PLANNING IN NATURAL HISTORY MUSEUMS

Research-in-Progress

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Abstract

The digital age has led to the evolution of IS/IT and with it, new areas of study such as Digital Transformation (DT). DT is an organisation-wide strategic approach that brings together people, processes and technology. As such, it is a complex process that requires organisational commitment, the development of new skills, organisational restructuring and overcoming staff resistance and inertia. In recent decades, museums have been no strangers to DT, but the pace of change has been slower than in other sectors, leaving most museums far from digital maturity. Strategic planning for DT, along with strong leadership for its successful implementation, is critical to setting the strategic direction that will help museums fulfil their mission and maintain their relevance in 21st century society. However, there is little research on DT for museums and even less on its strategic planning. Using a Design Science Research (DSR) approach, the Museu de Ciències Naturals de Barcelona, together with the Universitat Politècnica de Catalunya, is collaborating in this applied research, co-funded by the Generalitat de Catalunya within the framework of the Industrial Doctorate Plan, which aims to propose a comprehensive methodology to support the strategic planning and deployment of DT in natural history museums (NHMs).

Keywords: IS/IT Strategic Planning, Digital Transformation, Natural History Museums, Method Design, Digital Museums.

1 Introduction

The increasing digitalisation of economies has highlighted the importance of digital transformation (DT) and how it can help organisations gain competitive advantage. However, disruptive changes do not only occur at the firm level, but also have environmental, societal and institutional implications. For this reason, research on DT has received increasing attention over the past two decades, with a wide range of topics being explored in the literature (Kraus *et al.*, 2021). As a result, DT has emerged as an important phenomenon in the field of IS management and business (Zhu, Ge and Wang, 2021). However, research on DT in the non-profit sector or institutions such as museums are not as extensive as in the private sector. Consequently, there are a number of unexplored issues in the cultural heritage sector, such as digital networks between museums or the strategic planning of their DT initiatives. (Hurtado Jarandilla, 2020).

In addition, information systems and technology (IS/IT) strategy is of paramount importance and has been studied by numerous well-developed lines of research that have contributed to our understanding of IS/IT strategy. In recent decades, however, digitalisation has fundamentally changed organisations and challenged traditional strategic wisdom. As a result, an evolutionary shift in IS/IT strategy thinking has also given rise to new terms such as digital transformation (Teubner and Stockhinger, 2020).

Digital transformation (DT) can be defined as an evolutionary process that leverages digital capabilities and technologies to enable business models, operational processes, and customer experiences to create value (Morakanyane, Grace and O'Reilly, 2017). As such, DT is often a complex process that involves not only the adoption of digital technologies but also the potential rethinking of processes, legacy systems and even organisational culture (Sebastian *et al.*, 2017; Tim, Ouyang and Zeng, 2020; Vial, 2021). It therefore requires significant commitment from organisations, including developing new capabilities, restructuring the organisation and overcoming employee resistance and inertia (Lucas *et al.*, 2013; Karimi and Walter, 2015; Dremel *et al.*, 2017; Singh and Hess, 2017; Svahn, Mathiassen and Lindgren, 2017; Tim, Ouyang and Zeng, 2020). As a result, DT is a major challenge for organisations today (Rogers, 2016).

Cultural heritage institutions face even more obstacles in their DT process. Museums, as largely public institutions, need to maintain the link between themselves and their publics/audiences. On the one hand, this is an implicit part of their nature, core activities and mission; on the other hand, they need to remain relevant to 21st century in order to justify their existence and receive the necessary funding from the public authorities that govern them. In this context of change, one of the key challenges for natural history museums (NHMs) is to open up their collections information and knowledge to new audiences in order to become more relevant (Huxley *et al.*, 2020). NHMs must learn to integrate new technologies into their service/business processes in order to remain relevant and to serve audiences that are more diverse, more numerous and more tech-savvy (Dorfman, Landim and Kamei, 2018).

Although museums are no strangers to DT in recent decades, they are changing more slowly than other social organisations (Hossaini and Blankenberg, 2017; Mu.SA, 2020). Some implementation issues have hindered the rapid adoption of technology in museums, such as the loss of information in the migration of data from manual to digital processes, staff resistance to the intrusion of IS/IT into their traditional roles, and the high cost of using computers in relation to the modest budgets typically available to museologists (EVE Museos e Innovación, 2021). Recent evidence suggests that most museums are far from achieving full digital maturity (Mu.SA, 2020; Price and Dafydd, 2020).

The term digital maturity specifically reflects the status of an organisation's digital transformation, as it describes what an organisation has already achieved in terms of transformation efforts and how an organisation is systematically preparing to adapt to an increasingly digital environment in order to remain relevant and competitive (Chanias and Hess, 2016; Teichert, 2019). Digital maturity goes beyond a purely technological interpretation, reflecting the extent to which the organisation performs tasks and manages information flows through IS/IT; and also reflects a managerial interpretation in terms of what it has already achieved in terms of implementing digital transformation efforts, such as changes in products, services, processes, skills, culture and the ability to manage change processes (Chanias and Hess, 2016; Teichert, 2019). Thus, digital maturity includes both a technological and a managerial aspect; it's a holistic concept to describe the organisation's success in digital transformation (Teichert, 2019). Organisations reach the highest level of maturity when they have both a strong digital foundation and a good understanding of how to leverage that foundation for strategic business/service advantage (Shahiduzzaman *et al.*, 2017; Teichert, 2019).

Therefore, strategic planning for DT, together with strong leadership for successful implementation, remains essential to set strategic direction and goals and to help museums achieve a high level of digital maturity. This involves not only establishing a new way of thinking, organisational change, intro-

ducing new knowledge and skills, but also assessing the effort and all key resources such as skilled staff, IT infrastructure, money and time (Mu.SA, 2020).

In order to meet these challenges, the Museu de Ciències Naturals de Barcelona (MCNB), in collaboration with the Universitat Politècnica de Catalunya (UPC), has been carrying out an applied research project since July 2021. The project takes the form of a doctoral research, co-funded by the Doctoral Industrial Programme of the Generalitat de Catalunya (UPC and CMCNB, 2021). The study was born from the real needs of the MCNB to improve the management of its IS/IT and all the data generated by its collections, while being considered as a reference NHM in the Southern Europe, as opposed to its limited resources (human and monetary) as a public institution. Consequently, the main agreed goal for this research is to design, apply and share a comprehensive and strategic planning methodology for the DT initiatives and their deployment, designed to support the specific culture, services, processes and needs of NHMs, through the pragmatic approach of Design Science Research (DSR). In this paper, we present a novel approach that explores the unexplored field of DT in NHMs by explaining our research approach and the proposed meta-design to build the methodology.

2 Research problem

The Covid19 pandemic disrupted the activities of museums worldwide, threatening their financial survival and the livelihoods of museum professionals (ICOM, 2020b). During the closure, some museums were able to increase their digital activities, many of which built on pre-crisis investments (UNESCO, 2020). The museum sector reacted very quickly during the pandemic to develop its online presence in order to maintain a link with the public. Furthermore, during the lockdown and post-pandemic period, several studies were published on the impact of Covid19 on museums. Various sources, such as the International Council of Museums (ICOM, 2020a) and the Network of European Museums Organisations (NEMO, 2021), explain the importance of the need to train staff in digital and to rethink or develop a digital strategy in this new context (Rodà Llanza, 2021). As a result, the Covid19 crisis has forever changed museums' perception of the digital world, highlighting existing problems and accelerating changes that were already underway (ICOM, 2020a).

In addition, as digital transformation can be understood as the third stage in the adoption of digital technologies: digital competence → digital literacy → digital transformation (Baker, 2014), this last stage means that digital uses inherently enable new types of innovation and creativity in a given domain, rather than merely enhancing and supporting traditional methods. Digital literacy is an organisational capability and consists of the ability of employees to use digital technologies in practices related to their work (Cetindamar, Abedin and Shirahada, 2021). The digital literacy of the workforce is one of the key challenges for the adoption of technology in museums (Mu.SA, 2020). Increasing the digital literacy and confidence of museum professionals is a crucial aspect of supporting the DT initiatives in museums, creating a new mindset and enabling change. Museum professionals are challenged to develop new skills as IS/IT becomes more technically complex and the needs of their publics/audiences become more sophisticated (Marty, 2007; Tim, Ouyang and Zeng, 2020).

In addition, the Museum Sector Alliance (Mu.SA) has also detailed the critical issues and interrelated challenges that the museum sector faces in its DT processes, after studying the barriers to digital transformation in different European museums (Mu.SA, 2020): lack of investment in digitisation of collections, limited investment in IS/IT infrastructure, lack of digital literacy of museum staff, insufficient training programmes, gaps in museum organisational structures to support digital maturity, lack of strategy or planning within digital activities, and government policies without clear guidelines to address digital challenges. As a result, museums need to develop digital strategies to anchor their digitisation activities and digital assets on a sustainable and long-term basis in order to better achieve their mission and strategic goals (NEMO, 2020).

3 Literature Review and Novelty

The museum and heritage sector is recently discussing the issue of DT as one of the main areas for its policy and research (Liao, Zhao and Sun, 2020). Related concepts such as digitisation and digitalisation have been considered to improve the reach and performance of museums. These concepts are resulting in richer content, and have been studied extensively recently. Digitisation and digitalisation are linked to technologies such as 3D tools applied to cultural heritage. Digitisation refers to the collections that are digitised as resources, i.e. the conversion from analogue to digital to create data. Digitalisation refers to the use of these resources for education, exhibition or dissemination, i.e. the adaptation of processes (Liao, Zhao and Sun, 2020), see figure 1. On the contrary, DT research has been associated with human-related concepts, such as digital literacy. However, the related literature on DT remains unusual and small, and discussions on DT seem to take a more organizational, human resource and human capacity approach (Liao, Zhao and Sun, 2020). In fact, there are not many references that discuss about digital transformation and the creation of digital museums.

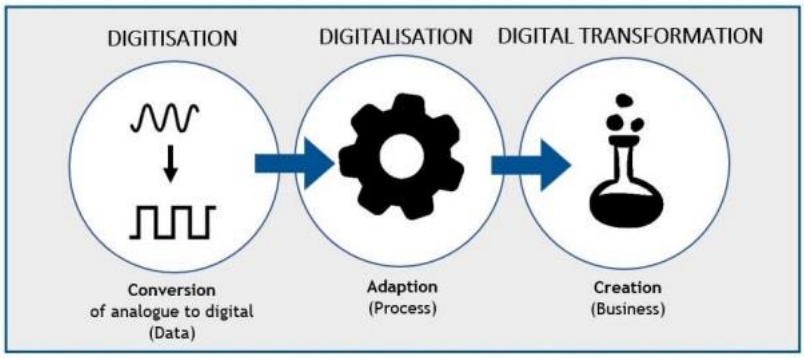

Figure 1. Digital Transformation Stages (Bumann and Peter, 2019, p. 16)

The digital museum has also been proposed recently and can be defined as a museum that uses IS/IT to digitally represent the functions of a traditional physical museum and to share the resources of the cultural objects it holds on the Internet (Tong and Ma, 2021). They are the digital form of the physical museum and must therefore meet the functional requirements of museums. At the same time, the main significance of digital museums is to bring into play the advantages of digital technology tools and propose solutions to the disadvantages of traditional museums, with physical collections as the core in the functional realization, to achieve functional complementarity. (Tong and Ma, 2021)

Thus, increasingly the museum's digital strategy plays an important role in how museums can use technology to promote the development of innovation networks, economic performance and comparative advantage. A digital strategy can also enable the design of digital museums in a more organised way (Kamariotou, Kamariotou and Kitsios, 2021). Ironically, a digital strategy for museums is not a priority for strategists (Lehman and Roach, 2011; Kitsios, Champipi and Grigoroudis, 2017; Kamariotou, Kamariotou and Kitsios, 2021). But, digital museums can and should be strategically planned to achieve economic and social development outcomes, and therefore more research is needed in this regard (Kamariotou, Kamariotou and Kitsios, 2021). In addition, digital museum policies need to be very concrete and critical in nature, as they require substantial investments and have significant implications for museum management. Hence, it is important to study them in a methodical and coherent way, in terms of policy design and implementation within museum institutions (Kitsios and Kamariotou, 2021).

To conclude, the types of studies that exist on DT topics in museums are diverse. There are topics that have attracted the attention of academics, researchers and experts, such as the dissemination or didac-

tics of cultural heritage. And there are other topics, such as digital networks between museums or strategic planning of DT, which have not generated as many references (Hurtado Jarandilla, 2020). Consequently, there is not much literature on DT within cultural and heritage institutions, and even less on their strategic planning of DT. This rather lack of prior research can be alleviated with research results from other classical disciplines, such as business management and information systems, which could be inspiring and adapted for museums, including NHMs. For this reason, we present in this paper a novel approach that studies the unexplored field of DT in NHMs.

4 The Applied Research at The Museu de Ciències Naturals de Barcelona (MCNB) and Universitat Politècnica de Catalunya

4.1 Design Science Research Approach

Design Science Research (DSR) is an investigative process that aims to produce innovative constructions (artifacts) that can be used to solve real-world problems or address opportunities that arise in the reality, and in doing so, make a theoretical contribution to the discipline in which it is applied. All human artifacts, such as models, diagrams, methods and information system designs are artificial constructs. Thus, DSR was chosen as the research approach for this project because there is a practical problem in the cultural heritage sector that also has research potential due to the knowledge gap found in the literature. Therefore, by developing an artifact to solve the problem (a methodology), a theoretical contribution is made at the same time (Lukka, 2003).

The model we have chosen to contextualize DSR is the one presented by Hevner (Hevner, 2007). Hevner divides DSR into three parts: environment, design science research and knowledge base. The environment includes the practical domains: people, technical and organizational systems, with their problems and opportunities. In this research, the environment is represented by the real museum (MCNB), where the research practice takes place and the designed solution will be tested. In this case, the initial knowledge base is constituted by the researchers' studies and experiences, the relevant state of the art, as well as the support offered by the university (UPC) involved in the project. DSR is presented as an approach between theory and practice, a real situation in which the proposed artifact (the method) is to be designed and evaluated. See Figure 2.

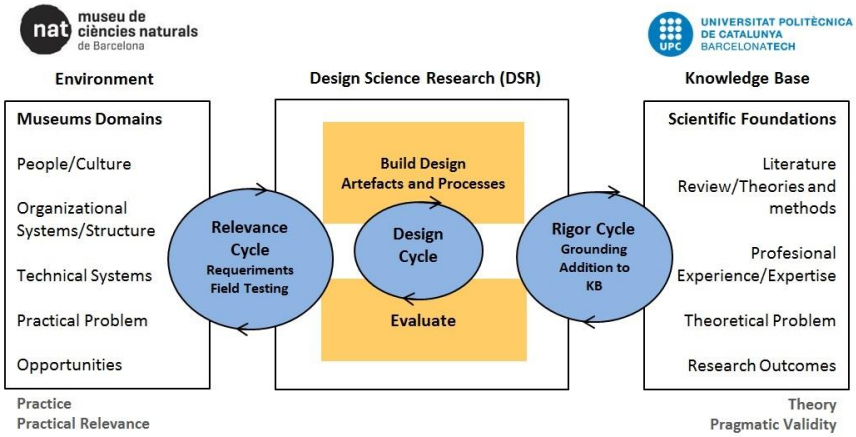

Figure 2. DSR model adapted from (Hevner, 2007)

Furthermore, as explained by Venable (2006), DSR must not leave theory and theorizing to the natural, physical and social sciences. Instead, DSR should engage in theorizing, before, during, and as a result of DSR work. Just as other scientific research paradigms, theory should be a primary output and

that theory and theorizing need to play a central role in the advancement of DSR in IS (Venable, 2006). As a result, Venable proposes an activity framework in which design theory should take the form of utility theories, which relate improvements expected from applying a particular type or types of research "meta-designs" to a particular type of problem "meta-requirements" or "user requirements" (Walls, Widmeyer and El Sawy, 1992; Markus, Majchrzak and Gasser, 2002; Venable, 2006). Theory and theorizing are then seen as a central research activity, as in other research approaches (Venable, 2006).

4.2 The Research Design (Meta-design)

In the context of this research, the meta-design is represented by the research design (Figure 3), which defines the roadmap for accomplishing the main goal (design a method for the strategic planning of DT initiatives in NHMs), by achieving the 5 steps (O1 to O5) and their specific objectives. The meta-requirements or user-requirements are represented by NHMs context, challenges and specific needs, for whom the method is designed and where the method (the final artifact) will be tested.

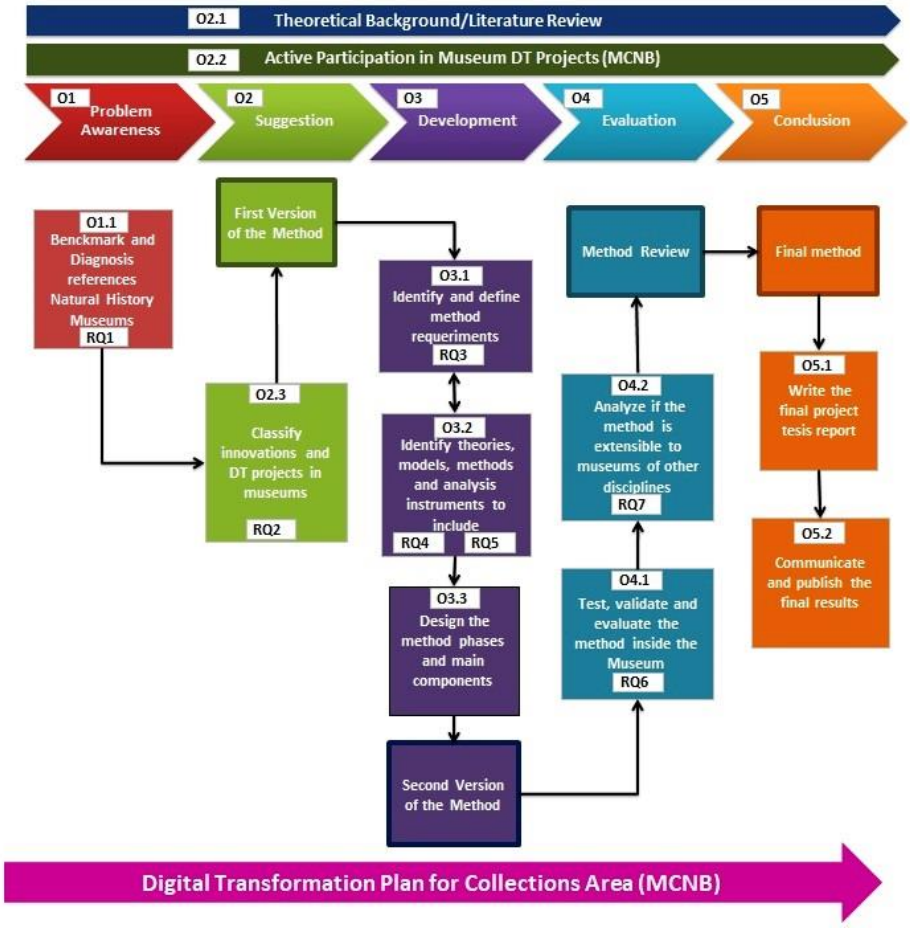

Figure 3. Research design (Meta-design)

As the main goal of this study is to design a method for strategic planning of DT and deployment in NHMs, the main expected outcome is a complete method and any utility theory contribution made during its development, as well as its instantiation in a first strategic DT plan for the collections area of the MCNB (March & Smith, 1995). In research design, the main goal was divided into five objectives (steps) related to the methodology to construct the artifact, as proposed by Manson (Manson,

2006): problem awareness (O1), suggestion (O2), development (O3), evaluation (O4) and conclusion (O5).

With the aim of increasing our awareness of the problem (O1), to get more details on the context of NHMs (O1.1), a benchmarking study is being carried out on 16 reference NHMs, including Smithsonian National Museum of Natural History, Berlin Museum of Natural History, London Natural History Museum, Naturalis, etc.

To prepare for a relevant solution (O2), a literature review to know the state of the problem and solutions about DT in NHMs was undertaken (O2.1). In addition, we have participated in digital projects within the MCNB (O2.2) to get more knowledge about its context. To date, two projects has been made, one related to collections data migration from one system (Museum-plus) to another (Specify 7) (Perellò Rodrìguez, Alvarado Pérez and Pastor Collado, 2022), and an IS/IT diagnosis to the Network of Natural Science Museums of Catalunya (Rubio i Quintana, Alvarado Pérez and Pastor Collado, 2021), which is coordinated by the MCNB. In addition, a taxonomic study on digital innovation in museums is being carried out by reviewing 1416 papers published at 'Museums and the Web' (O2.3), which is the main international conference on digital innovation in cultural heritage. As a result, and based in prior more generic methods, a first version of the specific method will be proposed to start the development phase.

To develop the method (O3), it is necessary to identify and define the method requirements (O3.1), the existing theories, models, methods and analysis tools to be included (O3.2), and to design the method phases and main components (O3.3). This will allow us to develop a second version of the method for the evaluation phase.

To evaluate the method (O4), we will test and validate the design within the MCNB by doing its instantiation (O4.1). Only after that, we will analyze if the method design could be adapted to museums of other disciplines (O4.2). An evaluation by expert groups will allow us to make the final review to initiate the conclusion state.

To conclude (O5), the final method will be presented, the final report (O5.1) and its publications (O5.2). Nevertheless, (O5.1) and (O5.2) are at the end, as long as results have come to light, they will be reported and published through the best channel. In addition, it is important to mention that O2.1, O2.2 and the DT plan for the MCNB are transversal for the whole design research.

Our work is still in progress; today we are finishing our O1 and O2 phases, while we are progressing with O3 and participating in IS/IT projects within the museum that will help us address O4. Our idea is to build an artifact that aims to facilitate the DT of NHMs. Therefore, the meta-design seeks a deep understanding of the context of NHMs and their digital innovation.

5 Conclusions

Digital Transformation has recently emerged as a research and policy area in the cultural and heritage sector. However, there has been little research on the strategic planning of DT processes in museums. As a result, there is a knowledge gap regarding methods and guidelines for strategic planning of DT in cultural institutions. Therefore, this is an unexplored area that we explore with this applied research.

Consequently, we take this as the starting point of our research: the need for methods and guidelines for strategic planning and successful deployment of DT initiatives in NHMs (that allow for the creation of digital museums in an organised way). This research aims to contribute to this field of study by developing a comprehensive method, i.e. a methodological procedure that will help to reap the benefits of IS/IT in NHMs while minimising and managing the risks, anticipating problems and overcoming the challenges that NHMs face when pursuing DT initiatives.

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