

**“Conversations About Life, Cultural Heritage,
VR, and Projects”
A Case Study on the Management of a Virtual Heritage Project**

Joaquín L. A. Hernández
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ABSTRACT

Thesis

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Abstract <p>The case study examines the production of a Virtual Heritage experience in the Maritime Centre Vellamo in Kotka in 2019-2020 as part of the Fateful Svensksund exhibition from the perspective of project management. The aim is to understand how internal and external circumstances influenced the work of the project managers and what role project management craft played in the project’s success. The findings suggest that the exhibition concept and the procurement contract provided clear frames and aligned the activities of the project parties. Furthermore, the project managers’ focus on people and relationships facilitated the forming of a shared understanding and ensured smooth communication between the parties. The study also reveals a weak dissemination of formal project management expertise in the project organization and a poor availability of context-specific project management training. Finally, the study recommends that systematic learning processes and practices should be developed within the field to increase understanding of Virtual Heritage projects and project management in the context.</p>	
Keywords Virtual Heritage, project management, case study, museums	
Additional information	

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1 INTRODUCTION

1.1 Background of the study

Safeguarding cultural heritage is a constant race against time. Awareness of the perishability of cultural heritage around the world has increased, as heritage sites, objects, and intangible cultural heritage, such as traditions and performing art forms, are facing various threats, including conflicts and intolerance, climate change, weakened practice and transmission, cultural globalization, and decontextualization, to name a few (UNESCO, 2018).

At the same time, cultural heritage organizations are facing major challenges due to the Covid-19 pandemic, which has increased the pace of digital transformation, but also revealed the needs for developing digital strategies and for the training of staff. The lockdown and travel restrictions caused by the global pandemic has seriously affected the operations of cultural heritage organizations, and it is estimated that the crisis will have a long-lasting impact in the economies of museums (NEMO, 2020; UNESCO, 2020a).

Digital cultural heritage has clearly demonstrated its value during the pandemic. The Network of European Museum Organizations (NEMO) recommends that museums invest in digital cultural heritage services and infrastructure, stating that museums need to develop "fun, engaging and creative digital offers" to compete with other digital services. In addition, to make organizations more fit for future crises, they need to consider "more flexible working methods and structures". (NEMO, 2020; NEMO, 2021.)

Sperwer (2020) sees immersive technologies as promising new media for museums to tell engaging and emotionally rich stories about their collections. Immersive experiences have the potential to generate new income streams, connecting museums and homes through technology. Therefore, organizations should explore the opportunities technologies such as Virtual Reality offer and acquire skills that enable them to develop initiatives based on them. (Sperwer, 2020.)

However, while investments in digital services and infrastructure are needed, the economic

situation in the cultural field is challenging. Cultural heritage organizations will be dependent on external funding and collaboration over disciplines to be able to develop innovative solutions and “fun, engaging, and creative” digital service offerings. In addition to understanding of the technologies, this development will require expertise of complex interorganizational projects and sensitivity to different work cultures.

The Fateful Svensksund exhibition at the Maritime Centre Vellamo in Kotka stands as a recent example of an externally funded project involving emerging technologies, multiple project parties, and a multidisciplinary team. Integrated in the exhibition on the late 18th century naval battle is a digital experience, *Smoke on the Waves*, which enriches the exhibition experience and helps visitors to understand the course of the battle and to place the displayed artifacts in context. The present study dives under the surface of the exhibition, aiming to uncover the circumstances under which the development of the digital experience took place and to understand their implications to project management in this context.

1.2 Previous Research and the Research Gap

The study builds on research from the fields of Virtual Heritage (VH) and project management. The application of virtual-worlds technology and serious games in cultural heritage has been the focus of interest for researchers from various disciplines since the 1990s, albeit not always under the term Virtual Heritage. Related studies often fall under the terms Digital Cultural Heritage or Virtual Archaeology. A number of studies have focussed on technical aspects, for example describing a detailed workflow for recording heritage through photogrammetry or 3D modelling and presenting them in Extended Reality (Bruno et al., 2010; Bustillo, Alaguero, Miguel, Saiz, & Iglesias, 2015; Rahaman, Champion, & Bekele, 2019; Monterroso-Checa et al., 2020; Bottino & Martina, 2010). Others have evaluated the usability, impact, or acceptance of the technologies in a cultural heritage context (Pietroni, Ray, Rufa, Pletinckx, & Van Kampen, 2012; Parker & Saker, 2020; Siang, Aziz, Ahmad, & Suhaifi, 2019; Hammady, Ma, & Strathearn, 2020). A few works have examined virtual worlds as learning environments for disseminating knowledge about cultural heritage (Bekele & Champion, 2019; Bustillo et al., 2015; Gamor, 2013; Meegan et al., 2020; Puig et al., 2020). However, there is virtually no research focussing on project management in this context, and therefore the field lacks

continuity in building a body of knowledge on Virtual Heritage project management.

Developing VH experiences resembles the development of video games and Virtual Reality experiences with the combination of technological and creative domains but introduces yet another layer of complexity with issues related to cultural heritage and the organizational context in the field. The literature review identified a number of works that highlight important aspects of the context without being specifically about it. Bakker (2010) identifies Time, Task, Team, and Context as central themes in research on temporary organizational forms. Jones and Lichtenstein (2009) examine how Temporal and Social Embeddedness help enhance coordination and manage uncertainty in interorganizational projects. Carpenter (2010) writes about project management in libraries, archives, and museums, providing information about the organizational context. Vom Brocke and Lippe (2015) study collaborative research projects and present three management paradoxes that summarize many of the challenges in interorganizational projects.

Furthermore, the discussion on project management methodologies is based on the works of Marion (2018), Opelt, Gloger, Pfarl, & Mittermayr (2013), Rigby, Sutherland, and Takeuchi (2016), Roudias (2015), and Schwaber and Sutherland (2020), which describe the PMBOK, PRINCE2, and Scrum frameworks in detail

1.3 Aim of the study

Considering the recommendation to invest in digital experiences and the growing interest in VH projects in the cultural heritage field, the study aims to contribute to the body of research on them with the hope of increasing cultural organizations' understanding of VH projects and capacity to successfully plan and coordinate them in the future. The study focuses on understanding the circumstances under which the development of the Smoke on the Waves VH experience took place and their implications for project management in the production of the experience and in the wider 'Fateful Svensksund' exhibition project in which it was embedded. Therefore, the first two research questions are:

- 1. What kind of internal and external circumstances influenced the project organization?**

2. What were the implications of the circumstances to the project management craft?

The thematical framework highlights six central concepts from project management research—Time, Task, Team, Context, Temporal Embeddedness, and Social Embeddedness—which will be used for discussing the management of the project. Furthermore, to inform the discussion on project management craft, three common project management frameworks are outlined and their relevance to the context evaluated.

In order to increase understanding of Virtual Heritage projects, it becomes necessary to define in the study what VH is and identify which characteristics in the project are particularly related to the field. Therefore, the third research question can be formulated as:

3. What are the distinct characteristics and challenges of Virtual Heritage projects?

Because of rapid advances in technology and a jumble of overlapping terminology, the concept of VH has eluded widely accepted definitions. Bottino and Martina (2010) define VH broadly as the combination of ICT technologies and cultural heritage to create tools, such as virtual museums, for displaying cultural heritage content (p. 422). Champion (2013) proposes a narrower focus on interactive and immersive digital media and suggests expanding the aims beyond merely displaying content to conveying meaning, agency, cultural significance, and social agency (p. 272).

The thematical framework of the study outlines the main concepts and technological solutions of VH, aiming to offer a pragmatic definition that encompasses the use of a wide range of virtual-worlds technologies but distinguishes VH from the broadly defined Digital Cultural Heritage. Considering VH merely as a technological approach would do disservice to the content and experiential design aspects of the applications. Nevertheless, the focus of the study is on project management. Other nuances of VH have been widely discussed by Champion in his body of works.

1.4 Structure of the thesis

The study is divided into seven parts. The Introduction describes the background of the

study, identifies the research gap, formulates the research questions, and sets the aims of the study. The second part, the thematical framework, is further divided into three sections. Firstly, the concept of Virtual Heritage is examined through its goals and applications and by giving an overview of the technologies and key concepts. A practical definition of VH is offered, and some criticism and limitations presented. Secondly, the central themes for discussion on project management are introduced and the topics of complexity, uncertainty, and project failure discussed. Thirdly, three common project management methodologies are outlined in order to discuss systematic approaches to project management.

In the third part, the design of the research, the choices made, and the methods applied are presented in more detail. The fourth part provides a rich description of the case, providing context and setting the stage for the analysis of the project management themes. In the fifth part, the management of the project is discussed in detail through the themes identified earlier. The sixth part aims to summarize the findings of the study, distilling the discussion in four learning statements. Finally, the seventh part reiterates the research problem and the findings and presents some future avenues for research.

2 THEMATICAL FRAMEWORK

Virtual Heritage experiences harness the immersive and expressive powers of virtual worlds to record tangible and intangible cultural heritage and present it to the target audiences in an educational and captivating way. Developing Virtual Heritage experiences requires expertise from such diverse fields as cultural heritage, software development, computer graphics, storytelling, sound design, and user experience design.

No cultural heritage organization alone possesses the expertise and resources needed to develop Virtual Heritage experiences as part of their operations. Therefore, collaboration between cultural heritage experts and virtual world developers in temporary interorganizational project settings are needed. Due to their complexity, VH projects are challenging to plan and coordinate efficiently. Additionally, the organizational context strongly influences the projects and subjects them to various requirements.

The thematical framework of the study briefly examines VH experiences as a medium for dissemination of cultural heritage, then reviews some common research themes on interorganizational projects, highlights the unique characteristics of VH projects, and gives an overview of three widely used project management frameworks which will be discussed in relation to project management in the case being studied.

2.1 Virtual Heritage

The term Virtual Heritage (VH) has since the 1990s emerged as a subcategory of Digital Cultural Heritage (DCH), which is broadly defined as a multidisciplinary field that studies digital representations of heritage (Reunanen, Díaz, & Horttana, 2015, p. 2). According to Bottino and Martina (2010), Virtual Heritage is "[t]he integration of cultural heritage and ICT technologies, in order to develop powerful tools to display cultural contents" (p. 422), which does not make a clear distinction from other forms of DCH. In fact, there does not seem to be a widely accepted definition of VH among researchers (Champion, 2013, pp. 272-273). Therefore, the following section approaches the problem by first looking into the

goals of VH, then examining the technologies utilized, aiming to land at a suitable definition of VH for the purpose of the study. After that, some examples of VH will be provided. The section concludes with the examination of some of the most relevant challenges and limitations of VH for project managers.

2.1.1 Goals and Benefits

Engaging with audiences

The background of Virtual Heritage can be traced to the emergence of the experience economy and the digitalization of the society. Consumers are increasingly demanding experiences instead of just goods and services (Pine & Gilmore, 1998, p. 1). Cultural heritage organizations need to answer the demand and connect with their audiences on the platforms and devices they are using everyday. According to A. Vargas (personal communication, February 19, 2021), some of the goals for developing VH experiences at Casa Batlló in Barcelona are precisely to establish a connection with audiences before the visit, maintain the connection afterwards, and to engage with new audiences that have not yet been reached because of a lack of attractive technology.

Enriching the visit

Experiences offered—or staged—at points of interaction aim at enriching the visit by engaging individual customers in a memorable way (Pine & Gilmore, 1998, *Staging Experiences that Sell*). Similarly, Virtual Heritage can transform the visitors' perception of cultural heritage by using the sites and artifacts to stage rich experiences. According to A. Vargas (personal communication, February 19, 2021), VH experiences can transport visitors to other times and dimensions, transcending their experience of cultural heritage beyond what is visible to the naked eye. Sahari agrees that VH can be used to construct an experience of a lost physical past, allowing visitors to travel back in time and experience historical events (Sahari, 2020, p. 49). Champion (2013) maintains, that in addition to the physical appearance, VH should aim to transmit "the meaning and significance of cultural artifacts and the associated social agency that designed and used them" (p. 272).

Increasing access

A third goal of Virtual Heritage is to increase access to cultural heritage (Sahari, 2020, p. 49). Digital experiences can be copied and distributed or streamed to the other side of the world at ease and practically without delay. In theory, this allows visitors anywhere in the

world to explore the temples of Teotihuacan or marvel at shipwrecks buried deep under the sea without having to travel long distances or learn to dive, offering visitors "substitute yet fulfilling experiences of visiting an actual heritage site" (Reunanen, Díaz, & Horttana, 2015, p. 3). However, as Champion (2013) notes, many projects are not publicly accessible or properly archived for later use, which not only restricts access to them but also hinders the research on Virtual Heritage (p. 274).

2.1.2 Technology

Virtual Heritage is sometimes simply defined as the application of Virtual Reality (VR) technology in a cultural heritage context but, as Reunanen et al. (2015) note, the term VR is frequently used to describe "almost anything that contains 3D graphics" (p. 3).

According to Champion (2013), few VH experiences are actually based on the traditional examples of VR technology, such as Head-Mounted Displays (HMDs) and room-scale CAVE systems, but many are viewed on desktop computers and fixed wall installations. Therefore, the definition of VH should more broadly include the use of virtual-world technology and "interactive and immersive digital media". (Champion, 2013, pp. 271-272.)

The terms VR, AR, MR, and XR, are frequently used in relation to Virtual Heritage, but sometimes without a clear understanding of the concepts. According to a seminal taxonomy by Milgram, Takemura, Utsumi, and Kishino (1995), both VR and AR are part of the Reality-Virtuality Continuum. At the other end of the continuum lies the Real Environment, the actual physical world where our bodies reside. At the opposite end lies the Virtual Environment, which encapsulates the participant in an entirely synthetic world. The range between these points, in which the real and the virtual world overlap, is called Mixed Reality (MR). On the MR range, the authors place Augmented Reality (AR) and Augmented Virtuality (AV), which juxtapose real world objects with virtual environment objects in varying degrees. (Milgram et al., 1995, pp. 283-284.) However, the term AV has all but disappeared from use, and AR is nowadays commonly used to refer to the superimposition of synthetic elements with the real world.

LaValle (2019) notes, that as the technologies advance, the distinctions between the terms become less relevant. Many modern HMDs are already capable of operating in both VR and AR domains. Therefore, combining terms such as Extended Reality (XR), VR/AR and MR are increasingly used. However, according to LaValle, the most important aspect of

VR is the alteration of the user's perception of reality through technology, and the varying blends of reality and virtuality can therefore be seen as "perfect examples of VR".

(LaValle, 2019, pp. 5-6)

Remarkably, regardless of whether XR experiences are viewed on HMDs or on flat screens, they have likely passed through a similar production pipeline, which includes defining the content and the narrative, creating the assets, and assembling them into a consistent experience using a game engine (Bottino & Martina, 2010; Díaz et al., 2012; Sperwer, 2020; S. Suominen, personal communication, May 18, 2021).

Game engines are extendable software systems that handle the core infrastructure of video games, including for example graphics rendering, physics modelling, audio mixing, and interaction management (Anderson et al., 2009, 3 - The Technology of Cultural Heritage Serious Games; Bottino & Martina, 2010, p. 436). Modern game engines such as Unity and Unreal Engine offer XR developers a wide range of time-saving tools, making production relatively fast and cost-effective, and allowing modification (S. Suominen, personal communication, May 18, 2021). Furthermore, the projects can easily be ported to diverse devices and platforms, including desktop computers, mobile devices, and VR headsets. However, the methods of interaction and the degree of immersion vary greatly between devices, and the target platform therefore influences many design decisions.

It could be argued that the production of a 3D animation also constitutes virtual-world-building. The production process requires meticulous modelling of characters, artifacts, and environment and construction of a scene based on them. While the world thus created may not be interactive and immersive, the scene and its components 'exist' beyond the animation clip and may be reused for other purposes, similarly as a theatre set and props exist and may be used to stage further performances. For example, the virtual world created for the Total War game series has been frequently used to stage and re-enact historical battles in documentary films (Anderson et al., 2009, 2.2.3.3. Total War). Similarly, assets created for VH experiences could be made available and reused in other experiences.

Considering the technological ambiguity of VH, I will disregard the aspects of a viewing device, interactivity, and immersion, and simply approach the definition through the

production method. Thus, VH is the interpretation and presentation of tangible and intangible cultural heritage through meticulously modelled, digitally constructed virtual worlds. This definition is broad enough to include XR experiences, video games, and 3D animations, but appropriately narrow to exclude many other forms of DCH, such as digitized documents, 360-degree video tours (often called ‘virtual tours’), websites and online archives, or podcasts.

2.1.3 Applications

Virtual Heritage applications utilize a diverse range of technologies with a varying degree of interaction and immersion. One application area is serious games—games that allow players to learn about history and cultural heritage without necessarily abandoning the entertainment aspect. Serious games are typically played on desktop or mobile devices. Some famous commercial examples include the Civilization series, the Total War series, the Assassin's Creed series, and Minecraft (Anderson et al., 2009, 2.2.3.3 - Total War; 3.1 – Virtual World System Infrastructure; Garcia-Fernandez & Medeiros, 2019, p. 2265). While all serious games are not originally created to be "serious" or to educate audiences about cultural heritage, they have been found to have the "capacity to transmit cultural values and raise awareness of cultural preservation in a highly engaging environment" (Garcia-Fernandez & Medeiros, 2019, p. 2262).

Augmented Reality, with its capacity to superimpose objects and information on top of the real-world view, has numerous applications in cultural heritage. Although there are AR and MR headsets available, such as the Microsoft HoloLens or the Varjo XR-3, AR applications do not necessarily require specialized devices, as they can be run on tablets or smartphones as well. Therefore, the threshold of adoption among visitors is relatively low. Examples of applications include augmented tours that provide additional information about cultural heritage sites, such as the Casa Batlló AR tour (A. Vargas, personal communication, February 19, 2021), and visualization of 3D objects and interiors at the location of user's choice, such as the Virtual Tomb extension of the Egypt of Glory exhibition at Amos Rex art museum (Amos Rex, 2020).

Among the applications that most typically are associated with VH are Virtual Reality experiences. VR experiences can be staged on HMDs, CAVE systems, or custom-built

simulator rigs, such as vehicle simulators. A CAVE system (Cave Automatic Virtual Environment) is a multi-walled stereo projection environment, which adjusts the image perspective based on the viewer's head position. CAVE systems can accommodate only a small number of visitors who are required to wear specialized glasses. They are relatively expensive to build and require ICT expertise to operate and maintain. (T. Takala, personal communication, September 17, 2020). Therefore, their adoption at museums is low in comparison with less complex installations.

VR headsets are physically limited to one user at a time but offer the highest degree of immersion by isolating the user from the real environment. Examples of VH experiences on VR headsets include the Explore VR Macchu Picchu by National Geographic, the Anne Frank House VR experience, and the battle experience at Muisti Centre of War and Peace in Mikkeli, the first two of which are available for home viewing on the Oculus platform. Online VR environments, such as the Mozilla Hubs platform, support the participation of a number of users on a large range of devices, making it possible to organize conferences, seminars, and tours in a custom-built environment, such as the virtual replica of the Museu de Arte do Espírito Santo.

2.1.4 Presence and Immersion in Virtual Worlds

Presence and immersion are some of the key concepts of virtual worlds, referring broadly to the sense of inhabiting a simulated space. However, there is no general agreement of their exact definitions. Presence is sometimes described as the psychological state of being located in a virtual environment, produced by human perception through sensory stimulation, albeit artificial. Immersion, then, is the quality of a technological solution to induce the sense of presence. However, Calleja (2014) argues that the sense of presence is highly subjective and depends on the participants' agency in the virtual world and their interpretation of it based on their life experiences (p. 225). Therefore, donning a state-of-the-art VR headset on a person would not automatically cause them to feel present in the world of the experience. Champion (2013) questions the importance of presence altogether, stating that VH should rather be concerned with the presentation of tangible and intangible cultural heritage, which does not necessarily require spatial presence, but rather a cultural presence (p. 278).

Needless to say, immersion as a term has applications outside of virtual worlds, too. In their model of the Four Realms of an Experience, Pine and Gilmore (1998) place immersion on the connection spectrum, which describes the participant's relation with the environment. According to the model, Escapist and Esthetic experiences have a high degree of immersion but differ in the degree of participation. Esthetic experiences, such as a visit to an exhibition, immerse the participant with the content but allow little or no interaction with it. (Pine & Gilmore, 1998, *The Characteristics of Experiences*) According to Sahari (2020), immersion is always present at museums through the use of space, architecture, objects, lights, and sounds for creating a captivating atmosphere as a distinction from the mundane. VH experiences offer an additional leap from the immersive exhibition space to an imaginary or simulated past. (Sahari, 2020, p. 54)

2.1.5 Criticism and Limitations

Reality vs. Interpretation

Sahari reminds that an exhibition is always a reconstruction of the past, based on the interpretation of available sources (Sahari, 2020, p. 53). Similarly, Champion (2013) maintains that simulating something that existed in the past involves extrapolation from unreliable and potentially conflicting accounts and using of one's imagination.

Photorealistic presentation and stand-alone experiences which do not provide enough background context may misguide the learning experience by implying a high degree of authenticity. It is therefore important in VH experiences to help participants make the distinction between reality and interpretation. The expectation of the audience should also be considered, as an average visitor may be satisfied with a lower degree of realism than an expert audience. (Champion, 2013, p. 273.)

Access and the Digital Divide

Despite a steadily growing interest in Virtual Heritage, VH experiences are still a curiosity rather than an integral part of the toolbox of most cultural heritage organizations. Bottino and Martina (2010) mention the poor user experience offered by early virtual world technology and high costs of technology and production as some of the reasons for slow diffusion of VH (p. 422). Furthermore, the short life cycle of virtual world technology compared with older media, such as video, can be an obstacle for wider adoption (Sahari, 2020, p. 54). Although the technology has further advanced and its price significantly decreased during the last decade, the cost of production remains high, due to the labour-

intensiveness of the work and the requirement for highly specialized expertise.

The high cost, the requirement for existing and open technological infrastructure, and the skills needed to produce and consume digital content introduce severe challenges for access to VH. According to UNESCO (2020b), nearly half of humanity still do not have access to digital technologies, and access is unequally distributed between and within countries. The imbalance in production capacity also narrows the diversity of cultural expression and may lead to the dominance of certain cultural practices and forms of expression over others. (UNESCO, 2020b.) Additionally, access to VH may be restricted by language barriers or by physical disabilities, which should be taken into account when designing experiences and installations.

Health & Safety Concerns

An important design consideration for VH experiences that have a high degree of immersion, especially VR solutions, is related to the concept of simulator sickness. VR experiences may cause fatigue, headache, dizziness, or nausea in users. While sometimes the reasons may be related to individual properties or a lack of previous experience of VR, simulator sickness can also be triggered by a sensory conflict due to the artificial stimulation of senses in VR. For example, perceiving a fast acceleration scene through an HMD, but not feeling the acceleration forces physically, causes a specific mismatch between the senses, calledvection. This issue is typical for flying in VR or rollercoaster experiences, which can make even an experienced VR user feel nauseous. Developers can greatly reduce the risk of simulator sickness by following common VR design guidelines. (LaValle, 2019, pp. 352-361.)

Furthermore, users wearing HMDs are not fully aware of their surroundings, which in public spaces introduces certain challenges. Firstly, users fully immersed in a virtual world may be a danger to themselves or to bystanders, as they may hit obstacles or other people in their vicinity. Secondly, not being aware of bystanders may pose a risk to privacy, as the users may be observed without their knowledge. Thirdly, users oblivious to their surroundings at public places may become victims of theft or other types of attacks (Mathis & Khamis, 2019). These risks should be considered in the design of VH experiences but also in the holistic visitor experience design at museums and heritage sites.

2.2 Temporary Organizations and Interorganizational Projects

Across industries, work is increasingly taking place in temporary organizational settings, that operate outside of everyday operations of an organization. These temporary organizational forms vary in type, size, and length, including for example movie sets, theatre productions, software development, construction, and R&D projects (Bakker, 2010, pp. 466-467). Cultural heritage organizations such as museums are also accustomed to organizing work in projects, for example when creating new exhibitions. The projectization of work has become so pervasive in society that it has led to an overuse of project terminology in different contexts, so much that their meanings have become somewhat unclear (Carpenter, 2010, p.1).

Jones and Lichtenstein (2009) make a distinction between projects within firms, project-based organizations, and interorganizational projects, with the latter defined as multiple organizations collaborating on a shared activity for a limited time period, across diverse industries. They see the project as "a nexus of activity that allows multiple organizations to collaborate to achieve their individual and collective goals" The relationships of parties in interorganizational projects can vary from partnerships to client-contractor-relationships, where a contractor can coordinate the work of multiple entities, or the client can represent multiple actors. (Jones & Lichtenstein, 2009, p. 234.)

Temporary organizational forms have been a subject of a considerable amount of research, which Bakker (2010) has summarized in his literature review, focusing on the organizational processes, behaviour and social interactions that take place in temporary organizations. The review identifies four broad themes around which research is centred: Time, Team, Task, and Context. Jones and Lichtenstein (2009) propose the terms Temporal and Social Embeddedness to understand how activities are framed and coordinated in temporary interorganizational projects under conditions of uncertainty. Vom Brocke and Lippe (2015) present three management paradoxes which illustrate some of the most common challenges in innovative interorganizational projects. Carpenter (2010) highlights the distinct characteristics of projects in libraries, archives, and museums. In the following section I will briefly summarize these partly overlapping concepts, using them as a

framework to understand and reflect on the characteristics and challenges of project management in an interorganizational setting.

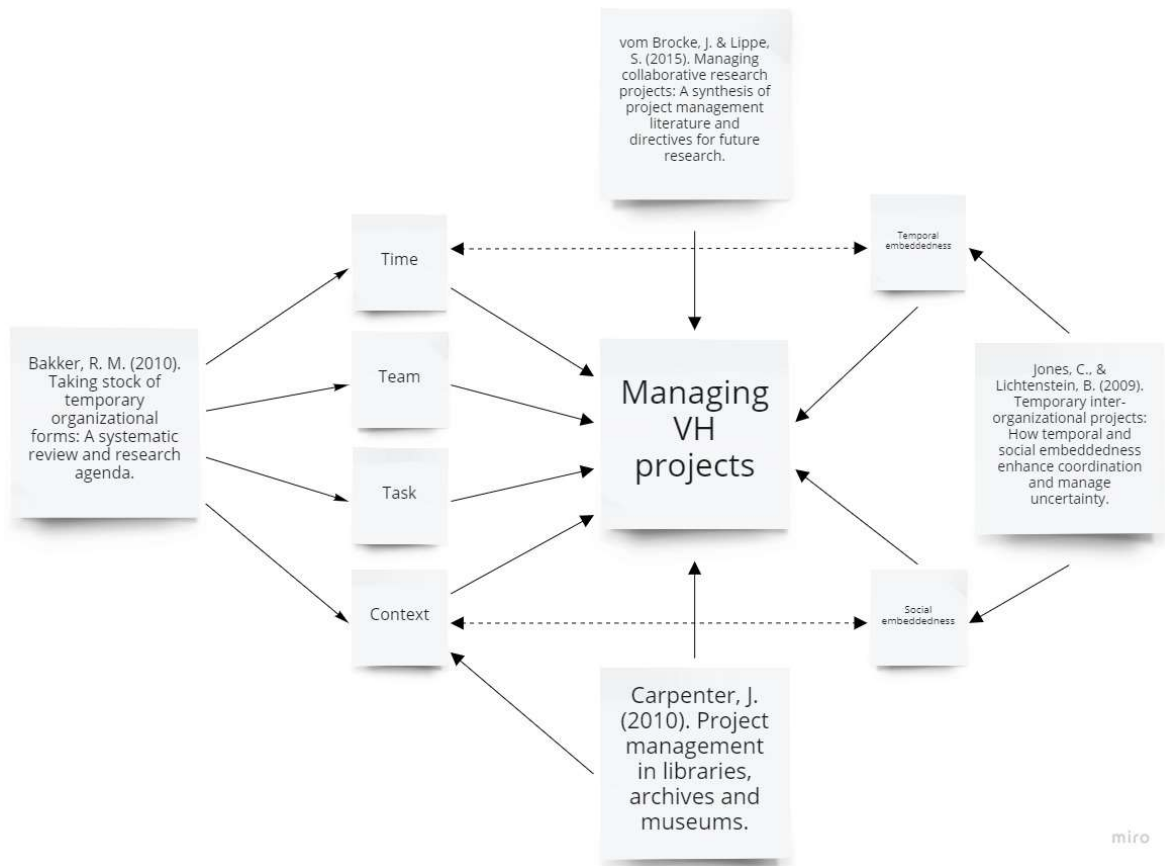


Figure 1 - Project management literature and themes

2.2.1 Time and Temporal Embeddedness

Projects are usually defined as being temporary of duration. The conception of time as being finite has implications for the behaviour of a project organization. The time limit evokes a sense of urgency, since in projects time is always running out. This perception of time as a scarce resource results in project organizations having a highly organized approach to time management. (Lundin & Söderholm, 1995, pp. 438-440.)

Time is also one of the components in the traditional triple-constraint model, describing the three competing constraints of projects, in which changes to the other two, the cost and the scope, also affect the schedule of the project (Watts, 2014, p. 15). While project plans aim at defining the duration of a project in advance, in reality the time to complete a project is often extended, for example due to adjustments in scope or change in resources. Arguably, missing the deadline is more common in some industries, such as construction and software development, and less common in others, such as theatre productions and

museum exhibitions, which usually have a set opening date functioning as a hard deadline.

Related to time, Jones & Lichtenstein (2009) use the term temporal embeddedness to refer to how in temporary interorganizational settings a project's expected duration produces mechanisms that demarcate and influence the coordination of collaborative activities between the parties. These mechanisms include chronological pacing—the use of deadlines, contracts, and timelines to keep a steady pace; event-based pacing—setting up milestones and target dates to maintain progress towards the goal; and entrainment-based pacing—finding a common beat by aligning activities based on external markers such as seasons, ceremonies, and openings but also based on each other's pace. (Jones & Lichtenstein, 2009, pp. 233-237.)

2.2.2 Team

Project teams are formed to perform certain tasks in order to achieve the goals of the project within a specified schedule. Therefore, it is typical that a project team is assembled of individuals with a diverse set of skills that complement each other. In addition to skills, team members bring with them their unique combinations of knowledge, experiences, expectations, attitudes, and ways of working, which have the potential of influencing how the team functions (Lundin & Söderholm, 1995, p. 441). According to Bakker (2010), one of the key issues of temporary organizations is precisely that they depend on these interdependent combinations of diverse sets of skills, knowledge, and experiences, but they lack the time to develop circumstances that foster creation of a supportive atmosphere and building of trust (p. 475). Yet, the experiences and expectations form the foundations for motivation and commitment within the team, thus influencing communication and leadership (Lundin & Söderholm, 1995, p. 442).

2.2.3 Task

Temporary organizations are formed to complete a certain task, which focuses the attention and guides the activities of the organization. Tasks can be repetitive, or unique. In the case of repetitive tasks, the actors share a common interpretation of the circumstances and the activities required to complete the task. In contrast, when a task is unique, the formula to its completion needs to be discovered intentionally through creative, flexible, and visionary actions. (Lundin & Söderholm, 1995, pp. 438-441.) However, the division to unique and

repetitive tasks is not necessarily always clear when planning a project. As a project unfolds, a unique task may turn out to comprise of mostly repetitive sub-tasks, or a seemingly repetitive task may reveal to contain unique components as well.

2.2.4 Context and Social Embeddedness

According to Bakker (2010), temporary organizations should be examined embedded in their enduring contexts, which consist of the firm level (the surrounding organization) and the wider social context. Carpenter (2010) maintains that the organizational context is a key characteristic of projects in museums, libraries, and archives, subjecting them to various policies and external requirements. Examples of embeddedness in the firm level include Project Based Organizations (PBOs), which live by projects, such as performing arts companies, but also projects within enduring organizations, such as exhibitions in museums. The wider social context encompasses project-based industries, such as construction or the movie industry, but also communities of practice and professional networks. (Bakker, 2010, p. 466.)

Jones and Lichtenstein (2009) use the term social embeddedness to refer to how a temporary interorganizational project is influenced by and interacts with its surrounding context both on the firm level and in the wider social network of organizations. The relational aspect of social embeddedness refers to how parties trust each other, understand each other's preferences, consider each other's needs, and share information with each other. Through repeated interactions partners or parties in client-provider relationships learn to know each other's ways of working, establish routines, and develop communication protocols, all of which improves coordination between the parties. (Jones & Lichtenstein, 2009, pp. 238-240.)

The structural aspect of social embeddedness refers to how parties are connected to each other. As a result of social actors moving between organizations once projects terminate, actors in a field form a network of connections, which links organizations together in more than one way. This network facilitates the development of shared understandings and codified working methods, leading to the forming of a macroculture among practitioners in the field. Eventually, through repeated and long-term relationships between organizations, a project ecology emerges, which solidifies the practices in a field. (Jones & Lichtenstein,

2009, pp. 239-240.) The age of an industry or a field may be an indication of how institutionalized the shared understandings are. For example, the movie industry has a strong network of connections and well established practices, but the Virtual Heritage field has barely started to develop a project ecology.

2.2.5 Not All Projects Succeed: Uncertainty, Challenges, and Risk of Failure

Projects inevitably contain a degree of uncertainty and various risks, which unaddressed can cause a project to fail. Jones and Lichtenstein (2009) suggest that in the case of interorganizational projects, there are two kinds of uncertainty: demand uncertainty, which is related to the market, and transactional uncertainty, associated with the interdependent and interactive nature of collaborative product and service development. Temporal and social embeddedness provide techniques for managing transactional uncertainty by framing activities and by facilitating the development of shared understandings and trust between partners. (Jones & Lichtenstein, 2009, pp. 235-236.)

Failure

A traditional way to think about a project's success is to evaluate how it meets the triple constraints of time, cost, and scope. More thorough evaluations take into consideration quality and customer satisfaction, too. Opelt et al. (2013) cite several studies from 2000s that indicate that in the ICT field more than 60% of projects failed either by taking longer than planned, costing more, or by emerging with different results than expected (pp. 4-5). Carpenter (2010) suggests that the reasons why projects in libraries, archives, and museums fail include not having a valid business case, inadequate planning and coordination of resources, unclear definition of outcomes and requirements, lack of communication during development leading to unsatisfactory results, failure to monitor and control progress before it's too late, poor quality control, unclear definition of project manager's role and responsibilities, and a lack of appreciation of project management on the higher levels of an organization. Opelt et al. (2013) extend, that unrealistic time constraints, lack of cooperation and coordination between the partners, and changes in requirements and specifications are additional causes of failure in ICT projects. Furthermore, the probability of failure increases with the duration and complexity of the project. (Opelt et al., 2013, pp. 4-6).

Complexity

Project organizations are seen as more efficient than enduring organizations, but on the other hand, they can be considerably more complex to manage, requiring more skill and sophistication (Marion, 2018, p. 22-23). Carpenter (2010) lists some factors that increase a project's complexity, including multidisciplinary, high levels of innovation, a new technological context, and shared responsibility between different organizations (p. 12). Reflecting on Lundin and Söderholm's (1995) views on project tasks, it could be argued that having a unique task increases a project's complexity as well as the risk of failure, as no models readily exist for its completion and estimation is thus difficult. Similarly, having multiple parties as in interorganizational projects is a potential project complication, presenting the need to manage transitional uncertainty.

Challenges and Uncertainty

In their research on managing collaborative research projects, vom Brocke and Lippe (2015) present three paradoxes which summarize well some of the most common challenges in complex, innovative, interorganizational projects. Firstly, they state that:

On the one hand, research projects operate under considerable uncertainty and require freedom and flexibility if they are to generate innovative results. On the other hand, uncertainty needs tight management in order to avoid failure, and creativity needs firm structures in order to be transformed into widely usable project outcomes. (vom Brocke & Lippe, 2015, p. 1031.)

While interorganizational projects need tight management and structures to align activities and control the outcomes, they also need to foster creativity to be able to solve problems related to unique tasks. Repetitive tasks may be routinely solved within provided time frames, with well understood team roles and responsibilities, drawing from experiences and practices derived from the social context. However, projects with unique tasks come with more uncertainty with regards to time, team, and context. To balance structure and flexibility vom Brocke and Lippe (2015) recommend a multi-level approach to planning and monitoring, through enforcing control at the project level, but allowing more freedom at the working level. This can be achieved by providing a high-level frame of reference, including roles and responsibilities, but not 'micro-managing' through explicit orders and

guidelines.

The second management paradox points out, that:

On the one hand, collaborative research fosters the integration of the research perceptions, ideas, and views that are needed in order to solve problems comprehensively. On the other hand, the resulting heterogeneity of partners leads to problems with respect to inter-cultural, inter-organisational, and inter-disciplinary management. (vom Brocke & Lippe, 2015, p. 1031.)

Completing a unique task of an interorganizational project requires the integration of inputs from multiple organizations, representing various disciplines that may differ considerably in their cultures, philosophies, and languages. The management challenge is then to facilitate the development of a shared language, a shared understanding of the task, and methods of collaboration. To achieve this, vom Brocke and Lippe (2015) suggest that project partners ensure compatibility of working styles and values through open discussion before embarking on a joint venture and maintain good communication during the project. Furthermore, they place emphasis on appointing a skilled project manager with good facilitating skills and a participative leadership style.

Finally, the third management paradox stipulates, that

On the one hand, the manager is assigned only limited authority because of the autonomy of partners and governance structures. On the other hand, the findings show that certain tasks, such as management of the project vision and integration of results, require the commitment and involvement of all project parties. (vom Brocke & Lippe, 2015, p. 1031.)

The low level of authority of the project manager poses an additional challenge to projects. The team members may belong to various organizations, each with their own managers, or the responsibility over the project may be shared between partners. Nevertheless, the project manager needs to engage the participants and get their commitment in order to keep the project on track and deliver the intended results. To manage this challenge, vom Brocke

and Lippe (2015) stress the importance of a commonly defined and clearly communicated project vision used as a framing device to reduce uncertainty, to align stakeholder views, and to engage project parties. (vom Brocke & Lippe, 2015, pp. 1031-1032.)

One more challenge that is often identified as a key issue of temporary organizations is the problem of knowledge transfer, or transmission of experiences (Bakker, 2010; Lundin & Söderholm, 1995). A project team generates knowledge of a specific context, whose value potentially extends beyond the project, being relevant for the parent organization in which the project team is embedded, too. Deliberate measures need to be taken to capture the knowledge and ensure its dissemination but allocating time for these actions is often ignored in project plans, or it may be sacrificed in the final rush to meet the project deadline. However, as Lundin and Söderholm (1995) suggest, individual learning in project organizations acts as a bridge to future temporary organizations, fostering learning in the wider social context (p. 450). Thus, although the learnings from a project may not be systematically collected, through the structures of social embeddedness they may still indirectly benefit the parent organizations as well as the whole field.

2.3 Project management methodologies

In the information age, changes in production and distribution technologies and consumption patterns have intensified the competition between businesses and created increasing demand for services and experiences. To respond to the needs of the market and the dynamic and rapidly changing work environment, organizations are increasingly running short-term projects alongside with their ongoing operations, which has created the need to develop a new work management paradigm. Project management has thus evolved as a discipline that aims at systematizing project work to create conditions for project success and to ensure project completion.

A project management methodology is a set of methods and techniques used at various stages of a project. Temporary organizations come in many forms, and as a logical consequence, various management methodologies have been developed over time. A methodology typically originates in a certain field, where it was developed to manage certain types of projects, but is later adopted in other fields, too. It can also be argued that project management methodologies reflect the nature of the industry or time in which they

are created. Whereas some of the more traditional methodologies focus on hierarchical structures, relevant and timely action, and the optimization of resource allocation, others put more emphasis on people and their interactions.

It is of course entirely possible to manage a project without any knowledge of or training in a methodology. Personal experience of projects within organizations has shown that projects can be successfully completed without a labelled method, following just a common-sense approach. While following a certain methodology rigidly may not seem necessary for small-scale projects, as project complexity increases the benefits of a structured approach begin to manifest (Carpenter, 2010, p. 3).

The choice of a project management approach is left to the project manager's judgement but should be influenced by the nature of the task and the constraints of the project (Roudias, 2015, Introduction). Vom Brocke and Lippe (2015) argue, that because available management methods don't necessarily fit the collaborative research project context well, it is common for managers to establish their own sets of tools and methods, following a learning-by-doing approach (p. 1023). Neither in museums should project management be imported from outside as a separate set of methods, but rather "grow organically" to fit the work culture and service ethos of cultural heritage organizations (Carpenter, 2010, p. 16).

In this section I will give a high-level overview of three common project management frameworks, the Project Management Body of Knowledge (PMBOK) which is widely in use in the United States, the PRINCE2 method developed for British government projects, and the most common of Agile management approaches, the Scrum framework, which originates in the software industry. The three approaches are not mutually exclusive, but complement each other, permitting the use of various methodologies and techniques. (Roudias, 2015, Introduction.)

2.3.1 Project Management Body of Knowledge (PMBOK)

The Project Management Institute (PMI), a non-for-profit organization that aims to define and standardize the terminology, processes, and practices of project management, publishes the PMBOK Guide, currently in its 6th edition, 7th edition pending to be released in 2021 (Project Management Institute, 2021). The PMBOK is a prescriptive

guide, listing the knowledge areas that project managers need to master (Roudias, 2015, Introduction). It combines a process and a content view of project management into a framework that provides managers with a checklist of actions to take and techniques to use, following a logical progression from beginning a project to finishing it (Marion, 2018, p. 3).

PMBOK is organized into a matrix of 47 processes, which are typical to most projects, most of the time (Roudias, 2015, 2 - Project Processes). The processes are divided into 5 process groups, which are labelled as Initiating, Planning, Executing, Monitoring and Controlling, and Closing. The process groups should not be confused with the stages of the project life cycle, a concept that is generally used to describe the stages in which a project advances from start to finish. Rather, the five process groups can be understood as forming an internal cycle for executing work within any part of a project, such as the planning stage in the project life cycle. Following the process groups, the planning stage is initiated, planned, executed, monitored and controlled, and eventually closed. (Marion, 2018, pp. 8-9.)

The processes are not evenly distributed across the five process groups. The Planning process group contains 24 processes and the Monitoring and Controlling process group 11 processes, which highlights the emphasis given to those areas in the PMBOK framework. Furthermore, the processes are scattered among ten knowledge areas that describe the content or skills applied within each process group. The ten knowledge areas to manage are Integration, Scope, Time, Cost, Quality, Human Resource, Communications, Risk, Procurement, and Stakeholder. (Roudias, 2015, 2 – Project Processes; 3 - Knowledge Areas in PMBOK 5th Edition.) Examples of processes of each knowledge area in the Planning group include developing the project management plan (Integration), collecting requirements (Scope), estimating activity durations (Time), estimating costs (Cost), planning quality management (Quality), planning HR management (Human Resource), planning communications management (Communications), identifying risks (Risk), planning procurement management (Procurement), and planning stakeholder management (Stakeholder). (Roudias, 2015, 3 - Knowledge Areas in PMBOK 5th Edition.)

The different processes are linked through inputs and outputs. Inputs are items, such as information or a product, that are required to proceed with a process. Outputs are the

results generated by a process, that may further be the inputs of a succeeding process. Moreover, the PMBOK defines the tools, such as templates or software, and techniques, or systematic procedures to follow, that can be used in each process. For example, the process of planning procurement management, which aims at specifying the need and the approach for procurement and identifying potential providers, lists various inputs, including the scope baseline, requirements documentation, project schedule, cost estimates, and organizational process assets. The outputs of the process include a procurement management plan, make or buy decisions, and the source selection criteria. The tools and techniques that can be used in the process are make or buy analysis, expert judgement, market research, and meetings. (Roudias, 2015, 3 - Knowledge Areas in PMBOK 5th Edition.)

2.3.2 *PRINCE2*

PRINCE2, short for P*RO*jects IN Controlled Environments, is a process-based approach to project management that provides an adaptable and scalable method for managing various kinds of projects. It is based on seven principles, seven themes, and seven processes. The seven processes largely correspond with PMBOK's five process groups, but with increased granularity. In PRINCE2, the processes are called Starting, Initiating, Directing, Controlling a Stage, Managing Stage Boundaries, Managing Product Delivery, and Closing. The seven themes in PRINCE2 are Business case, Organization, Quality, Risk, Plans, Change, and Progress. The themes describe management aspects that need to be constantly addressed during a project. They aim to answer questions such as why the project is being done, who are involved, what is being done, what the impact of the project is, and what to do if something goes wrong. (Roudias, 2015, 4 - Principles, Themes, and Methodology in PRINCE2.)

The seven principles list the central values that need to be considered and addressed in a project. The principles are Continued business justification, Learning from experience, Defined roles and responsibilities, Managing by stages, Managing by exception, Focusing on products, and Tailoring to suit the environment. The first principle suggests that a project's business case is carefully evaluated when starting, and frequently re-examined during the project. The second principle directs attention towards the importance of systematic learning throughout the duration of the project; sufficient efforts should be

made at recognizing learnings from previous projects and at documenting experiences during the ongoing project. The third principle recommends that a project has clearly defined roles and responsibilities to have a clear management structure. Furthermore, the roles of business sponsors, users, and suppliers should be considered. The fourth principle implies that projects are broken into manageable portions. The fifth principle, Management by exception, is a management mechanism that is activated if an issue is outside of its pre-defined tolerances, for example if a process is on a trajectory to exceed its time or cost estimate, or if the quality of an output is lower than required. In effect, management by exception can be a way to avoid micro-managing and intervene only when needed. The sixth principle suggests that adequate emphasis should be placed on defining the products to be delivered. Lastly, the objective of the seventh principle is to ensure that the method is adapted to the project's environment, scale, and complexity. (Roudias, 2015, 4 - Principles, Themes, and Methodology in PRINCE2.)

2.3.3 Agile and Scrum

Agile management methods originated in the software industry in the 1990s but have recently been gaining a lot of interest in various fields outside of their original context. Indeed, Tzanaki et al. (2017) claimed that "Agility is the new stability" by listing the Agile methods as one of the ten trends that changed the museum world in 2017 (Tzanaki, Seleli, Bierwisch, Koppen, & Perinčić, 2017, pp.109-116).

In 2001, a group of software developers published The Manifesto for Agile Software Development, which describes the 12 principles of Agile development. In summary, the Agile Manifesto emphasizes focus on individuals and interactions over processes and tools, delivering working software over comprehensive documentation, collaboration with customers over contract negotiation, and responding to change over following a plan as the order of priorities. Elaborating on the focus on individuals, the fifth principle advises to "Build projects around motivated individuals. Give them the environment and support they need and trust them to get the job done." Furthermore, the last principle states that "At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly." (Beck et al., 2001.)

Table 1 - the twelve principles of Agile development (Beck et al., 2001)

Principle
1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility
10. Simplicity - the art of maximizing the amount of work not done - is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly.

All agile processes emphasize the importance of team members and all other stakeholders talking to each other and exchanging ideas constantly. The probability of a software development project's success is highest when developers and customers work closely together. This requires active involvement from the customer - they need to make themselves available as partners. (Opelt et al., 2013, p. 9.)

The benefits of adopting agile methods are increased success rates and improved quality in

the software industry, higher team motivation and productivity, ability to handle changing customer requirements, making progress visible, contributing to a more agile organizational culture, and fostering trust and cohesion in teams (Rigby et al., 2016; Hidalgo, 2018; Opelt et al., 2013, p. 2).

The Scrum framework

Scrum was developed by Ken Schwaber and Jeff Sutherland in the early 1990s, predating the Agile manifesto by 10 years (Schwaber, K., 2010). The purpose of Scrum is to "help people, teams, and organizations to generate value through adaptive solutions to complex problems" (Schwaber & Sutherland, 2020). It is therefore not a software development method but a management framework, within which work, such as software development takes place.

During the 21st century, Scrum has further evolved from a project management framework to a paradigm for understanding how to manage work teams, departments, and entire organizations. (Opelt et al., 2013, p. 11). Scrum does not provide detailed instructions on how to manage work, but rather provides mechanisms that guide the relationships and interactions between the people doing the work, adapting to existing practices or rendering them unnecessary (Schwaber & Sutherland, 2020).

Opelt et al. (2013) see constant delivery as the main difference between Scrum and traditional project management methods (p.12). Scrum is an iterative and incremental approach to generating value for customers. It is not intended for producing a rigid predefined result, but to produce a steady stream of parts that build up the end product, leaving room for changes or new requirements that emerge during the development. This increased capacity to respond to change, in contrast to predictive project planning, is one of Scrum's main benefits. (Roudias, 2015, 5 – Scrum Method.)

Philosophy and Values

The philosophical foundation of Scrum is based on empiricism, which is manifested in the emphases on building knowledge on experience and basing decisions on observations. Therefore, the framework builds on the three pillars of Transparency, Inspection, and Adaptation. Transparency demands that work, processes, and progress must be visible to the team and the stakeholders. It is the prerequisite for successful inspection, through which progress is evaluated at regular intervals. Adaptation refers to the adjustment of

processes or work, if they are observed to deviate outside the set tolerances. (Schwaber & Sutherland, 2020.)

The Scrum guide lists five fundamental values that Scrum teams should embody. These values include Commitment to achieving goals and supporting each other, Focus on the task, Openness about the work and its challenges, Respect towards other team members and their abilities, and Courage to bring up problems and work on solving them. Combined with the empirical pillars of transparency, inspection, and adaptation the values work to build trust within a team. (Schwaber & Sutherland, 2020.)

Events

In Scrum, work is organized in Sprints - fixed length development cycles that are typically one month or less in duration. Each sprint is effectively a short project with a set goal and scope, which should not change during the course of the sprint. Scrum defines four events that take place within Sprints. Firstly, Sprint Planning is a collaborative meeting that initiates a Sprint and defines its scope. Secondly, the Daily Scrum is a 15-minute meeting during which the team inspects progress towards the goal of the Sprint and communicates on issues. Thirdly, in the Sprint Review the team presents the results of the Sprint and reflects on progress with relation to the overall product goal. Finally, the purpose of the Sprint Retrospective is to reflect on the team's processes and ways of working and improve on them as needed. (Schwaber & Sutherland, 2020.) Opelt et al. (2013) note that the Scrum events make planning and monitoring processes frequent, concrete, transparent, and collaborative in Scrum teams (pp.10-11).

Artifacts

Central for the planning and execution of work in Scrum teams is the Product Backlog, which is a list of items that constitute the long-term objective of the team, the Product Goal. The Product Backlog is thus a prioritized collection of requirements, features, information, and content that need to be produced to develop a product. The backlog is continuously and collaboratively refined to add detail to the items, so that the team has enough information for starting to work on them. The Sprint Backlog is a refined list of items that the Scrum team commits to working during one Sprint, thus defining the scope of the Sprint. An Increment is a usable part of a product that is created during a Sprint, and meets the Definition of Done, the organization-wide or the team's own quality standard. (Schwaber & Sutherland, 2020.)

Roles

In Scrum, the creative freedom of self-organization takes place within a clearly defined framework. As Scrum teams are non-hierarchical and self-organized, there is no de facto manager defining who does what, when, and how. Instead, the team members choose to commit to the amount of work they will be able to complete within a Sprint. Time-boxing the work introduces creative pressure but also provides security necessary for self-organization, as Scrum aims to protect the team's working time from interruptions. (Opelt et al., 2013; Schwaber & Sutherland, 2020.)

Scrum clearly defines the roles and responsibilities within a team. The three roles defined in the Scrum guide are Product owner, Scrum master, and Developer. The Product Owner is responsible for maximizing the value of the product created by the team. The Product Owner may represent the user or other stakeholders and is accountable for managing the Product Backlog. The Scrum Master's responsibilities include ensuring the team's effectiveness, facilitating the Scrum Events, and coaching the team and the organization on adopting and following Scrum. The Scrum Master is a servant-leader, whose work helps the Product Owner, the Scrum team, and the wider organization collaborate successfully. Finally, the rest of the members of the Scrum team are simply called Developers. Their responsibilities include creating the Sprint plan and producing high quality increments that meet the Definition of Done. (Schwaber & Sutherland, 2020.)

3 RESEARCH METHOD

3.1 Methodological Approach of the Study

The study is a qualitative case study, examining project management in one Virtual Heritage project and the wider exhibition project encapsulating it. The literature review on Virtual Heritage and project management was conducted during winter and spring 2021 and the data collected during the spring, partly overlapping with the literature review. The material consists of two interviews as the primary sources of information and two internal documents and a journal article as secondary sources, describing the background of the case.

The philosophical background of the study is based on the constructivist view that reality is constructed by individuals in interaction with their social context. The chosen research approach is the qualitative case study, which involves the in-depth analysis of a bounded system. (Merriam & Tisdell, 2015, p. 24.)

The phenomenon to be studied is project management in the context of a single project. The unit of analysis—the VH project—is inseparable from its context, which according to Merriam and Tisdell (2015) endorses the case study approach. The case is demarcated by a unique organizational context, a unique task, a unique team, and a limited timeline.

Lee and Saunders (2017) describe two broad approaches to qualitative case studies: the orthodox and the emergent. The orthodox approach considers the case study as a research strategy in which research processes in a pre-defined, linear sequence of activities. The emergent approach is a more iterative one, in which new information discovered during the process may influence the decisions made earlier. (Lee & Saunders, 2017, p. 2.) Perhaps fittingly for the study, the two approaches remind the distinct approaches to project management. Traditional approaches treat projects as logical sequences of activities that can be planned ahead and executed in an orderly fashion. In contrast, the Agile methodologies assume an iterative approach and embrace change and continuous revision of assumptions for ensuring the best results.

The approach to the case study at hand has been of the emergent type. The literature review and the definition of the research problem progressed hand in hand, and the research questions were revised a number of times. The themes emerging from the interviews still influenced the research problem and the thematical framework. If the initial research plan had been rigidly followed, the resulting study would look very different. For instance, the initial problem setting placed more emphasis on the adoption of Agile methodologies but learning about the organizational context during the research diluted the relevance of focusing on a specific methodology and steered the research towards understanding the context better.

3.1.1 Case Selection

My initial plan was to conduct a comparative case study by examining three cases and compare their relation to the project management themes presented in the thematical part to possibly draw stronger conclusions. However, I could not get enough relevant data of the other two cases within the time frame of the study, thus having to settle with a single case. In the end, a single-case study allowed me to provide a richer case description and conduct a more in-depth analysis of the project management themes.

The criteria for selecting the cases included the requirement for having a strong Virtual Heritage component - an application of virtual-world technology that engages visitors with and educates them about a cultural heritage topic. Additionally, the production of the Virtual Heritage experience had to take place in a project setting instead of an ongoing development of an existing product.

I initially conducted an online interview about another case as well but, due to some communication challenges, was not able to acquire enough reliable information about it. The connection at the interviewees end was weak which, combined with a slight language barrier increased the risk of misunderstanding and misinterpretation. Furthermore, the interviewee was not in a position to provide accurate enough information about the management of the VH project. With the third case, the project was in a hectic phase at the time of the interviews, and the project manager unfortunately too busy to give an interview.

The other cases I evaluated were either abroad or located in another city in Finland.

Furthermore, both were still in development, and not open to public at the time of the research. Considering that, due to the travel restrictions related to the Covid-19 pandemic, travelling abroad was not possible and domestic travel not recommended during the research period, I would not have gotten similar insights provided by first-hand experience of the two other cases.

Thus, the selection of the main case was based on availability, researchability, and personal experience. I visited the Fateful Svensksund exhibition in Kotka in summer 2020 and had a first-hand account of the VH experience and the context of the surrounding exhibition, which made it far easier to understand the source material and place it in context. Additionally, my connection with the town and its cultural heritage influenced my choice.

3.2 Data Collection

The data collected about the case includes two interviews, two documents, an article, and a personal experience of the exhibition as anecdotal evidence.

3.2.1 Interviews

The selection of the interviewees was based on their roles in the project. From the exhibition's web page I found out who the appointed project manager was and was able to contact her directly. After establishing a connection with Aartomaa, she recommended that following the share of responsibilities during the project I should also interview the coordinator of the VH subproject, Sahari, employed in the project with the title of researcher.

The interviews were conducted remotely over Zoom, which allowed recording them easily for detailed analysis. The interviews followed a semi-structured approach, directing the discussion to the overall themes of interest, but not defining the problems too accurately to leave room for emerging themes (Brinkmann, 2014, p. 286). The time scheduled for the interviews was one hour, but both interviewees were happy to continue the discussion past the time limit.

There were several days between the interviews, during which I was able to reflect on my learnings and adjust my focus. Therefore, I personalized the question set for each interviewee, aiming to focus on the most relevant themes. It may be worth noting that the interviews were conducted approximately 10 months after the completion of the project. It is therefore possible that some of the interviewees' memories of the project had faded or transformed over time.

3.2.2 Documents

From Aartomaa I received two documents that provided valuable background information about the exhibition project and were helpful for writing the case description. First one, a summary of the Digital Customer Experience development project, outlined the vision of the digital customer experience, defined the technologies and methods of digital storytelling, and provided guidelines for exhibition creators. The second one, the Fateful Svensksund Exhibition Concept, described the target audiences, framed the philosophical approach to the treatment of the topic, and defined the designs for the exhibition sections, helping to understand the context and the decisions that influenced the project.

3.2.3 Article

Sahari's account of the project (Sahari, 2020), published in the Tekniikan Waiheita-journal, while focusing more on the issues of re-interpretation of the ship models and the battle in 3D based on historical sources, offered valuable insights about the subproject and some challenges encountered during it, from his perspective. It also served as a basis for discussion during the interviews.

3.2.4 Visit

Finally, my visit to the Maritime Centre Vellamo in summer 2020 helped me understand the context of the exhibition but otherwise provided merely anecdotal evidence. By then I did not yet know that I was going to study the topic, and therefore did not take notes of the experience. On the other hand, an informal visit allowed me to experience the exhibition and the VH experience as a visitor, not as an observer.

3.3 Data Analysis

The interviews were conducted and transcribed in Finnish. The transcripts were then annotated with the project management themes identified in the literature review, and with custom tags for emerging themes. The analysis of the data was approached visually by creating a concept map with Miro, an online visual collaboration platform. The high-level categories in the map were project management and case description. The project management themes and their sub concepts identified in the literature functioned as the main nodes of the map, to which findings and emerging themes from the data were connected. Furthermore, links were drawn between interdependent concepts based on what the interviewees said. To visually distinguish between the data sources, different colours were used. The network thus created consisted of 220 items and 267 connections between them. The connections were then examined to understand how items related to each other and affected other items in the case.

3.4 Critical Reflections on the Research Process

The generalizability of the findings of the study is limited by many factors. Firstly, the organizational context is influenced by the Finnish cultural policy system and by the unique characteristics of the organizations. Secondly, the interviewees emphasized that the case is exceptionally well-funded among the Finnish museum field, with its significant external funding. Thirdly, it could be argued that every project setting is unique, and therefore learnings may not be directly transferable to other projects. However, the existence and wide diffusion of project management methodologies suggest that projects can be fitted within existing frameworks to some extent, especially if the frameworks are adapted to the project context and not treated as rigid formulas.

Furthermore, innovative projects in the cultural heritage field often require external funding and participation of multiple organizations, which suggests that the project setting was typical for a VH project. However, due to the relatively small amount of case study research on VH project management, it is not evident what constitutes a typical VH project. It could also be argued, that a VH project is per se an atypical example of a cultural heritage project, due to the weak diffusion of the applications so far. According to Flyvbjerg (2006), atypical cases may in fact reveal more information of the phenomenon

being studied, because they "activate more actors and more basic mechanisms in the situation studied" (p. 229).

The findings of the study are based on interviews with two project team members in leading roles. Therefore, the study offers a limited perspective to the project from within the museum organization, although one interviewee had experience from working in the ICT field and could empathize with the provider's perspective, too. Neither interviewee had significant formal training in project management, which implies that the discussion related to project management methodologies involves a high degree of the researcher's interpretation.

Furthermore, the analysis is based on interpreting the network of interlinked concepts, from which another researcher could have drawn different kind of conclusions. Indeed, in a qualitative case study the primary instrument of data collection and analysis is the researcher (Merriam & Tisdell, 2015, p. 37). As a researcher, I am biased by my own professional experience from working in Scrum teams and managing projects in the ICT field. However, the bias also allowed me to empathize with the interviewees on a deeper level. Indeed, according to Flyvbjerg (2006), the ability to place oneself within the context being studied helps the researcher to achieve a higher level of understanding of the topic (p. 236).

Following the limited sample size and narrow perspective of the data, the study does not aim to generalize the findings beyond projects taking place in similar context. The case described may or may not be a typical example of a VH project. However, even a case study with an atypical case may provide widely valuable information of the phenomenon being studied. As Flyvbjerg (2006) suggests, context-dependent and non-generalizable knowledge contribute to a field's body of knowledge, providing material for learning about and developing expertise on a phenomenon (p. 222).

4 CASE DESCRIPTION

4.1 Background

Kotka is an unassuming port town in Southern Finland, spread over multiple islands in the location where the river Kymi's main branch meets the sea, approximately 130 kilometres from Helsinki, towards Russia. Although the commercial seaport has nowadays been moved further away from the centre, the long seafaring and naval traditions can be witnessed in place names and the local culture. The town yearly hosts one of the biggest summer festivals in Finland, the Kotka Maritime Festival, and among other attractions are the Maretarium aquarium and the Maritime Centre Vellamo, which houses the Maritime Museum of Finland. The sea and the nearby islands form an essential part of the recreational activities for inhabitants and tourists alike. However, just off the coast, below the surface of the sea, lies grim evidence of a battle long gone that claimed the lives of thousands of people.

On June 9, 1790 two massive navies confronted each other in a battle at a visual range from the main island of Kotka. Approximately 370 ships and vessels of various sizes from the Swedish and Russian fleets engaged in a deadly exchange of cannonballs that raged on for the entire day. At the end of the day, heavy losses forced the Russian fleet to retreat (Sahari, 2020, p. 52). The second naval battle of Svensksund, as the event later became known, is the largest naval battle ever fought in the Baltic sea. In its aftermath, the Ruotsinsalmi-Kyminlinna coastal fortress was built to guard the strategic location, the remains of which can still be seen in Kotka. The Fateful Svensksund exhibition (Kohtalona Ruotsinsalmi) in the Maritime Centre Vellamo tells a story of the battle and the campaign surrounding it, as well as the life in the garrison town, through the fates of ordinary people caught in the middle of the power struggles between two rulers, Gustaf III of Sweden and Catherine the Great of Russia, wrestling for control over the coast of Finland. (“Fateful Svensksund”, 2020)

I have lived in Kotka twice during my life: first as a child in the late 80s, and then again at the beginning of 2000s when I worked in the Finnish Navy. As a child I first got exposed to

the history of Svensksund through the exhibition in the Kymenlaakso museum in 1990. I was only 9 years old but still remember the strong impression the experience made with its use of music (the orchestral version of Musorgsky's Pictures at an Exhibition, 10th movement "the Bogatyr Gates", which I since have always associated with the battle), video, and lights. As a conscript I served at the island base of Kirkonmaa and the Kymminlinna fortress on the continent, and later as part of the staff my daily commute to the island passed the location of the battle. Although the formal ceremonies and military traditions did not address the history of the area significantly, it was strongly part of the cultural identity of the people in the region, linking the modern life to the past.

4.2 Project Parties and the Organizational Context

The Fateful Svensksund exhibition is a collaboration between the Maritime Museum of Finland and the Kymenlaakso Museum. The former is part of the organization of the National Museum of Finland, and the latter operates as the city museum of Kotka and the regional museum of Kymenlaakso. Both museums are located in the Maritime Centre Vellamo and can be accessed with the same ticket. ("Vellamo - Unexpected Points of View", 2019.)

Within this context, but with a separate funding and a considerable degree of independence, a subproject was executed, called Bringing history to life through digital storytelling (Historia eläväksi digitaalisella tarinankerronnalla). The aims of the subproject were to produce the Smoke on the Waves digital experience of the battle and to publish the 3D models of the historical ships online with an open license for anyone to use. The developer of the digital experience was selected through a careful tendering process, which the Helsinki-based Zoan Oy won. For clarity, as the main project consisted of multiple subprojects, the digital storytelling subproject will from now on be referred to as the Virtual Heritage Project (VHP).

While the VHP had its own funding, project plan, and a project coordinator, it was tightly embedded into the main project. Both were framed by the overall exhibition concept, strongly influenced by the organizational context, and joined by a shared goal. It is therefore not feasible to examine the management of the VHP as a separate entity, but

rather in dialogue with the main project. Moreover, the approach offers a wider perspective into Virtual Heritage project management than examining either one alone. A similar project setting with external funding and external project workers may even be a typical way to develop Virtual Heritage components in cultural heritage organizations (Aartomaa, 2021).

4.3 Project Management

The main project was coordinated by Johanna Aartomaa, recruited internally to the project from the position of the curator of education at the National Museum of Finland. Her salary cost was shared by both participating museum organizations. Before Aartomaa, there had already been other people moving the project forward, but her task for last 1,5 years of the project was to see to its completion. According to Aartomaa, having a full-time project manager for an exhibition is quite exceptional:

It's not given that a project manager for an exhibition can work 100% on one job. Usually, smaller scale exhibition projects are coordinated alongside other projects in different phases. (Aartomaa, 2021.)

The VHP had a single employee, Aaro Sahari, who was hired from outside the organizations, with the title of a researcher. However, Sahari's tasks during the project and the share of responsibilities between him and Aartomaa suggest that he was the de facto project manager for the VHP.

Johanna led the whole exhibition project, therefore I always informed her on what I was working on, always brought to her first the things that needed decisions on. At the same time, she gave me nearly free hands to work on my subproject. (Sahari, 2021)

I was mostly involved in the kick-off meeting, and after that... the schedule was very tight, partly due to the procurement process, so Aaro saw it best that he communicates with [Zoan] and would only bring me or the museum manager issues that he considered needed to be accepted by

someone else. (Aartomaa, 2021)

Additionally, a project manager from Zoan, Janne Itäpiiri, coordinated the development of the Virtual Heritage experience and its components, most importantly the ship models. Thus, there were three project managers involved in coordinating the interorganizational project and ensuring that the final product follows the exhibition concept. Aartomaa coordinated the main exhibition project, excluding the VHP. Sahari coordinated the client-provider relationship between the joint museum organization and Zoan, while closely participating in the creation of the Virtual Heritage experience. Itäpiiri coordinated the creation of the assets and the development of the experience at Zoan. While shared responsibility can increase project complexity (Carpenter, 2010), in this case it was likely one of the factors that contributed to the project's success. Aartomaa trusting Sahari with taking the lead on the VHP ensured that she could concentrate on coordinating the rest of the project components. Having direct and confidential lines of communication between the project managers, especially between Aartomaa and Sahari, and Sahari and Itäpiiri, ensured that information flowed between organizations and that problems were resolved efficiently (Sahari, 2021).

4.4 Schedule

The roots of the Fateful Svensksund exhibition date back to 1948, when the wreck of a well-preserved Russian frigate was discovered outside of Kotka, giving rise to the field of Finnish marine archaeology (Sahari, 2020, p. 53). The Kymenlaakso Museum opened an exhibition depicting the naval battle on its 200th anniversary, in 1990. Yet, the idea of an exhibition on a grander scale remained, and the opportunity presented itself when the Maritime Museum of Finland was moved from Helsinki to Kotka in 2008.

The interorganizational project leading to the production of the exhibition was a massive undertaking, which gradually built up from smaller streams. Sahari remembers having drafted early plans for subprojects and funding for what later developed into the exhibition project when working in Kymenlaakso Museum in 2012-2013 (Sahari, 2021), but a co-production was already discussed when the opening exhibitions for the new joint museum space in the Maritime Centre Vellamo were planned. Therefore, when Vellamo opened in

2008, the topic was not yet strongly featured in the contents of the museums (Aartomaa, 2021).

There were many efforts to find funding for the co-production with different approaches, with more emphasis on research, and some progress was made, but not enough to produce the exhibition. And then at some point things started moving in the right direction and both internal and external funding was secured. (Aartomaa, 2021.)

The exact beginning of the main project is obscure, but towards the end of the project the timeline got more defined. The exhibition was to be opened for the summer season, in May 2020, and eventually did on June 9, 2020, slightly delayed due to the Covid-19 pandemic.

The timeline for the VHP can be outlined more accurately. The project funding was applied for in autumn 2018 and the grant decision was received at the end of the year. Sahari was recruited to the project in January 2019 on a 1,5-year contract. After some initial revising of the plans, the next steps were to conduct a market research and a formal tendering procedure. The experience production began in October 2019 and was completed just in time for the opening of the exhibition.

4.5 Funding

The project collected funding from various sources, including the Alfred Kordelin foundation, Jane and Aatos Erkko foundation, Google, Finnish Cultural Foundation, and Kymenlaakso fund ("Fateful Svensksund", 2020). The 349000€ grant from Jane and Aatos Erkko foundation was dedicated entirely for the VHP and was the requirement for initiating the project. Aartomaa states that the amount of external funding is exceptional in the Finnish museum field and allowed the project organization to concentrate more resources into the project than what is usual (Aartomaa, 2021). While the project's funding structure enabled doing things on a larger scale, it was also a source of uncertainty, and was mentioned among the major challenges of the project, which will be discussed further.

4.6 Project vision

The project vision that provided the ideological and physical frames for the VHP was mainly guided by two documents: Vellamo's digital customer experience strategy and Fateful Svensksund's experience concept. The digital customer experience strategy, created as the result of a joint development project between Vellamo and Pentagon Design, outlines the aspects of a holistic customer experience vision, defines the channels of a digital customer experience, and provides guidelines for digital storytelling. The experience concept, also created in collaboration with the design agency, defines the main emphases of the exhibition, its target audiences and the methods of storytelling, presents the layout describing the atmosphere in the different sections, and traces the visitor path through the exhibition space.

4.6.1 *Customer Experience Vision and its Key Aspects*

Vellamo's purpose is to create meaningful encounters between different people and between different views, and to tell evocative stories that place things in their proportions. The customer experience vision reflects this purpose by stating, that the exhibition content and the supporting digital solutions should enrich the visit and leave a lasting memory. The content offering is most effective as shared, engaging learning experiences, aiming to increase understanding of history as well as contemporary phenomena. Thus, the key aspects of the digital customer experience include offering meaningful content, considering the customer need, enrichment and emotional engagement, increased interaction with the customers, social and shared experiences, technology as subject to purpose, and open access to data. The final point is in line with a recent trend in the museum field, which suggests that museums should open up their research for reinterpretation. (Pentagon Design, personal communication, 2019)

4.6.2 *Guidelines for Digital Storytelling*

The digital customer experience vision lists guidelines that all the digital elements in Vellamo's exhibitions should follow, including extended reality experiences, immersive projections, interactive touchscreens, and gamified elements. The guidelines include designing as part of a concept, keeping the user experience at the centre, ensuring ease of use, charting the methods of delivery, evaluating solutions critically, and sharing good

practices. (Pentagon Design, personal communication, 2019)

4.6.3 Exhibition Concept

The exhibition concept places the human experience of historical events at the centre. The purpose of the exhibition is to offer new views into the wartime fates of Finns, Swedes, and Russians alike, helping to understand the complex conflicts of our day. The exhibition is built around three themes: the shipwrecks at the bottom of the sea, the naval battle raging on top of the surface, and the Ruotsinsalmi-Kyminlinna fortress that was built after the war and developed into a lively settlement. Each theme has a dedicated section in the exhibition space, each with different atmospheres. The shipwreck section is a calm, meditative space, resembling the world under the surface. As a contrast, the sound and light design in the naval battle section creates a dramatic tension between anticipation and explosive action. Within the section there is a separate space dedicated for the digital experience, a theatre that also functions as a place for encounters and discussions. In the layout plan it is called a "Cave theatre 360 naval battle experience", although that is not the actual technological solution that was chosen for the final experience, as discussed further. (Pentagon Design, personal communication, 2018)

4.6.4 Target Audiences

The target audiences of the exhibition are defined as the Surprised - those who have no previous knowledge of the topic, the Curious - frequent visitors to exhibitions, and the Socializers - people who look for shared experiences with family or friends (Pentagon Design, personal communication, 2018). Sahari emphasizes that the Virtual Heritage experience is not targeted at the devotees, the people who have read books about the subject and have already formed a relationship with it, but for the majority of the audience, people who may encounter the topic for the first time: "I can live with someone criticizing that it wasn't what they expected. It wasn't meant to be. I'm sorry, but there are other things for you in the exhibition." (Sahari, 2021.)

4.7 How the Project Vision Influenced the VHP

The exhibition concept and the digital customer experience vision have strongly influenced the decisions made before and during the VHP, functioning as an ideological framework.

Firstly, according to the digital storytelling guidelines digital elements should be designed as part of the exhibition concept, not as isolated solutions. With the Fateful Svensksund exhibition, this was indeed the case, as the exhibition concept provided strict physical and informational frames for the VHP. Furthermore, Aartomaa and Sahari discussed the boundaries together: “Right in the beginning we agreed on how the experience relates to the surrounding exhibition, both physically, regarding the physical space, and story and content wise.” (Sahari, 2021.)

Secondly, Vellamo's customer experience vision emphasizes the importance of providing social, shared experiences and opportunities for encounters. Similarly, the exhibition concept depicts the physical space reserved for the digital experience as an open, theatre-like space that facilitates discussions. Furthermore, the digital storytelling guidelines emphasize ease of use of technological solutions.

With these fundamental values established, it would not have been possible to develop an extended reality experience viewed on a closed, single-user device such as a VR headset, nor a CAVE theatre, which was suggested in the exhibition concept. Therefore, at the expense of interactivity and immersion, a more traditional projection-based technological solution was best suited to the concept. It was practical too, as experiences relying on wearable or touchable devices require more resources to maintain and sterilize (Sahari, 2020, pp. 55-56; A. Vargas, personal communication, February 19, 2021). In hindsight, it was probably the most sustainable solution considering the current crisis (May 2021) and the post-pandemic trauma related to touching surfaces.

The chosen solution is based on a curved wall projection, offering a 180-degree field of view to the naval battle. To facilitate the formation of a social, shared experience, the theatre has only a few seats, allowing the visitors to move around the space more freely (Sahari, 2020, p. 56). The experience lacks actual extended reality technology, as the visitors' presence in the physical world is not masked by artificial stimulation of the senses, nor are there any synthetic elements superimposed with the physical world. The visitors can not interact with the experience either, which turns them into passive viewers. It could be argued however, that the immersion to the historical setting may have already taken place when passing through the atmosphere of the exhibition section outside the theatre. Furthermore, placing the visitor to the centre of a chaotic battle through a higher degree of

immersion and agency would render the experience considerably less suitable for a wider audience, while also failing to provide a bird's eye view of a battle of such a large scale. It therefore seems justified to present the experience as an animation, projected on a two-dimensional surface in a theatre setting. As the aim of the experience is to offer an overview of the battle through an engaging and immersive experience, it is hard to imagine how it could have been achieved using an alternative technology within the boundaries set by the exhibition concept.

Lastly, the customer experience should be central for digital storytelling. According to the digital storytelling guidelines, it should be carefully considered whether the planned element aims at increasing information about a topic or engages the customer emotionally. In VH experiences these are not necessarily mutually exclusive. Indeed, with its two separate goals, the VHP aimed to satisfy both aspects. On one hand, the digital experience's aim was to evoke a strong emotional response in visitors. On the other hand, the ships were modelled on a more detailed level and with more historical accuracy than what could be appreciated when viewing the digital experience. This was necessary for publishing the ship models for open use. Thus, the VHP aimed both at engaging customers emotionally with the battle experience and at increasing information about the ships through the detailed modelling and publishing of the 3D assets.

5 EMPIRICAL FINDINGS

Previously it was established that the project vision set the boundaries for the exhibition and the Virtual Heritage experience within it, influencing the technological solutions and methods of storytelling. In the case description the task and the context of the projects were outlined. In this section I will further discuss the themes identified in the literature review—Task, Team, Time, Context, and Temporal and Social Embeddedness—based on the interviews with Aartomaa and Sahari. Furthermore, I will discuss the topics of project management expertise and methodological approach in the projects, as well as some of the challenges encountered.

5.1 Task

The task of the VHP was two-folded. Firstly, the project aimed at producing an engaging and memorable digital experience of the Svensksund naval battle that would enrich the visit and offer the visitors a better understanding of the context of the shipwrecks and artifacts. Secondly, the aim was to produce a reinterpretation of the ship models based on historical sources and share the 3D models publicly.

If project tasks are classified simply to unique and repetitive tasks, as Lundin and Söderholm (1995) suggest, it can be observed that the overall task of the VHP is unique in many ways. The unique characteristics include the exhibition concept (choices regarding the treatment of the topic, the content, and the audiences), the organizational context (collaboration between two museums, the project team and management), and the funding (exceptionally large external funding). A unique task lacks precedents and requires therefore considerable efforts to discover how it can be completed.

However, some aspects of the task can be observed to have repetitive characteristics. For a repetitive task there exists a certain situational awareness and an understanding of the activities required to complete the task. Firstly, it can be assumed that the museum staffs have developed some routines and processes for producing exhibitions: “We had of course

several people with some expertise, museum professionals who usually lead exhibition projects." (Aartomaa, 2021.)

Similarly, as a VR-studio with custom-made solutions as one of their products, Zoan has honed their processes of developing digital experiences in collaboration with clients. Moreover, according to a project manager at Zoan, they have had previous experience of working with cultural heritage organizations (J. Hämäläinen, personal communication, November 13, 2020). Therefore, their expertise in bespoke Virtual Heritage solutions enabled them to suggest how the VHP should be approached:

Zoan's project managers and heads of departments said that this needs to be run like a movie production, that all the parts of the production move all the time so that everything can be completed in time and wrapped up in the final phase. (Sahari, 2021)

However, sometimes a seemingly repetitive task - for which there are established tools, processes, and guidelines - needs to be approached as a unique task, as Sahari points out:

There were some challenges regarding 3D modelling. They could not, based on the challenging and ambiguous historical data that was available, create better interpretations. They would have been technically capable of doing it. But unfortunately, there isn't an abundance of 3D modellers who understand centuries old sailboats. (Sahari, 2021)

Thus, in interorganizational projects a unique task does not necessarily require the participants to completely reinvent the wheel. A Virtual Heritage project takes place at the intersection of cultural heritage and virtual world development. The organizations bring their unique expertise to the project, which helps to reveal the repetitive components of the task. The challenge that remains is to collaborate to develop a shared understanding of the task and to align the diverse approaches and working methods of the organizations.

5.2 Team

5.2.1 *The Core Team and the Extended Team*

The demarcation of the VHP team is not a straightforward task. By employment status, Sahari was the only one directly hired to work on the VHP, but producing the experience required the contribution of dozens of individuals, employed by different organizations. The extended team included various staff members from the two museums as well as external contractors working on the exhibition project lead by Aartomaa. They all contributed to producing an impressive and informative exhibition, the components of which seamlessly connect and support the main concept. However, most of them were not directly involved with the Virtual Heritage experience production.

At Zoan, various internal teams participated in creating the experience. There were teams working on the ship models, modelling the environment and the characters, creating the sound and video effects, and putting the experience together using the Unreal game engine. According to Sahari's estimate, 20 - 30 Zoan employees worked on the project at different times.

It varied, but altogether I'd say there were at least 20 people involved. But it could go up to 30 because I don't know exactly how many people were working on the ship models. I didn't have visibility over it because I was primarily discussing with the area leads who were monitoring their own fields. (Sahari, 2021)

Zoan's commitment to the project was however based on a contract and driven by mainly economic interest. It is therefore debatable whether their employees considered themselves as part of the VHP team.

Defining the team composition based on organizational ties or motivation for commitment doesn't thus produce a clear demarcation. Alternatively, the core team of the project could be defined as the network of people who mostly collaborated and participated in discussions during the project. This includes Sahari as the researcher and coordinator of the VHP, Aartomaa as the project manager for the entire exhibition, with whom Sahari

discussed about higher level decisions, and the project manager, area leads, and other key roles at Zoan: “And then we had weekly discussions with the necessary departments, i.e., the scriptwriter, the director, and the responsible for modelling.” (Sahari, 2021)

5.2.2 Multidisciplinarity

Projects, and especially interorganizational projects, are typically defined as being multidisciplinary, involving various knowledge areas or professional specializations that complement each other and help the project team achieve the project goals (Roudias, 2015, 1 – What’s a Project?; Jones & Lichtenstein, 2009, p. 236). Exchanges of information and creative collaboration between different disciplines diversify the available perspectives and feed innovation, but can also introduce challenges, e.g., regarding language and differences in working cultures.

A Virtual Heritage project requires the integration of cultural heritage and - depending on the selected technological solution - XR or game development expertise. Furthermore, XR and game development involve ICT expertise and various forms of arts, such as visual arts, music, and literature. The Fateful Svensksund extended project team was assembled from two museums, and the professions of the team members included curators, collection specialists and conservators, researchers, an archaeologist, and museum technicians. Moreover, many additional services were bought from external contractors (Aartomaa, 2021). At Zoan, the different roles involved in the experience production included 3D artists, a concept artist, a scriptwriter, a sound designer, and an artistic director (Sahari, 2021), in addition to the technological specializations needed, such as Unreal Engine development.

The roles in a project team are not always rigid. One aspect of the work culture in dynamic technology start-ups is that people often have flexible roles, allowing them to work across disciplines to better utilize their strengths. For example, at Zoan the project manager Itäpiiri drew the storyboards for the experience and participated in scriptwriting with the artistic director (Sahari, 2021). Since large museum organizations can be more rigidly structured, Aartomaa felt that there was a need to develop the work culture of the project team towards a more collaborative and multidisciplinary one. Therefore, she made efforts to facilitate flexible working across disciplines and to encourage team members to think

beyond their typical role descriptions. Some of the efforts included adopting a design thinking approach for planning the exhibition project, assigning people tasks they enjoyed doing, and on the other hand avoiding inviting people to time-consuming meetings that were irrelevant for their task.

When you blend [the organizations] you get rid of the silos of knowledge and the customary ways of working, such as what a conservator or a museum technician does or doesn't do. ... I think it's rather sad that there is this idea that they should somehow justify their views. They are museum professionals and just as qualified as a researcher to say what they think is good or bad from the audience's perspective. (Aartomaa, 2021)

5.3 Time and temporal embeddedness

5.3.1 Perception of Time

The temporary nature of projects suggests that time is a finite resource. Experience shows that even a seemingly abundant amount of time and a generous schedule may turn into a hectic race against the calendar. Organizations try to plan project schedules based on their best estimates. However, there is always a degree of uncertainty inherent to projects, which can affect the schedule and cause delays. Project managers, as the main responsables for projects staying in schedule, need to counter the uncertainties utilizing mechanisms that Jones and Lichtenstein (2009) refer to as temporal embeddedness, or through interventions when the unexpected happens. The project managers' perception of time is therefore interesting, as they are the ones responsible for managing how time is used.

Regarding the timeline of the VHP, Sahari concludes that "[t]here would have been time, but there was no time" (Sahari, 2021). The entire time scheduled for the project—including preparation and closing—was 1,5 years but the actual production time decreased to approximately 8 months for reasons that will be elaborated on further. Therefore, the schedule was tight, which forced the project parties to adopt a cinematic production approach, making it impossible to adjust the plans without affecting the schedule or the cost of the project (Sahari, 2020, p. 67).

According to Aartomaa, the staff resources available due to the external funding also increased the time allocated to the exhibition project. However, due to the nature of expert work, it was important to control the use of time by keeping the schedule of content decisions strict.

The way of working in museums tends to be very precise, ensuring there are no mistakes in the information since we are an expert organization. And so, the contents are contemplated as long as possible. That was one of the topics related to renewing the ways of working, that we keep a tight pace and don't hone things endlessly so that the schedule doesn't stretch. (Aartomaa, 2021.)

Aartomaa further elaborates that she did not see a need to interfere with the schedule of the VHP.

5.3.2 Internal and External Factors Affecting the Schedule of the Project

Funding decisions

Many components or subprojects of the exhibition project were dependent on external funding, which were applied from multiple sources. As the results of the funding decisions were uncertain and their timing scattered, all subprojects could not be started simultaneously. This resulted in challenges with synchronizing and coordinating the subprojects. For example, a positive decision from Jane and Aatos Erkkö Foundation was a definitive prerequisite for initiating the VHP, but it was one of the final funding decisions received, at the end of 2018.

How these different projects run together... Usually they don't progress at the same pace or in the right order. Like, some new project may require information that is not yet available from another project. It sometimes felt like juggling with too many balls in the air. (Aartomaa, 2021.)

Time estimates

The exhibition project team members had a lot of experience of building exhibitions and could therefore reliably estimate how many weeks or months the traditional exhibition

components take to complete, but there was more uncertainty regarding the duration of the digital experience production phases, which the museums had less experience of. According to Aartomaa, there were some surprises related to the duration of work phases in digital productions.

It's harder to estimate with our expertise what the different phases are and how long they will take. Then you can have surprises like with the 3D models of the shipwrecks that the computers process the final result for weeks to render the model from the vast amount of data. (Aartomaa, 2021.)

Delays

During the first two months after joining the project, Sahari needed to revise the project plans and untangle an issue that was created before he joined. The issue was related to an intended collaboration with the national broadcasting company YLE as the potential partner for developing the experience, which for legal and contractual reasons could not be carried on with. (Sahari, 2021)

After that issue was resolved, the next phase was to chart the XR field for potential partners and to gain information to prepare for the following phase, the tendering process. A formal tendering procedure is required of publicly funded organizations by EU legislation, when the budget of a purchase exceeds a certain threshold ("Public Procurement Is Regulated", n.d.). After careful preparation, the tendering call was published in June 2019. Following a thorough selection process, there was an obligatory appeal time of one month, when the participants to the process could file a complaint about the decision. Finally, in October 2019, the contract was signed and work on the experience could begin. (Sahari, 2021.)

A final delay occurred towards the end of the project, in March 2020, when the Covid-19 was declared a global pandemic, and both the client and the provider had to adapt to working remotely. Deviating from the contract timeline required the contractor to issue a formal notice of the invocation of the Force Majeure clause. At the same time however, a decision was made to postpone the opening of the whole exhibition by approximately one month, which also granted the VHP additional time to complete. (Sahari, 2021.)

5.3.3 *Synchronizing Activities*

Opening Date

The intended opening date of the exhibition, although eventually postponed, functioned as a hard deadline for the main exhibition project and all its subprojects, including the VHP. As a form of entrainment-based pacing - aligning activities based on external markers - it directed the collaboration between the museums and Zoan by influencing the procurement process, the contract, the production approach, and the communication between the parties.

Project Stages

The VHP's stages and schedule were defined already in the tendering call and confirmed in the final contract with Zoan, acting as an event-based pacing mechanism. The three-stage production process consisted of the design stage, during which the script and the production concept were finalized, the production stage, during which the concept was prototyped and verified and some of the models created, and the finalizing stage, which delivered the final experience. Instalments to Zoan were tied to the completion of the three stages and their deliverables. (Sahari, 2021.)

Weekly Meetings

Both Aartomaa and Sahari mention weekly meetings with the project team as a regular activity and a forum to discuss project issues. However, meetings were not held merely for the sake of having meetings. Aartomaa wanted to avoid wasting people's time unnecessarily and filter out irrelevant information by inviting people to the meetings selectively, depending on the issues on the agenda (Aartomaa, 2021). For Sahari, the meetings with the VHP team were an additional way to have visibility into the different areas of the production, complementing direct communication channels and access to the work-in-progress ship models (Sahari, 2021).

5.4 Context and Social Embeddedness

5.4.1 Characteristics of the Organizational Context

According to Carpenter (2010), some of the distinguishing features of projects in the cultural heritage field are their subjectedness to various policies and external requirements, and their focus on people and relationships (pp. 15-16). Jones and Lichtenstein (2009)

maintain, that interorganizational projects interact with the organizations they are embedded in and with their wider social context through mechanisms of social embeddedness. This chapter will discuss some of the implications of the project's organizational context, and how social embeddedness affected the course of the project.

Hiring

Museums and technology companies deal with employment in different ways. It is considerably easier for a commercial organization to hire external contractors to a short-term project than it is for a publicly funded organization. For a museum organization, the hiring criteria are more rigid, and a project's hiring needs must be defined already in the funding application, long before the project is started (Sahari, 2021). In contrast, businesses are usually highly agile regarding staffing (Harris, 2007, p. 104). A company can more easily allocate resources to a project, either internally, or by purchasing services from a pool of freelancers, bypassing employment contracts altogether.

It was stated in the funding application that a researcher will be hired. And that's the way the Finnish Heritage Agency works. ... But in a creative organization like [Zoan], if they need an additional modeller and have money left in the budget, they just hire them or buy the work from a subcontractor. (Sahari, 2021.)

Time Commitment to the Project

Museums often operate with relatively small staffs, forcing people to divide their attention between various projects or areas. In the exhibition project, too, most of the team members had responsibilities in their enduring organizations. Under those circumstances, the exhibition project could have been experienced as competing with their other duties. However, the large amount of external funding and the combined staff resources of the two museum organizations allowed the Fateful Svensksund project team to focus on the task exceptionally well and have a dedicated project manager with no other liabilities. Yet, as a project manager, Aartomaa had no formal authority to influence team members' time commitment but needed to ensure they were motivated by their tasks and the work atmosphere. (Aartomaa, 2021.)

The Procurement Procedure

In the Finnish cultural policy model, cultural heritage organizations are jointly financed by the central and local governments. One of the most defining external requirement for

projects in museums is the legal obligation to conduct a formal tendering procedure. The procedure, strictly regulated by national legislation and EU directives, aims to "increase the efficiency of the use of public funds and to enhance the competitiveness of European businesses – including Finnish undertakings". A transparent tendering process and an equal treatment of tenderers are required. Furthermore, the legislation dictates that the contracts are to be awarded based on either the lowest price or the most economically advantageous tender, in which case the bids are measured against formerly stated criteria. ("Public Procurement Is Regulated", n.d.)

Because of the complexity of the procedure, public organizations typically employ legal advisors with procurement expertise. Additionally, procurement requires some understanding of the field of the service that is being contracted. Due to the highly specialized and fast evolving field of VH production, the process was demanding (Aartomaa, 2021). Additionally, agreeing on the internal processes for carrying out the tendering was not uncomplicated in the beginning. According to Sahari, aligning the views between experts of different fields required a lot of effort, but eventually resulted in a successful tendering (Sahari, 2021). Along with the preparations, the procurement procedure for the VHP took 5-6 months from market charting to signing the contract.

Predeterministic Planning

The formal procurement procedure and dependence on external funding steer organizations towards predeterministic project planning. A tendering call usually already includes a draft of the contract, with little room for later adjustments (Sahari, 2021). Similarly, the funding applications often require an initial project plan, which strongly influence the scope of the project if the funding is granted. Therefore, a project manager may not be able to influence the project plan or adjust the project scope in response to new information discovered during the project. This can increase rigidity in projects in the cultural heritage field, which may contrast with an agile working culture typical in many software companies. While this may not necessarily be an issue at all, it can be good to acknowledge as one possible contributor to cultural differences between organizations.

5.5 Relational Embeddedness

Relational embeddedness refers to the ways in which project parties and participants understand and consider each other's needs, share information, and trust each other (Jones & Lichtenstein, 2009). It was already mentioned that Aartomaa trusted Sahari by granting him a lot of freedom in coordinating the VHP. This trust was partly due to Sahari's relevant expertise in the field of marine history and former experience of related digital heritage projects, partly a result of an earlier background of working together. Sahari also formed direct lines of communication with the key staff members from Zoan, especially the project manager Itäpiiri.

With Itäpiiri we both deliberately made a considerable effort to form a confidential line of communication between us. Not all our conversations during the project were even specifically about it, but about life, cultural heritage, virtual reality, and projects in general. So, we consciously engaged in a dialogue to increase familiarity and to build trust. (Sahari, 2021)

Having direct and confidential lines of communication between the project managers, especially between Aartomaa and Sahari, and Sahari and Itäpiiri, ensured that information flowed reliably between organizations and that problems were resolved efficiently (Sahari, 2021).

This meta-conversation continued throughout the project and made it possible that when challenges occurred... then you could trust that when the other one speaks bluntly, he's not fooling... but there is a problem that needs to be solved. (Sahari, 2021.)

Additionally, one success factor for the VHP was Sahari's ability to bypass conventional organizational structures within the National Museum organization and talk directly with the top management when high-level decisions needed to be made. Sahari believes that this atypical arrangement was possible because of the combination of a high cost, high complexity, and high prestige of the project, which is why the management had special interest in its success. (Sahari, 2021.)

5.6 Structural Embeddedness

Structural embeddedness refers to the networks of connections that are formed within organizations, between organizations, and between individuals in their fields of expertise. Repeated interactions between the actors in a network lead to the formation of a macroculture, within which a shared understanding of the nature of the work, roles, and methods exist. (Jones & Lichtenstein, 2009.) In a specific field within a limited geographical area, such as the Virtual Heritage field in Finland, the existence of links between individuals is highly probable. Experts are likely to have met each other during studies, in work life, at conferences, or by participating in professional association activities. To demonstrate the existing links between the project participants, Aartomaa and Sahari were connected through their work at the Maritime Museum of Finland and through their membership in the Finnish Association for Maritime History. Through his earlier work experience in a game company, Sahari was also connected to the XR and game industry in Finland, within which actors move between companies. Coincidentally, he had also met Itäpiiri before, through a museum-donor relationship activity nearly a decade before. (Sahari, 2021) Further analysis of the relationships between the museum organizations and Zoan would likely reveal more connections, as Zoan has also collaborated with the National Museum of Finland in 2018, with the creation of a VR experience of a painting (“Aikamatkailu On Sittenkin Mahdollista”, 2018).

By connecting individuals across organizations and establishing a macroculture within a field, structural embeddedness may help organizations collaborate on projects more seamlessly. However, personal relations also include a risk of abusing one's power and influence, which can be seen as a threat to equal conduct, for example during the tendering procedure.

I was aware that I posed a risk for objectivity in tendering. I knew people from more than one actor in the XR field because... it's a small world. So, I acknowledged that I needed someone else to watch over my shoulder to ensure that my conduct is equal, fair, and in accordance with the tendering legislation. (Sahari, 2021.)

It could also be argued that a highly established macroculture defining the roles and codifying work within a field can sometimes be detrimental to creative thinking and collaboration, as in the case of some museum professionals not feeling confident in commenting on things outside of their areas of responsibilities, which Aartomaa hinted at earlier (Aartomaa, 2021).

5.7 Project Management Craft

5.7.1 Expertise

According to Carpenter (2010), project managers in cultural heritage organizations are likely to have an expert rather than management background (p. 16). This was also the case with Aartomaa and Sahari, who both studied history and have worked in expert roles in cultural heritage organizations or as independent researchers. For Aartomaa the exhibition project was the first large-scale project she coordinated. Her formal training in project management is limited to a number of courses and training days attended while working.

5.7.2 Custom Method

It is not uncommon that project managers in an expert field follow a learning-by-doing approach and establish their own sets of processes that suit the needs of their projects (vom Brocke & Lippe, 2015). Aartomaa recalls having adopted a number of practices from a project management course she attended but can not name the methodology they originated from. The course was targeted at public sector management and delivered by people with an engineering background. According to Aartomaa, training specifically on exhibition projects is hard to come by. She criticizes the National Museum organization for not having made project knowledge and tools available sufficiently. In her view, it would be beneficial to disseminate them on all levels of the organization so that every new project would not have to start from a scratch. (Aartomaa, 2021.)

5.7.3 Agility

Regarding the adoption of Agile methodologies in museum organizations, the interviewees are somewhat sceptical. Aartomaa comments, that as a fashion term, it may have been picked up in speech on some level, but the principles have not yet influenced the work culture in the wider organizational context, which in her experience seems rather stagnant

and resistant to change (Aartomaa, 2021). Sahari argues, that there are many obstacles for adopting Agile methodologies in the public sector context. The rigid legislative framework, the management models, the decision-making chain, and the way management thinks are not compatible with Agile.

I find empty speech about agility annoying and unfounded. My view is quite strict, but it's based on dozens of discussions with Agile developers and people who have researched Agile. (Sahari, 2021.)

To ensure smooth collaboration in interorganizational projects, the parties will need to consider each others' cultures and ways of working. It is therefore beneficial to understand how the different organizational contexts and management paradigms influence project work.

There was a lot of settling between different ways of working, different schedules, different understandings, things like that. In a way, structuring the tacit organizational and expert knowledge. Like, explaining that they don't act like this because they're evil but because they're a government agency. (Sahari, 2021.)

While Agile methodologies may not be widely adopted in the public sector, in the ICT industry they are starting to be the standard. For instance, a quick search on LinkedIn with the keyword Scrum master found 124 published jobs in the Helsinki area alone at the time of writing.

I'm almost certain that Zoan followed some kind of Agile framework. They were able to present demos and prototypes at certain dates, which they let me know in advance. But the communication with the key people was so direct that I did not need to know how they worked behind the scenes. (Sahari, 2021.)

In the collaboration between the Maritime Museum of Finland and Zoan, Sahari was the intermediary acting on the interface of public administration and an agile organization, facilitating an effective flow of information and increasing the speed of decision-making.

I was the component that tried to be as agile as possible on the public administration side, so that the provider was able to get what they needed when they needed it. And it took away some of the friction from the project, but I still had to take care of it with the bureau. (Sahari, 2021.)

Despite the general organizational context not being compatible with Agile, the fifth principle of the Agile manifesto—giving motivated individuals "the environment and support they need" and trusting them to "get the job done" (Beck et al., 2001)—can be identified in Sahari's relationship to Aartomaa and the top management. Sahari reported directly to the director general of the National Museum, allowing him to bypass the usual organizational structures and hierarchy.

However, Sahari notes that museums and units within museums can be agile to a certain degree (Sahari, 2021). Museums have also recently been forced to renew and rethink their ways of working due to the global pandemic (Aartomaa, 2021). The friction is mainly caused by the public administration models in the wider organizational context. The more complex the organizational structure is, the more layers of administration there are, which generates more friction. To overcome the resistance, organizations could contract and empower project workers or consultants who can complement the organizations' expertise and help them achieve short-term goals. However, the hiring criteria are rigid, and titles and compensation are based on pay grades.

I think it would be great if the system could rise to the level where it's possible for an organization to hire an external consultant to handle a complex issue, and bend the organizational rules as needed, because there are many areas where public organizations lack expertise. Maybe this kind of discussion about compensation, role definitions, and flexibility would be the kind of agility that is needed. (Sahari, 2021.)

5.7.4 On the Role of the Project Manager

Regarding the role of the project manager, Aartomaa's role was closer to the traditional concept of a project manager running the project, but she saw the role as more than managing the budget, the schedule, and the scope. She was concerned about the processes

and their inputs and outputs, but also about managing the project team and developing the working culture towards a more multidisciplinary, collaborative one.

Sahari's role was more complex. On the one hand, it was less that of a traditional project manager and more that of a facilitator. He went to great lengths to ensure that the different parties involved in the experience production understood each other and collaborated smoothly. Therefore, his role resembles the role of the Scrum master, a servant leader acting as a link between the product owner, the team, and the wider organization. On the other hand, he was at the same time closely involved in the experience production and enforced the quality criteria for the 3D models of the ships. These various aspects of his role sometimes created a conflict of interest, as high accuracy was required of the ship models, but at the same time the project needed to move forward to stay in schedule:

It was schizophrenic because at some point I had to tell the guys at Zoan that I'm not going to approve that model for publishing as it is because it has too many mistakes. (Sahari, 2021.)

5.8 Challenges

Some of the challenges identified earlier in the section are a general lack of project management expertise and experience, uncertainty related to the schedule of funding decisions, and the strict requirements of a formal procurement procedure. Furthermore, the need to develop a shared understanding of the task was discussed.

5.8.1 Working with a Concept

In the Fateful Svensksund exhibition project, the exhibition concept defined the task comprehensively, describing the value decisions as well as guiding the design of all the components, including the digital elements. According to Aartomaa, the exhibition concept was a novel approach to exhibition projects in the museum, and therefore required specific attention.

That has definitely been the most challenging and most interesting part of the project: how to get everyone to understand the importance of developing the concept and placing the visitor experience first, and then

to follow the concept. (Aartomaa, 2021.)

5.8.2 Communication

In relation to the multidisciplinary composition of the project team, the issue of communication was discussed. Representatives of different disciplines do not necessarily share the same terminology or meanings for words, which needs to be actively addressed.

There were museum representatives who didn't understand what the counterpart was saying, although both were speaking Finnish. And that may have caused some frustration in both, that the other one doesn't understand a simple thing. But then at the other extreme we had a person who speaks the same language. (Aartomaa, 2021.)

Placing Sahari in charge of the VHP thus largely solved the issue of cross-discipline communication as, due to his earlier experience from game and XR productions, he was either familiar with the terminology or was capable of finding out the meanings.

I follow the field, I'm interested in it, it's an evolving technology and a lot is going on from an economic and social perspective. So even if I didn't right away understand some terms the guys at Zoan used, I was able to ask, to find out, to read. (Sahari, 2021.)

5.8.3 Ensuring Learning

A main challenge in all temporary organizations is how to capture the relevant experiences and knowledge generated of a specific context and transmit them further (Bakker, 2010; Lundin & Söderholm, 1995). The existing body of knowledge in the Virtual Heritage field is modest, especially regarding project management. It is therefore important to take measures to document learnings from projects and disseminate them widely to build capacity in cultural heritage organizations and provide future projects with more points of departure.

Aartomaa acknowledges that proactive measures were not taken to prevent loss of information at the closure of the VHP when Sahari's contract ended. On the other hand, some learnings were captured in the form of reports that are required by external funders.

Sahari also wrote a project closing report raising issues and proposing ideas for organizational development. However, Aartomaa questions the usefulness of reports for learning.

There would be that kind of material available regarding that particular subproject. But then again, who has time to read them afterwards and does reading them even lead to learning, understanding, and the right actions? I don't know how to ensure that. (Aartomaa, 2021.)

Sahari considered it important to extract as many learnings as possible from the rare opportunity to work on a large-scale Virtual Heritage project with a considerable amount of external funding. At the same time, he was aware that as he moved on from the project, he would take a lot of the knowledge with him. He also realized that he had a key role in ensuring that the members of the enduring organizations had opportunities to learn from the interactions between Zoan and himself.

I recognize it as a real problem, and I didn't have a silver bullet for it. I just tried to underline to the colleagues every now and then that here's this thing and it's important. So, in a way trying to keep the topic up in conversations. (Sahari, 2021.)

6 DISCUSSION

6.1 Time is a Source of Uncertainty and Requires Structuring and Management

The temporary nature of projects suggests that time is a finite resource. Even a seemingly abundant amount of time and a generous schedule may turn into a hectic race against the calendar. Organizations plan project schedules based on their best estimates, informed by earlier experience of conducting similar work, but estimating is more difficult for tasks that are outside of the core expertise of the organization. Aartomaa comments, that the team was able to reliably estimate the time needed to create most of the exhibition components with the exception of the digital elements, which were more uncertain (Aartomaa, 2021). Organizations have developed routines for completing repetitive tasks but uncertainty regarding time estimates and the sequence of events increases with a unique task. As of yet, cultural heritage organizations do not have substantial experience of Virtual Heritage projects

In an interorganizational context, the perception of time may differ between project parties. Misaligned progress between project components complicates the management of a project, can cause significant delays, and at worst leads to project failure. It is the responsibility of the project manager to manage the project schedule and to synchronize activities between project parties, binding the project activities to a shared timeline through the mechanisms of temporal embeddedness. These mechanisms include a mix of entrainment-based pacing such as seasons, event-based pacing such as deadlines and milestones, and chronological pacing such as weekly or daily meetings. To align activities in the VHP, the contract between the museum organization and Zoan defined the project stages with corresponding milestones, to which the payments to the provider were tied. Furthermore, the deadline of the VHP was tied to the opening date of the entire exhibition—just in time for the summer season. Within the projects, work was cadenced with weekly meetings, where the progress was tracked and discussed.

There is always a degree of uncertainty inherent to projects. Moreover, a range of external factors can affect the schedule and cause delays. In a project that is dependent on external

funding, the scattered schedule of the funding decisions greatly influences the project timeline. On one hand, the project plans and contracts are drafted in advance for the funding applications. On the other hand, the uncertainty of the outcome of the decisions discourages organizations from making further preparations until the funding is secured. According to Aartomaa, the schedule of the funding decisions causes challenges for project management, as subprojects start at different times and may complete in the wrong order (Aartomaa, 2021).

Furthermore, external funding introduces additional policies and requirements that need to be taken into consideration. The EU legislation requires publicly funded organizations to conduct a formal tendering procedure for procurement if the purchase cost exceeds a certain threshold. The tendering procedure requires careful preparation and close collaboration between the experts tasked with procurement and legal advisors specialized in it. The duration of the process can take months. For Fateful Svensksund, the entire procurement process for the Virtual Heritage production took 5-6 months.

While many uncertainties and risks—the known unknowns—can be taken into account and prepared for in project planning, sometimes unexpected things—the unknown unknowns—occur. Towards the end of the Fateful Svensksund project, in March 2020, the global Covid-19 pandemic closed museums and offices and forced organizations to adapt to working remotely. The delay caused by the lockdown forced Zoan to invoke the Force Majeure clause, as they were not able to meet the deadline defined in the contract. Due to the lockdown, the opening of the exhibition was postponed by approximately one month.

Within the PMBOK framework, time management is one of the ten knowledge areas of project management craft. The framework describes seven processes related to time management, each with their inputs, outputs, tools, and techniques. The PMBOK guide maintains, that equipped with appropriate tools and techniques, a project manager can deduce the outputs from the inputs. With its prescribing approach, the PMBOK offers a systematic approach for planning and managing project schedules. However, the processes rely heavily on expert judgement as a tool and the outputs created in previous processes as the inputs. Therefore, it could be argued that with a unique task, the degree of uncertainty of the outputs will be high, nevertheless.

The Scrum framework has a highly structured approach to time management, in which all tasks and events are time-boxed. The overall product goal is divided into subgoals that are completed in fixed-length Sprints, 1 to 4 weeks in duration. Sprints start with Sprint planning, a meeting in which the Scrum team chooses to commit to work that can be completed within the Sprint. This requires estimating the durations of work components. Estimation is a joint activity among the team members. While the estimates may initially be off, they can be adjusted in subsequent Sprints as the team learns about its pace and the nature of the task. Within a Sprint, work is paced with Daily Scrums, a daily occurring 15-minute meeting where the team discusses progress and potential problems.

While museums may not be able to organize their work in Sprints or afford to have a full-time Scrum team working on a Virtual Heritage project, certain aspects of Scrum, such as a collaborative and reflective approach to time estimates, and time-boxing activities, may be worth exploring further. Moreover, understanding the temporal embeddedness of Scrum teams can make collaboration with ICT companies smoother.

6.2 Collaboration over Disciplines and Organizational Boundaries Requires Facilitation

Interorganizational project teams are assembled from multiple organizations and departments, implying that the team members may have never worked together before. To have an efficient and innovative team, project managers should take measures to build trust and cohesion among team members. In the Fateful Svensksund project, the exhibition team was assembled from the staffs of two museum organizations, and a project worker was hired externally to coordinate the VHP. To increase the team's cohesion and commitment, Aartomaa took measures to build trust and foster a collaborative atmosphere through joint activities and encouragement to express views.

Working on a complex project task requires the integration of a wide range of expertise and perspectives. In Virtual Heritage projects, cultural heritage organizations need to collaborate with XR or game developers, and vice versa. Among the challenges of interdisciplinary collaboration are a lack of shared understanding of the task, a lack of shared professional terminology, and differences in values and work cultures. To develop a

shared understanding among the project parties, project managers need to frame activities by providing a clear vision and goals. For the Fateful Svensksund project, the exhibition concept provided a strong vision which Aartomaa kept in the spotlight to align the activities of the organizations.

The project parties can develop a common vocabulary and an understanding of each other's values and ways of working through deliberate activities, such as workshops and seminars. The role of a project manager is to facilitate collaborative activities. Sometimes, a team member or an external consultant can act as an intermediary between different work cultures. Sahari's experience of both the cultural heritage and ICT fields enabled him to act as a translator and a mediator between the VHP parties.

To facilitate working in multidisciplinary teams, the Agile principles emphasize focus on people, interactions, and collaboration. The Scrum framework highlights the importance of collaborative planning, regular discussions, and reflection on the team's processes. After each work cycle, or Sprint, the team gathers to discuss and evaluate the successes, failures, and learnings of the past Sprint, and to suggest ideas for further development. The collaborative and reflective practices contribute to the development of trust within Scrum teams. Furthermore, Scrum stresses the roles of respect and constant collaboration between project parties as factors for project success. These aspects of Agile and Scrum can be valuable to consider in the management of future Virtual Heritage projects as well.

6.3 Managing Projects Requires Understanding of the Organizational Context and Benefits from Acknowledging the Wider Social Context

The organizational context for Virtual Heritage projects is affected by the local cultural policy model. In Finland, many cultural heritage organizations are funded by the state and municipalities. The public funding sets requirements for the organizational model, the administration, and the procurement process. Furthermore, external funding needs to be applied for projects that are not covered by the core budget. Regardless of the technological solution, Virtual Heritage productions require large teams of highly specialized professionals, which costs significant amounts of money. Therefore, Virtual Heritage productions are highly dependent on external funding. The funding applications

and the tendering calls define many aspects of a project in advance, which increases the rigidity of the project plan and resistance to change during a project.

The technological and the software solutions needed in Virtual Heritage projects can be developed either by university partners or by private sector companies, or a combination of both. While universities in Finland are government institutions, they operate under similar administrative models as museums, adding some unique organizational characteristics. Private sector companies, on the other hand, can have significantly more freedom regarding management, budgeting, and hiring, and can therefore be more dynamic in their decision-making processes and ways of working. The collision of the two realities in a project can generate friction, if not accounted for sufficiently. In the Fateful Svensksund project, Sahari operated similarly to a differential, synchronizing the varying input and output rates of the parties into a coherent progress. However, it was only possible because the management granted him the agility to operate outside of the conventional organizational model.

A high degree of relational embeddedness—having direct connections between individuals across organizational borders—increased trust and promoted fluent communication between the project parties. Some of the connections predated the project, others were established and deliberately strengthened during the project. The value of the direct and candid communication was manifested in the ability to efficiently solve problematic situations.

Structural embeddedness—a network connecting individuals in organizations and communities of practice through links that outlast projects and employment contracts—promotes the development of a project ecology and macroculture in a field. The evaluation of the connections between the project parties revealed signs of structural embeddedness. Furthermore, there are indicators of a project ecology starting to emerge in the Virtual Heritage field in Finland. At least three Finnish museums have executed Virtual Heritage projects as part of their exhibitions during 2020-2021: The Fateful Svensksund at the Maritime Centre Vellamo in Kotka, the opening exhibition of Muisti Centre of War and Peace in Mikkeli, and the Egypt of Glory at Amos Rex in Helsinki. XR companies such as Zoan and Arilyn already have experience of a number of collaborations with museums.

The development of a macroculture implies that project teams develop shared understandings of the tasks and codify working methods, which the team members carry over to further projects and employments. However, while individual learning takes place, it may remain as tacit knowledge if not properly documented and disseminated. A lack of systematic learning processes poses a challenge for increasing the body of knowledge of Virtual Heritage projects, forcing every new project to discover their own way.

The PRINCE2 methodology emphasizes the importance of learning from experience as one of its seven principles. The principle suggests that learnings from previous projects should be recognized and new learnings systematically captured throughout a project. Similarly, Scrum is based on empiricism and considers every event during a Sprint an opportunity to adjust and improve plans and processes. Documentation of learnings is not left to closing reports, but takes place in the Retrospectives, at the conclusion of each Sprint.

6.4 Project Management Craft Requires Maturing and a Consideration of the Unique Characteristics of VH Projects

Both Aartomaa and Sahari come from an expert background and—it could be argued—lack what Marion (2018) refers to as "management sophistication" (p. 8). While the lack of project management expertise may have introduced challenges and stress at times, the project was successfully completed despite having a unique task, a number of uncertainties, a demanding schedule, and an emergence of a global pandemic. By following the exhibition concept and focusing on people and relationships, Aartomaa and Sahari were able to harness the combined skills and expertise of the extended team members to deliver a memorable exhibition and a Virtual Heritage experience that seamlessly connected with it.

Nevertheless, Both Aartomaa and Sahari agree that there should be more project management training available for museum professionals. Aartomaa yearns for the dissemination of project knowledge to all levels of the organization to increase understanding of project realities among the administration and the experts. Sahari emphasizes the importance of better understanding of the procurement process for all who

are involved in it.

Ideally, a custom project management framework would be developed organically within the field, instead of introducing and implementing a ready-made solution oblivious to the circumstances and realities of the organizational context. The Virtual Heritage Project Management Framework (VHPMF) could adopt suitable practices from various existing frameworks, such as the PMBOK with its prescribing matrix of knowledge areas and processes, or the PRINCE2 with its guiding principles and themes.

Furthermore, to increase agility within a project and to facilitate collaboration with more agile organizations, the VHPMF could be influenced by certain Agile principles and processes. While the organizational context in museums may not be compatible with the adoption of an Agile framework such as Scrum, the emphasis on people, relationships, collaboration, and the processes facilitating them are relevant and directly applicable. Indeed, evaluation of the Fateful Svensksund project and the VHP has demonstrated that focus on individual relationships and close collaboration between project parties were key factors for the projects' success.

7 CONCLUSIONS

7.1 Summary of Findings

Virtual Heritage has many interesting avenues for development in the future. Museums and cultural heritage sites have already long experimented with VH experiences for enriching the visit. Additionally, the improving usability and decreasing prices of VR-capable devices hastens the adoption of the technology and creates new possibilities for accessing cultural heritage from within homes. According to A. Vargas (personal communication, February 19, 2021), VH experiences can help organizations connect with their visitors before and after the visit, extending their experience beyond the walls of heritage sites and museums. S. Suominen from Helsinki XR Centre (personal communication, May 18, 2021) envisions a subscription model for cultural heritage as an interactive digital service.

Furthermore, virtual worlds as tourism "destinations" may help develop more sustainable models for cultural tourism while allowing audiences to visit heritage sites that are destroyed, in a state of decay, or otherwise inaccessible and interact with objects that can't be handled in the real world. In one scenario, the various threats that cultural heritage is facing, including wars and climate change (UNESCO, 2018), and the increasing initiatives to record and digitally reconstruct endangered heritage (UNESCO, 2020b) lead to situations where the original heritage is lost in the real world and exists only in the virtual world.

Champion (2013) argues, that along with advances in technology, the field needs to advance in philosophical and creative ways as well (p. 279). I would argue, that to be able to advance on these fronts while keeping up with technological developments, the project management craft and learning practices within the field need to evolve. Currently, there is little written on the management of VH projects. Additionally, organizations need to adopt "more flexible working methods and structures" (NEMO, 2020) to facilitate the development of innovative VH experiences.

The case study has described the development of the Smoke on the Waves VH experience embedded within the Fateful Svensksund exhibition project that opened in the Maritime Centre Vellamo in Kotka in June 2020. The manifestation of the themes identified in the literature review have been examined through interviews with the project managers, Aartomaa and Sahari. Additionally, the case description was informed by two internal documents and an article (Sahari, 2020).

The previous part summarized the discussion in four statements. Firstly, time is a source of uncertainty and requires structuring and management. Secondly, collaboration over disciplines and organizational boundaries requires facilitation. Thirdly, managing projects requires understanding of the organizational context and benefits from acknowledging the wider social context. Lastly, project management craft requires maturing and a consideration of the unique characteristics of VH projects.

Regarding time and temporal embeddedness, it was observed that the project schedule was a complex puzzle, affected by a number of external factors, but deadlines, milestones, and weekly activities provided structure and reduced uncertainty. The task of the project was unique, with no clear formula for completion. However, it was framed by the exhibition concept and could be divided into more repetitive tasks that the project parties had experience of. Yet, in certain areas, such as creating the tendering call or the 3D modelling of the ships based on historical sources, the path forward had to be discovered through significant effort and close collaboration between experts.

Various teams worked on the production of the VH experience. The interviews provided insights on the facilitation of teamwork and cross-discipline collaboration within the museum organization and between the project parties. The findings support the notion that project teams should develop a shared understanding of the task and of each other's roles, responsibilities, language, and work culture. Within the project team, much was achieved with the clear concept and with Sahari's experience of the two fields. Furthermore, direct communication between managers ensured a fluent communication.

Main characteristics of the organizational context of the project include public administration models and the requirement for external funding, which set the stage for VH projects in publicly funded organizations. The concept of social embeddedness helps

understand how the existing and new connections between individuals influenced communication, collaboration, and decision-making during the project. Structural embeddedness predicts how informal learning takes place within the VH project ecology, through the development of a macroculture.

7.2 Distinct Characteristics of VH Project Management

Some of the findings of the study appear to be more generally related to interorganizational projects. The distinct characteristics of VH projects are related to funding, planning, technological understanding, team composition, and collaboration. Firstly, VH experiences are expensive to produce and require a significant amount of external funding. Successful procurement of the experience production requires a basic understanding of the technology and the actors in the VH field. The completion of a unique task requires close collaboration between cultural heritage experts and virtual worlds developers, who may not share similar knowledge, terminology, values, or work culture. Creating the funding applications and the tendering calls necessitates making early decisions regarding the project scope based on available knowledge, which may lead to inaccurate estimations and a rigidity of project plans. Furthermore, early decisions steer the VH experience to a predefined mould, possibly hampering experimentation and innovation.

7.3 Managerial implications

Regarding project management craft, the interviewees expressed views that there is not enough knowledge or training available for museum professionals in general. Furthermore, any project management framework applied in the VH context should address the unique characteristics of VH projects. Certain aspects of the three frameworks presented in the thematical part were evaluated in relation to their adaptability and relevance to VH projects. While Agile frameworks may not be directly adaptable to the organizational context, some of the principles and processes may be relevant and applicable to VH project teams. To ensure that new projects can build on learnings from previous projects, project managers should develop a systematic approach to capturing and documenting learnings during projects. The interviewees suggested that greater organizational agility in employing project workers or hiring external consultants may be beneficial already in the

procurement phase and help overcome some organizational friction during projects.

7.4 Generalizability and Limitations

One challenge with the timing of case studies is that project organizations dissolve after fulfilling their task but getting relevant information about them during the project may not be possible. The interviews for the study were conducted approximately 10 months after the project was completed. Arguably, the more time passes between the project completion and the interviews, the more unreliable are the accounts based on memories.

Alternatively, active participation in and observation from within a project organization could provide direct evidence and function as complementary data collection methods. For studying a project during its entire life cycle, interviews at different phases of the project or a diary study could be conducted.

The case study at hand has been a learning process. It does not aim to present general truths about Virtual Heritage projects but rather the subjective interpretations of the researcher about the themes discussed. The value of such a description for the field is to provide insights on a real-life situation and references for learning. For some validation of the interpretations, the analysis part was read and commented by the interviewees.

I have attempted to summarize the discussion as clearly as possible. According to Flyvbjerg (2006), a descriptive case study can not be easily summarized as a list of results, but the case story itself is the result, constituting a kind of a 'virtual reality' per se (p. 238). Indeed, the study is a reconstruction of the past based on interpretation of sources, telling a story of what may have taken place but dealing with issues related to authenticity and reliability.

7.5 Suggestions for Further Research

Further studies examining the management of VH projects should increase the body of knowledge in the field and help develop good management practices case by case. For instance, a case study examining the development of VH experiences for the Centre of War

and Peace Muisti's opening exhibition—scheduled to open in June 2021—could provide information of a very similar context.

It has been mentioned various times that the production of VH experiences is labour-intensive and expensive. However, consumer-grade technology and free-to-use or open-source software can go a long way in prototyping experiences and even creating small-scale experiences ready for release (Bottino & Martina, 2010, pp. 440-441). Small and agile research-and-development teams with some degree of skills in photogrammetry or 3D modelling and XR development using game engines could work with or within cultural heritage organizations and innovate on their content offering on an on-going basis, operating outside of the constraints of complex interorganizational projects. These R&D initiatives could be piloted as university collaborations, for example within the multidisciplinary Building Virtual Worlds minor program in Aalto University.

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