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Quo vadis, historia?

The role of innovation types and their
complementarities in national museums during the
Covid-19 crisis in 2020

Master's Thesis

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I have written this master's thesis independently. All viewpoints of other authors, literary sources and data from elsewhere used for writing this paper have been referenced.

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Abstract

This paper assesses the complementarity-in-use between Product, Process, Organisational and Marketing innovation in National Museums during the Covid-19 Crisis in 2020 through a series of inductive interviews. 11 interviews with five different national museums in four countries were conducted, revealing that although Product Innovation was the most employed type, it alone was if at best only partially solving the problem of the loss of visitors. A complementarity-in-use was found between Product and Organisational Innovation as well as between Product and Process Innovation. The paper also showed the difficulty of measuring different innovation types within the service sector and the strong neglect of Marketing Innovation that needs to be addressed. Furthermore, it was found that innovation type and complementarity are strongly influenced by previously acquired capabilities and geographical context.

Keywords: Innovation, Complementarity-in-use, complex innovation, innovation in museums, innovation during covid-19

Glossary

PI = Product Innovation

PrI = Process Innovation

OI = Organisational Innovation

MI = Marketing Innovation

SME = Small and Medium Enterprises

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1. Introduction

In the beginning of 2020, a worldwide crisis emerged due to a virus, better known under the name Covid-19. Without much prior notice, countries gradually closed borders and public life, forcing thereby public institutions like museums that were dependant on physical attendance, to rethink their business models (Tully, 2020a).

Due to this unusual situation, museums have found themselves in a crisis where the need for innovation was not a suggestion but mere reality because visitors had to be reached differently than through physical exhibitions. Museums are among the oldest institutions existing throughout mankind and hoard of innovations which helped humanity to advance. However, literature linking innovation and museums is rather scarce and rather focused on high tech companies (Melville & Ramirez, 2008). It is assumed that different innovation types have been used to tackle the problem. Contrary to most existing literature (Karlsson & Tavassoli, 2015), this study aims to not only analyse single innovation strategies but also their complementarity, which is described as “A relationship or situation in which two or more different things improve or emphasize each other's qualities.” (*Definition of Complementarity*, 2020). Schumpeter was among the first to research this relationship and positive effects of employing different innovation types together (Schumpeter, 2013). Complementarity can be sub-classified into complementarity-in-use and complementarity-in-performance. The first approach tries to get an understanding what types get employed together and link them, whereas complementarity-in-performance is interested in the benefit of the combination of innovation types in regard to performance or profit. (Ballot et al., 2015) The term “complex innovation” describes the innovation through not a single innovation strategy but combinations between them (Karlsson & Tavassoli, 2015).

This paper aims to contribute to the field of complex innovations and is to the knowledge of the author the first paper investigating the complementarity-of-use of innovation in museums. Complementarity-in-use and -performance has been investigated through quantitative research in most papers (Ballot et al., 2015; Expósito & Sanchis-Llopis, 2019; Hervás-Oliver et al., 2015a; Junge et al., 2016; Karlsson & Tavassoli, 2015; Martínez-Ros & Labeaga, 2009; Rebane, 2018). In this paper the data is gathered through a series of open interviews since non-technological innovation types are difficult to capture (Damanpour, 2014) and a qualitative approach with inductive reasoning will provide a great opportunity to explore not only all innovation types but also helps to detect complementarities that might be unnoticed

in a purely quantitative assessment. In addition, it allows to follow the timeframe of the implementation.

Most innovation studies focus on innovation in the free market economy, where companies, with the exception of NGOs, have in most cases profit-maximizing as main goal (Friedman, 2009). Even though there has been an increased interest in tourism-related innovation, scientific literature has been rather scarce, especially in the context of innovation processes (C. M. Hall & Williams, 2019) because researchers tend to look at innovation processes in companies with R&D activities (Barge-Gil et al., 2011; Damanpour et al., 2009a; Hervas-Oliver et al., 2015b) and only few studies such as from (Hervas-Oliver et al., 2015b) focus solely on non-R&D intensive companies. It should be noted that museums -by definition- may perform R&D activities, e.g. through the creation of new exhibitions but at the same time may have escaped the attention of researchers since most innovation studies focus on manufacturers.

In contrast to companies on the free market, museums usually have different missions: Education, collecting, research or preservation are amongst those, although profitability is still important (Barker, 2010; Eid, 2016; Kraemer & Jaggi, 2003; Sandell & Janes, 2007; Tam, 2011). In the context of this work, mainly innovations related to the fulfilment of the educational mission will be investigated because it was the area that experienced the strongest external shock.

When the Covid-19 crisis was hitting Europe in Spring 2020, the situation has brought lot of museums into financial distress. Their main income through direct (ticket) and indirect (shop, café, restaurant) sales has decreased drastically because visitors were either not allowed or reluctant to visit, with the sudden decrease of tourism affecting them directly. On the upside, almost half of museums saw an increase in digital visits, and 80% of museums have increased external digitalization to reach customers independent of location (Network of European Museum Organisations, 2020b). Especially in times of financial instability, as it was previously the case after the financial crisis of 2008, finding the correct balance between revenue-based activities but at the same time not neglecting the missions of the museums, which are usually not profitable, creates tension (Hughes, 2010). Scholars have so far looked into the direct resulting actions of the Covid-19 crisis (Network of European Museum Organisations, 2020b; Rex, 2020), strategies (Orlandi, 2020) or future outlook (Tully, 2020a). However, there is a research gap in analysing what museums did or did not to overcome the problems during the crisis, especially regarding the educational mission, which was under threat as the physical

offering could not be accessed due to closures, which affected 90% of the museums in Europe and worldwide (Network of European Museum Organisations, 2020a).

Summing up, the aim of the paper is to evaluate the complementarity-in-use of innovation types in national museums during the Covid-19 crisis in 2020.

The following research tasks will be conducted:

- Discuss relevance and concept of missions for museums, innovation during crisis;
- Provide an overview of literature concerning types of innovation, specifically in context of museums, complementarity of innovations, and influencing factors;
- Formulate interview plan about the ability of museums to handle the occurring change with respect to the educational mission achievement during the Covid-19 pandemic in 2020;
- Select suitable museums to conduct interviews with;
- Analyse the results of the interviews and conclude how different types of innovations and their complementarities may have influenced museums to achieve their educational mission during Covid-19 period in 2020

This paper contributes with a qualitative approach on complementarity-in-use to the quantitative research on complementarity-in-performance as done by, for example, Hervas-Oliver et al. (2015b) or Karlsson & Tavassoli (2015), and adds to the research of complementarities in an international context as done by Ballot et al. (2015) and Tether & Tajar (2008a).

2. Literature review

2.1. Museum mission

Museums hold multiple stakeholders who pursue different goals, some of them economic, others social. These goals contain conservation, education, and collection improvement. (Camarero & Garrido, 2009) Although visitor revenue is important, visitors should not be the main influence of a museum's objectives but at the same time should not be ignored either (Weil, 1995). Museums have different missions due to the influence of different stakeholder groups, which often causes inconsistency in goal prioritization. However, as museums are financially dependent on the main stakeholders, they are bound to fulfil different goals (Lindqvist, 2012).

As most museums are non-profit organisations, their main mission is not to generate profit but they are rather value-driven and should serve their community (Malaro, 2013; McCarthy, 2020). Categorizing museums according to their orientation can help understanding their mission although they usually are not confined to one category only. Museums can be divided into five orientations, as can be seen in *Table 1*. Despite the helpfulness of categorizing museums, it should be noted that museums can be a combination of multiple types.

Table 1
Museum orientations

Museum orientation	Description	Usually employed by
Object-centred	Emphasis on the collection itself. The visitor does not engage with the collection but rather finds everything sorted, numbered with descriptions. The composition of the exhibited material is important, with focus on installations.	War museums
Narrative-centred	Trying to tell a story behind the exhibition. Quite often making use of technologies to bring the collection to life by showing examples of how the collection was used or what a certain period used to be like.	History Museums and buildings, open air museums
Client-centred	The visitor is the most important part, and the exhibited material means to motivate visiting the museum. Content and staff are primarily focused on educating the customers and engage them. Will research customer needs and try to satisfy them, also using different marketing tools.	Children museums, science centres
Community-centred	Also known as "cultural centres". Open space for different organizations who can use the available space for their own purpose. Involvement and engagement is vital.	Ethnography/cultural museums
National museum	Represents the history of the corresponding state and its achievements.	National Museums

Source: Compiled by author, based on Gurian (2006) and Kotler et al. (2008)

Knowing its mission is vital for a museum to prioritize. If its mission is for example preservation, it gaining more visitors is only of secondary importance but creating an environment for researchers and curators to productively gain more knowledge about the content. Unlike most companies on the free market, museums do not have profit as main goal but rather identify a mission that needs to be fulfilled. Therefore, it is assumed that the solutions employed by the museum have not profit-maximization as goal but the fulfilment of the respective mission. In national museums it can be expected that the education of visitors about the country's history is a vital part.

2.2. Innovation during crisis

When talking about Covid-19, the term “Crisis” is quite often used. It can be defined as “an abnormal situation which presents some extraordinary, high risk to business” (Shaluf et al., 2003, p. 29) related to disaster, whereas the crisis is more comprehensive in nature. Although crisis is often associated with negative events, it also has positive sides, especially if detected early (Darling, 1994; Shaluf et al., 2003).

Innovation policy differs in times of crisis, as the concern of solving the problem is extended by the dimension of the time constraint. Meaning, that the quickness to solve the problem is the most important, which often sees multiple approaches employed to tackle the issue (Gross & Sampat, 2020).

During the financial crisis 2009, it could be seen that firms stopped increasing their innovation expenditure, although 60% were still spending the same amount. It was furthermore found that the distance to the frontier played a significant role, where companies further away from the frontier were less able to maintain the same level of investment for innovation (Filippetti & Archibugi, 2011).

Whereas in previous financial crises museums have only been partially affected by the loss of sponsorship (Lindqvist, 2012), the current Covid-19 crisis brought museums into financial distress due to closures, absence of tourists and the therefore resulting loss of visitor revenue (Crooke, 2020; McGivern & Kenney, 2020; Network of European Museum Organisations, 2020b), which play an important part in most museums' financial schemes. To overcome the Covid-19 crisis, suggestions like corporate sponsorship from smaller and medium companies (Biraglia & Gerrath, 2020), investment into digital services and infrastructure (Network of European Museum Organisations, 2020b), new web strategy (Orlandi, 2020), enhancing digital offering and emphasizing the social value (Tully, 2020a)

could be found. In a survey of the Network of European Museum Organisations (2020b) two more important indications are given: namely that film and video content of the collection and for educational purposes was most popular, and secondly, when staff tasks or resources were changed they saw an increase in digital services and online visits.

Different associations came up with different ideas on how to react on the situation, reaching from detailed instructions (Museums and COVID-19, 2020) to level systems with different impacts ('Using Scenarios to Plan Your Museum's COVID-19 (Coronavirus) Response', 2020).

In contrast to before the Covid-19 crisis where physical solutions like Augmented and Virtual Reality (AR-VR) were seen as tool to reach the educational mission (Recupero et al., 2019), a trend towards web-offering during and likely after the pandemic can be observed, where active and regular engagement of the visitor is suggested as effective way to keep contact with the museums' clientele (Cioppi et al., 2020; Orlandi, 2020).

Since the Covid-19 crisis has had a massive financial impact on the museums, it will be difficult especially for those further from the technological frontier to invest into new products or services. Since the crisis came unexpected, it is most likely that museums are trying to introduce multiple approaches at the same time to solve their problems as quickly as possible. A possible correlation between organisational change and increase in digital products has been found and thus it can be expected that museums that allow their workers to work on new tasks will see an increased amount of services.

2.3. Types of Innovation

One of the pioneers and most important authors in the field of innovation was Joseph Schumpeter, who argued that capitalism is the best form for innovation because it helps capitalists to gain more profit by investing into new ideas. He also created the term "creative destruction", which describes the everlasting replacement of existing product and process innovations with newer ones. It also emphasizes the fact that an innovation can help a company to gain competitive advantage only for a certain period of time as the competition will introduce improved imitations, thus arguing the necessity of constant innovation to remain competitive. (Schumpeter, 2013) Because the resulting balance between exploration or exploitation of innovation is important as a too strong focus on one of them leads to negative effects (He & Wong, 2004), these issues have resulted in a wide research in the field of ambidexterity and innovation change capability (Birkinshaw et al., 2016; Birkinshaw & Gibson, 2004; Day &

Schoemaker, 2016; Meyer & Stensaker, 2006; O'Reilly & Tushman, 2004; Rajapathirana & Hui, 2018, 2018; Schoemaker et al., 2018; Tushman & O'Reilly, 1996).

Innovation is associated with uncertainty as new, unattempt activities with uncertain outcomes are tried, possibly risking the successful existing solution and therefore not seldomly resulting in failure (Jalonen, 2011; Jalonen & Lehtonen, 2011). This failure may however have a positive outcome on innovation in a company if thoroughly investigated and innovative activity is not abandoned and failure is integrated as part of the innovation process (Chesbrough, 2010; Leoncini, 2016). It can be said that it is more beneficial to change and adopt new innovations than to stay with the status quo, especially in financial terms (Damanpour et al., 2009a; Jansen et al., 2006; Jiménez-Jiménez & Sanz-Valle, 2011; Zajac et al., 2000). It is even argued that a company, which is not developing new routines will not be able to keep its dominant position (Karlsson & Tavassoli, 2015).

Because "Innovation" is a wide field, it is commonly subdivided by scholars into Product, Process, Organizational, and sometimes into Marketing Innovation as well (Evangelista & Vezzani, 2010; Mothe & Uyen Nguyen Thi, 2010; Oslo Manual 2018, 2018).

The definitions of the different types of innovations are taken from (Gault, 2018, p. 619) and will be used throughout the paper, whereby the terms „Process Innovation“ and „Production/Delivery Innovation“ will be treated as synonyms:

“A product innovation (PI) is a product, made available to potential users, that is new or significantly changed with respect to its characteristics or intended uses.

A production or delivery innovation (PrI) is the implementation of a new or significantly changed production or delivery process. This includes significant changes in inputs, infrastructure within the institutional unit, and techniques.

An organisational innovation (OI) is the implementation of a new or significantly changed organisational method in the business practice, workplace organisation or external relations of the institutional unit.

A marketing/communication innovation (MI) is the implementation of a new or significantly changed method of promoting products of the institutional unit.”

Whereas product innovation and partially also process innovation have been researched thoroughly (Karlsson & Tavassoli, 2015), organisational and marketing innovation have often been disregarded in literature, with organisational innovation mainly due “variety of conceptualization, lack of established typologies, difficulty of measurement, and the dearth of comparable data across organizations.” (Damanpour, 2014, p. 1279).

Older studies focused on R&D as source of innovation but newer studies show that R&D is not the only innovative driver and non-technological types of innovation as well as parallel employment with technical innovations are existing (Barge-Gil et al., 2011; Dell’Era & Verganti, 2009; Hirsch-Kreinsen, 2008). R&D-employing companies have a high degree of collaboration with other firms and develop most product or process innovation in-house (91%). However, a high amount (71%) of non-RD employing companies are doing the same and in terms of revenue no difference between these two groups can be found, confirming the assumption that R&D activities are not necessary as innovative driver. (Arundel et al., 2008)

Product Innovation is the most persistent type, probably due to its self-efficiency and difficulty to neglect and re-engage unlike other types, such as Marketing Innovation (Tavassoli & Karlsson, 2015). Organizational Innovation is typically employed in non-RD employing companies, as they normally lack the capabilities for Product and Process Innovations but still are trying to innovate. It was also found that it is likely to increase technological innovation through the usage of Marketing and Organisational Innovation. (Hervas-Oliver et al., 2015b) This stands in confirmation to previous studies showing that high-tech companies are more prone to Product Innovation whereas low-tech companies rather make use of Process Innovation (Arundel et al., 2008; Fritsch & Meschede, 2001; Tether & Tajar, 2008b). This separation can sometimes be seen as difference in “services” and “goods/manufacturing” sector, where companies employ different innovations and intensity of complementarity (Damanpour et al., 2009a; Evangelista & Vezzani, 2010; Mairesse & Mohnen, 2010).

Despite the initial problems with innovations such as uncertainty, it has quickly been found that even though negative side-effects might be encountered at first, it is worth innovating as long as a sufficient balance between exploration and exploitation has been found. Descriptions of the single innovation types have been defined in works like the Oslo Manual (Oslo Manual 2018, 2018), even though that there are still a lot of different types and sub-types that appear in literature. Initially this was owed to the non-awareness of scholars of non-technological innovations due to the difficult of grasping them. R&D has for a long time been seen as the only means of innovating for a company, which enforced this belief. It was when those non-R&D employing companies were researched that scholars understood that such companies can indeed be innovative as well even if they do not produce any or almost no new innovative products. Product and Process Innovation can be found in most research and should naturally always be considered but Organisational and Marketing Innovation need to be closely monitored and understood as they show a wider picture of innovation, especially in the service picture.

2.4. Innovation in the context of museums

There have been extensive studies from (Camarero et al., 2011, 2015; Camarero & Garrido, 2012) about the usage of innovation in museums. Those empirical studies have shown that museums indeed do innovate and gain more visitors and revenue through innovation. Another of his studies confirms Schumpeter's theory that the bigger the institution, the more likely it is to innovate (Camarero et al., 2011; Schumpeter, 2013). Other studies, such as from (Bernardi & Gilli, 2019) or (Navarrete, 2019) deal with the product innovation, whereas other, such as (McNichol, 2005), are interested about how museums market themselves.

Museums were due to the Covid-19 situation unwillingly pushed into something that Isenberg describes as "Global Entrepreneurs" (Isenberg, 2008), competing not only with local establishments but trying to reach customers all over the world through web-offerings. However, the access to the global market can also be of advantage, when museums made use of open innovation, sharing their source codes and thus gaining knowledge and improved services through contributions (Eid, 2016). Before, they had to compete only with local tourist or leisure activities such as cinemas, historical buildings and other tourist attractions as well as entertainment establishments (Ballantyne & Uzzell, 2011).

The usage of computers may have been a disruptive innovation for museums, enhancing not only the visitors' experience but also initialising organisational change (Parry, 2007; Peacock, 2008). Disruptive Innovations usually under-perform in the beginning established technologies but have the potential to completely reshape entire sectors (Christensen, 2013; Meyer & Stensaker, 2006). It has been argued that museums are also going through disruptive innovation because classic guided tours are no necessity anymore to obtain information about the exhibition due to usage of new technologies (Akbar, 2019a). More specifically, museums have since the Covid-19 crisis developed into a direction where the creation of own content and communication with visitors have seen a stronger focus and likely will persist even after the crisis has passed (Cioppi et al., 2020; Crooke, 2020; Newman et al., 2020; Samaroudi et al., 2020).

To understand what kind of innovations are to be expected from museums, it can be helpful to look at their orientation. Because each of them has different stakeholders, the usage of innovation is also directed at different aims. For example, it can be expected from an object-centred museum that preserving and categorizing its collection has a high priority and therefore new processes that aid to achieve this outcome are most likely to be found. Table 2 is giving an indication based on previous literature and the author's personal experience as licenced

museum guide what kind of innovations might be expected when engaging those different orientations.

Table 2

Expected type of innovation by museum orientation

Museum orientation	Expected type of innovation	Example
Object-centred	Process Innovation	Establishing workflows to tag and implement new items to the collection (PrI). VAR, “Take-away” tablets with videos, screen telling background stories (PI).
Narrative-centred	Product, Organisational, Marketing Innovation	Establishing department responsible for event-telling events such as “folklore weeks” (OI). Branding museum as story-telling adventure where visitors learn from practical examples (MI).
Client-centred	Product, Organisational, Marketing Innovation	Engaging exhibitions like controllable miniatures, physical and hydraulic parts that can be controlled by visitors (PI). Creation of visitor engaging department (OI). Advertising an exhibition as adventure for the whole family (MI).
Community-centred	Process, Organisational, Marketing Innovation	Creating workflows to efficiently manage different communities with the same quality (PrI). Creating Board of Trustees (OI). Offering museum facilities as exclusive event space for companies (MI).
National museum	Process, Marketing Innovation	Creating schedules for releasing or showcasing new or rarely exhibited items of national importance, especially during national holidays (PrI). Advertising the museum “by the people, for the people”, exporting parts of the exhibition to other countries or online in alliance with the foreign office (MI).

Source: Compiled by author based on Akbar (2019b), Biraglia and Gerrath (2020), Cioppi et al. (2020), Gurian (2006), Kotler et al. (2008), Samaroudi et al. (2020), Tully (2020b)

Innovation has had an influence on museums for a long time because it was seen as a mean to attract more visitors. The closing of museums during the Corona pandemic has shifted the focus from purely physical product innovation to a direction where visitors do not need to be on site and are able to engage more directly; even contributing through their own creations

as it was seen with the #gettymuseumchallenge. Traditional guide tours could not or hardly be conducted anymore, which led to a shift in knowledge presentation. The crisis therefore might have changed the way of how museums are engaging their audience and might have reshaped the whole industry towards widening their offering, also reaching visitors who are not physically at the museum.

2.5. Complementarity in Innovation

Roberts & Amit (2003) argue that companies who are constantly engaged in innovation are more able to exploit previous knowledge to gain competitive advantage and previous process and product innovations can be combined to strengthen the competitive position. That study can be seen as noteworthy milestone as it refuted the previous assumption that gaining deep knowledge in multiple areas is hardly achievable and previous knowledge in the area is required to successfully implement new innovation, which was seen as argument that companies focus on one type of innovation only (Bosch et al., 1999; Cohen & Levin, 1989).

More recent studies confirm that aforementioned types of innovations are usually not employed alone but as combination (Ballot et al., 2015; Karlsson & Tavassoli, 2015). It has been found that firms from the service sector are more prone to combining technological and non-technological innovations to improve performance, whereas in the manufacturing sector disruptive innovations play an important role (Arundel et al., 2008; Damanpour et al., 2009a).

While investigating French and UK manufacturers, it was found that whereas a combination of two types of innovation were beneficial, the combination of all three (Product, Process, Organisational) seemed to have held no additional advantage, due to associated cost. Regardless of that fact, the combination of three innovations has been used most frequently. It was shown that only 5% of the sampled companies were using only one form of innovation. (Ballot et al., 2015) In a similar study of Swedish companies, it was shown that way fewer, but still 58% of companies were complex innovators, introducing more than just one innovation type at some point of time. It is noteworthy that this study showed that following a single innovation type does not seem to be an indicator for a positive effect on productivity, with Product Innovation mayhap as exception. In this study it also became clear that the by far most popular combination of innovation types is Product & Process Innovation, followed by the combination of all types, then Product & Marketing & Organisational Innovation, and Marketing & Organisational Innovation. (Karlsson & Tavassoli, 2015) To gain sustainable

performance, a complex and unique set of combinations of innovations is advised to be employed (Arundel et al., 2008).

Complementarity-in-use has been used to establish links between different types of innovation, even though they may not produce a direct financial advantage (Ballot et al., 2015). This link was researched widely between Product and Process innovation in studies like (Martínez-Ros & Labeaga, 2009) because new products may require a change in the processes and therefore can be observed frequently. Complementarity-in-performance focuses on the gain of combined innovations, for example on productivity growth as researched by (Junge et al., 2016) and (Rebane, 2018).

Comparing multiple studies as shown in Table 3 it becomes quite visual that Product Innovation is mostly dominant in manufacturing, where it is commonly accompanied by Process or Marketing Innovation, with Product and Process Innovation being complementary in some cases. Whilst research on Product and Process Innovation and their complementarity has been existing for some time, most likely due to the focus of scholars on manufacturing and R&D-intensive companies, the usage and complementarity of non-technological innovations has been a rather scarce and new field. Marketing and Organisational Innovation appear to play an important role especially in conjunction with technical innovations, gaining them a leverage through complementarity introduction at the same time. Most studies focus on the complementarity-of-performance, which is measurable through an increase in productivity or performance, which might be difficult to measure in a qualitative study. In the case of museums which are part of the service sector, the complementarity-of-use of Process, Organisational and Marketing Innovation can be expected.

Table 3

Types of innovation and their complementarity in literature

Author	Location/Sector	Innovation types	Findings	Implications for museums
(Expósito & Sanchis-Llopis, 2019)	Spain/ SMEs within manufacturing, real estate, construction, commercial, service	PI, PrI, OI	Finds that all three innovation types have a positive impact on both firms' productive capacity and improvement in product/service quality. The influence of innovation type on capacity and quality is different with PI as most influential for quality improvement and PrI for productive capacity. Financial benefit can be obtained through implementation of any innovation type, either through increased sales (PI) or reduction in associated cost (PrI, OI), thus increasing profitability.	Indicates that implementing any kind of innovation should have a positive impact on financial productivity through higher sales (e.g. online tickets) or cost reduction (e.g. more cost-effective introduction of new exhibitions).
(Azar & Ciabuschi, 2017)	Sweden/ export ventures	Technol. Innovations, OI	OI works as levelling support for technological innovations within the context of exporting activities, therefore improving export performance. Complementarity of OI and technological innovations (PI, PrI) has a positive impact on export performance and increase in innovative capacity.	Seeing the sharing of museum content to an international audience as "export", the usage of OI and technological innovations may increase innovative capacity.
(Ballot et al., 2015)	France, UK/ manufacturing	PI, PrI, OI	Combination of PI&PrI, and OI&PI increase performance but usage of all three does not give any advantage due to the associated cost despite most frequently used. Firm size, national context and R&D intensity also influence efficiency. PI sees complementarity with PrI in small&medium and RD-intensive firms and complementarity with OI in small&medium French firms. PrI substitutional with OI when combined with PI but complementarity with PI in small&medium and low-RD firms. Complementarity with OI in large UK firms. OI often used in France when introducing PI, due to national context. Complementarity with PI in small&medium French firms regardless of RD-intensity. Substitutional with PrI in low-RD firms if combined with PI.	The national context will need to be considered when comparing museums across borders. Some museums might be inclined trying to implement all types and the results should show no significant difference to those implementing only two types.
(Hervas-Oliver et al., 2015a)	Spain/ not specified ("non-R&D firms")	PI, PrI, OI, MI	Companies without R&D are using OI&MI to strengthen technological innovation as compensation for the missing R&D capabilities, therefore concluding the positive effect of complementarity of technical and non-technical innovation on performance. Despite drawing attention to "Managerial Innovation", it is pointed out that an increased focus on R&D activities would be beneficial. Furthermore, it was found that OI is increasing production performance more than MI.	As in national museums departments developing technical solutions are not to be expected, the lack of technical innovation might be compensated through OI&MI

(Karlsson & Tavassoli, 2015)	Sweden/ unspecified	PI, PrI, OI, MI	<p>Complex innovation has more positive impact on productivity than neglecting innovation, although knowledge about effects of complex innovation on company performance is limited and not all types have a positive impact on productivity.</p> <p>Most innovators use PI, PrI or the combination of both, with PrI appearing in 58% and PI in 57% of all innovative cases. Non-technological innovations were employed by 57%, with MI appearing in 41% and OI 40% of the cases.</p> <p>If introduced solely, only PI appears to have a positive effect on productivity.</p>	Those museums that are more daring and introduce a complex combination of innovations should be more successful in reaching their goals. If a museum has been found to only introduce PI, it should show a positive effect although due to the situation of museum closures this might only apply to digital products.
(Barge-Gil et al., 2011)	Spain/ manufacturing	PI, PrI	<p>Highlights that also companies without R&D are innovating, thus explaining R&D not as only source of innovation.</p> <p>Companies who engage a diversity of clients have higher PI. Market concentration increases PI for firms with R&D and PrI for those without R&D.</p> <p>Being in an expanding market facilitates the acquisition of PrI.</p>	Due to the diversity of clients, the probability of PI might be higher.
(Gunday et al., 2011)	Turkey/ manufacturing	PI, PrI, OI, MI	There are significant relationships between different types of innovations, excluding OI&PI. Underlining the importance of OI for innovative capacity.	Indicates that previous OI is important for future innovative implementations
(Evangelista & Vezzani, 2010)	Italy/ manufacturing &services	PI, PrI, OI, MI	<p>Emphasis the importance of enlarging innovation modes beyond PI&PrI. Four innovation types in manufacturing and services sector: PI, PrI, OI, and their combination. Economic impact differs with type and differences and similarities of impact are depending on the sector. Complex Innovation (usage of all innovation types) aiming for Product and Quality enhancement instead of cost-reduction are seen by bigger companies as most effective, equally underlining the importance of organisational change. Positive effect on economic performance could only be found in the manufacturing sector. PI more dominant in manufacturing than service sector, often accompanied by MI. PrI used in manuf. and service sector, often accompanied by OI&MI. OI is difficult to establish underlying strategies but when introduced solely. Dominant in the service sector, however, has a higher impact in the manufacturing service when introduced. Often accompanied with PrI.</p>	Indicates usage of PrI, probably in conjunction with OI&MI but a combination of all innovation types could also be possible.
(Arundel et al., 2008)	Europe/ not specified	PrI	High percentage of innovative companies without in-house R&D. PI&PrI adopted equally among companies with and without R&D. PrI more likely employed by firms without R&D with employees as driving innovating force.	Indicates usage of PrI could be initiated from museum staff and PI&PrI might be found as well.
(Tether & Tajar, 2008)	Europe/ manufacturing &services	PI, PrI, OI	Company size, sector and technological intensity influence usage of innovation type. PI is most likely used by technological intensive and bigger firms. PrI is more likely used by small&medium low-tech manuf. and seldomly in the service sector. OI is used in the service sector and small&medium retailers and wholesalers.	Indicates usage of OI, whereas it might also possible to find PrI.

Source: Compiled by author.

2.6. Factors influencing innovation

As it was shown by the cross-country comparison from (Ballot et al., 2015), the usage of innovation types and their complementarity is dependent on different factors, which shows the importance of investigating this topic before drawing conclusions as deviations might be explained by them.

The international context plays an important role for innovation. The lower the GDP of a country, the further it is from the “frontier” and therefore competition through innovation is more present in countries with high GDP, who also more often employ R&D (Griffith et al., 2004), whereas countries with low GDP focus more on the absorption of existing technologies and price competition (Acemoglu et al., 2006). Companies further away from the frontier have difficulties innovating due to lack of financial resources, whereas those closer to the frontier experience rather a lack of skillset (Hölzl & Janger, 2014). Therefore, a significant difference in type and complementarity of innovations should be observed when comparing museums throughout Europe. Literature generally finds differences in the type of innovation influenced by the national context, where size, type, age and sector also play an important role (Ballot et al., 2015; Barge-Gil et al., 2011; Tether & Tajar, 2008b). This confirms Schumpeter’s theory (Schumpeter, 2013), which links the ability to innovate to the size of the organization. Other studies have shown that Central Eastern European countries employ different types and intensity of Organisational Innovation, usually work management orientated and not as complex innovators as their Western European counterparts (Kondratiuk-Nierodzińska, 2016; Sakowski et al., 2019).

It is argued that the exploration of external knowledge is enhancing the performance of innovation, and that in order to be able to affectively absorb it into the own company, all employees engaged with the future innovation should have prior knowledge, namely labelled as “Absorptive Capacity” (Cohen & Levinthal, 1990). In a survey among the heritage sector in the UK it became clear that a high percentage of staff had a good level of digital literacy, which could be an indication that the implementation of technological innovations could be facilitated (Newman et al., 2020).

Capabilities are “patterns of experience and skills” (Foss & Loasby, 2013, p. 5), which are subdivided into different fields, such as organisational (Jones et al., 2005; Ulrich & Smallwood, 2004), technological (Lall, 1992; Stuart & Podolny, 1996) or social capabilities (Abramovitz, 1986; Ali et al., 2018). Technological capability describes the ability of a company to make use of technological advancements for their own means to create new

products and processes. Further subcategories of technological innovations are production, investment and innovation capabilities. (Fagerberg & Srholec, 2015) When it comes to change, especially dynamic capabilities are important because they associated with “sensing change, seizing opportunities, and transforming organisations.” (Schoemaker et al., 2018, p. 16).

When looking at museums in different countries, it will become apparent that the lack of financial resources (apart from the crisis) will influence the type of innovation. But also social capability, namely the level education and technical competence in a country, will shape the type and intensity of innovation. Because previous organisational innovation and technological capacity also affect future innovations, institutions with previous technological knowledge and recently established technologies might react quicker to the closures, giving them a clear advantage over those who did not. In this paper, the term “digital capabilities” will be used to describe the ability of employees to make use of digital advancements to create new products or services. Furthermore, those museums with high absorptive capacity and digital capability should adapt quicker to new technical solutions and therefore increasing its efficiency.

3. Data and Methods

3.1. Data Gathering

Due to the time-frame of the Master Thesis, the still ongoing Corona crisis and the novelty of the topic, a qualitative approach for gathering data was chosen. As the researched period lies in previous year's events, a longitudinal approach would have only been feasible if considering the evolvement during 2021, which would have been out of scope for a Master's Thesis. The same applies to a mixed data sampling by employing quantitative and qualitative methods (Creswell & Creswell, 2017), which might have been very useful considering the possibility to link ticket sales numbers, amount of visitors (online and offline) and museum income compared to any introduced innovation type.

Because some innovation types like Organisational Innovation are difficult to identify (Damanpour, 2014), an open interview that can be decoded through inductive reasoning (Bengtsson, 2016) was seen as most suitable approach of data gathering.

It was planned to conduct interviews with different national museums across Europe due to multiple reasons:

Firstly, the international aspect has been shown in many studies (Ballot et al., 2015; Hölzl & Janger, 2014; Kondratiuk-Nierodzińska, 2016; Sakowski et al., 2019) as influence factor for the used type of innovation. Thus, a more varied picture of the usage of innovations and conclusions could be drawn.

Secondly, national museums have usually a certain size that allows innovation as argued before. Smaller, especially privately funded museums might behave completely different to those receiving governmental support. Museums that receive governmental support may not require to lay off staff or see their mission critically endangered as the preservation of the national collection is one of the reasons why national museums exist. Therefore, those smaller museums might have a higher urge to come up with solutions and are thus more innovative than their bigger counterparts.

The interview request was drawn up to reach suitable employees in the museum but also keep the possibility open to gain a wider sample. In the first draft it seemed to be a sensible idea to address the head of the museum and managers because they are the ones who have insight about the decision-making processes. It became quickly clear that a lot of museums were busy re-opening their museums and therefore the management was occupied with associated activities. It was planned to have three interviews with three different museums but due to the lack of resources or willingness, only two museums were interviewed thoroughly,

with 4 employees each. Three additional museums have been interviewed with one employee each. The interview request was modified as can be found in *Appendix 3*, allowing the museums to send someone to do the interview who may not have been deemed suitable before. The interviews were also translated into German and Estonian as shown in *Appendix 4* and *Appendix 5* because museum employers may not feel comfortable giving an interview in English. This assumption proved to be correct as all interviews were conducted in Estonian and German. A positive side effect could also be observed because the participants were able to speak more freely without being limited or disturbed by the language barrier.

17 national museums were first contacted as can be seen in Table 4, first via the info mail found on the respective website. Since it did not help to get positive or any replies, a more direct approach for contacting museums has been chosen. Instead, museums were called and asked for a suitable person of contact and on some occasions a direct call to possible attendees was attempted. In one case even a message through LinkedIn established contact for an interview.

Table 4

Overview of contacted museums

Institution	Contact date	Outcome	Interview Language	Contacted by
Eesti Rahva Muuseum	08.03.2021	4 interviews	Estonian	Mail
Scottish National Museum	08.03.2021	Not successful		Mail
Landesmuseum Zürich	08.03.2021	Not successful		Mail
Lietuvos nacionalinis muziejus	15.03.2021	Not successful		Mail
National Museum of Ireland	15.03.2021	No reply		Mail
Deutsches Historisches Museum	16.03.2021	1 interview	German	Mail
Suomen kansallismuseo	17.03.2021	No reply		Mail, phone
Nationalmuseet Danmark	17.03.2021	No reply		Mail
Naturhistorisches Museum Wien	17.03.2021	No reply		Mail
Národní muzeum	17.03.2021	No reply		Mail
Musée national d'histoire et d'art	25.03.2021	4 interviews	German	Mail
Musée national d'histoire naturelle	25.03.2021	1 interview	German	LinkedIn
Museum Volkenkunde	25.03.2021	No reply		Mail
Rijksmuseum	25.03.2021	No reply		Mail
Kulturhistorisk Museum	25.03.2021	No reply		Mail
Haus der Geschichte Österreich	29.03.2021	1 interview	German	Phone

Source: By author

3.2. The interviews

Interviews were conducted with open end questions to gain a full understanding of the situation and to find information that might be new or obliterated by the author. The main questions as can be seen in *Appendix 1*, translations in *Appendix 2*, were included in each interview although not always in the same order but according to the flow of the interview and follow-up questions were written down in case they have not been covered or the participant's extroverted nature is not their strong suit. After the first interviews, questions about the museum's mission were kept optional because the topic itself deemed to produce no fruitful replies as the different missions (preservation, conservation, research, education) were seen by participants as equally important and interwoven.

Interviews have been conducted in the time frame between 12.03. – 09.04.2021 with an average duration of around 30-40 minutes. An overview of the interviewed museums is presented in *Table 5*.

Table 5

Overview of interviewed museums

Institution	# of employees	Established	Last constructure change	# of visitors (2019)	Loss of physical visitors 2020 to 2019
Eesti Rahva Muuseum	129	1909	2016 (New main building)	186,507	-50%
Deutsches Historisches Museum	220 (145 full-time)	1987	2003 (new building for temporary exhibitions)	798,198	-63%
Musée national d'histoire et d'art	107 (96 full-time)	1946 (1996 separated from MNHA)	2002 (main building) 2012-2014 (new wing)	83,364 (all buildings: 126,158)	-60%
Musée national d'histoire naturelle	105 (full-time)	1850 (1996 separated from MNHA)	2014 (change in main exhibitions)	77,173	-60%
Haus der Geschichte Österreich	25 (14 full-time)	2016 (opened 2018)	2020 (change in main exhibition)	102,456	-78%

Source: Compiled by author

Interviewees have been categorized according to their job description and area of expertise as explained below and can be found in *Table 6*.

The following Job descriptions have been used:

- **Director:** Director of the Museum
- **Leader:** Responsible for an area and/or managing teams
- **Expert:** Expert in the area
- **Employee:** Employed within an area with clear team leader

The area of expertise has been categorized as follows:

- **Museum Management:** Responsible for tactical and strategical decisions in the institution
- **Visitor Experience:** Working with visitors, including school groups
- **Exhibitions:** Working actively on creating exhibitions, curating
- **Temporary Exhibitions:** Working on only temporary exhibitions
- **Marketing:** Working on advertisement/market research for the institution

Table 6

Overview of interviewees

Participant	Institution	Job description	Area of expertise	Duration
A	Museum 1	Leader	Exhibitions	39:15
B	Museum 1	Leader	Marketing	Written
C	Museum 1	Leader	Visitor Experience	40:00
D	Museum 1	Employee	Visitor Experience	34:13
E	Museum 2	Expert	Temporary Exhibitions	29:34
F	Museum 3	Leader	Visitor Experience	48:41
G	Museum 4	Expert	Visitor Experience	29:21
H	Museum 4	Expert	Exhibitions	52:32
I	Museum 4	Expert	Marketing	28:15
J	Museum 4	Director	Museum Management	28:30
K	Museum 5	Expert	Communication & PR	48:20

Source: Compiled by author

3.3. Interview findings about innovation findings and complementarities

In general, museums behaved differently to the Covid-19 Crisis depending on previously acquired capabilities and previously implemented innovations. This seems to have a crucial influence on their reaction time and ability to cope with the situation.

All museums had little to time to react when the first closure happened and a different pattern in reaction could be seen. Since one of the first measures was to send employees at least partially to work from home, first problems occurred for those museums who did not have the digital infrastructure and were hindered in their efforts by data and security protection laws because a lot of national museums are connected within the state IT network. The time to normal operation showed to be a crucial factor for following innovations. Whereas most museums were able to have their employees work from home within a time frame of 1-2 weeks, one museum proved to have huge problems due to governmental restrictions.

“In comparison to other institutions in our city we had the advantage that our IT was already on quite a high level, however with restrictions. For example, we were able to -and I have to stress this is not taken for granted in the public sector due to data protection and legal reasons- gain access to our e-mails from our home-office. The problem is that a lot of programs are forbidden for usage because we are part of the public sector. For example, google docs is not allowed, Zoom as well.” – Participant E

Legal restrictions were encountered often but the time to resolution was usually around 1-2 weeks. It shows the huge influence legislation can have on innovation as a proper workflow cannot be achieved without solving infrastructural problems.

“Only half of our staff had laptops. It was quite difficult getting IT access because we are a public institution, so it took around a week. In the beginning a lot of communication went via phone because all video servers were overloaded.” - Participant G

Once the digital infrastructure was set up, some museums looked at internal capabilities and how they might help to mitigate.

“We had to completely re-organize ourselves. We had now the opportunity to occupy ourselves with those tasks we had to neglect in the past because we were too busy with other tasks. Next, we investigated how to organize ourselves, what projects should we tackle. For example, we tried to find out what our key capabilities are.” - Participant E

It could be found that those museums with an already established strong digital capability needed only a very short period for workplace organisation and capability finding. In two museums this step was barely mentioned at all and it seems that they were already well-

aware of them. One museum reacted very fast and tried to just “create something”, so they started off with simple approaches that may not seem ground-breaking but helped to gain attention by simply being the first with a Product Innovation that might not sound extremely innovative but gained the museum a lot of attention, even from newspapers. Since this initially under-performing try transformed into a highly complex event with several cameras and own direction in the same museum, it describes a disruptive innovation (Christensen, 2013; Meyer & Stensaker, 2006). The usage of live and recorded video material may indeed have reshaped the entire sector and was found across all interviewed museums.

“At short notice we did a basic facebook live-stream through the house (museum) on Monday or Tuesday after beginning of the lockdown and was -to my surprise- a huge success. One would think that everyone was aware that such things are possible and even the press reported about it as if no museum in the world had done this before. [...] Since we were the first who did this [live stream] it helped us because people talked about it.” - Participant K

Other museums with digital capabilities were able to react within short time, usually 1-3 weeks after closure and tried first to expand their digital offering. This was the start of a phase when a lot of different Product Innovations, such as video guiding, virtual tours, audio guides and even a riddle rally could be observed. In *Table 7* examples of Product Innovations are displayed.

“Firstly, we filmed web tours. We created around 17 web tours for our main exhibitions. Our first tour came 26.03., 13 days after lockdown.” - Participant C

“Since we are a contemporary historical museum and thus see ourselves as a place where we collect in current times as well, we wanted to display the Corona Crisis on our web page where visitors can contribute. Partially, you can already find parts of it in the physical museum as well. On the other hand, we tried to have a stronger display of those exhibitions, which were not related to Corona, online.”. - Participant F

Table 7

Product Innovations across museums

Museum	Examples of Product Innovation(s)
1	Videos of exhibition, interactive workshops, “virtual museum”, guide tours on outside premisses
2	Audio guiding, videos to selected topics, interactive history workshops, live video guiding
3	Implementing online contributions into physical exhibitions, interactive website
4	Audio & video guides, online workshop, riddle rally, online exhibitions, quizzes combined with 3D exhibition
5	Orchestrated exhibition video with own direction, videos of exhibition, nature app

Source: By author

Although a huge emphasis laid on the digital offering, physical Product Innovations were encountered as well, not only to solve the problem of close contacts but also for future usage, and extension to a new audience. The “Guide-Robot”, which was tested in March 2021 and shown in *Figure 1*, is a prime example of this. This is noteworthy because this solution despite being in the early phase of development, said robot shows the innovative mindset of the museum who might even make use of aforementioned technology after the crisis has passed to reach visitors who do not have the possibility to physically visit the museum, thus reaching a new customer segment. This might become a trend with more museums realizing that they should not be bound anymore to their physical location alone.

“Can we maybe offer web tours for web conferences? Now we have a guiding robot which might be of help for such situations, and we just have to learn how to efficiently use it.”

- Participant C

“We have to go more outside and reach people even regardless of our museum’s location.” - Participant F



Figure 1 - Guide-Robot (Karm, 2021)

Process Innovation was difficult to identify and found rather towards the end of 2020 or later. Most interviewees admitted that they had to work from home instead of in the museum, which may have changed their workflow but was not confirmed in the interviews. One could furthermore argue that home office is hardly an innovation but rather a necessity due to the situation. When asking about general changes in the workflow, most interviewees claimed to not have observed any changes in their processes, although the author believes they might exist. Participant J showed a clear change in the archiving process of exhibitions, which saved time and money, as displayed in *Figure 2*. Since this Process Innovation was only possible due to a preceding Product Innovation, a complementarity-in-use, with PI enabling PrI, and complementarity-in-performance between PI and PrI were observed.

“Before, we had a photographer who first made pictures and then we had to archive the whole collection manually. Now we can create a 3D archive, which is more automated, less complicated, can be made public, and will save a lot of time and money.” – Participant J

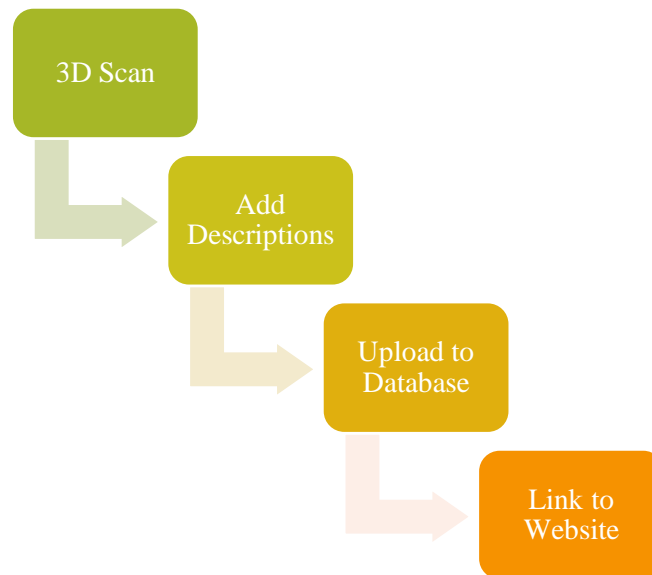


Figure 2 - Process simplification for archiving exhibitions (by author)

In almost all museums an Organisational Innovation took place in form of employees who took up tasks in other departments mainly because their main tasks, which included working with visitors, could not be conducted anymore. Participant A stresses, that it is only temporary, and employees will move back to their original tasks once the museum can operate normally again, whereas Participant F from a different museum indicated that the collaboration between different departments might continue. It can be expected that museums which adapt Product or Process Innovation will also need to change the workplace organisation of many employees on the long run, so they will be able to work with the traditional and new offering. It was found that there is a complementarity-in-use between PI and OI, since employees who were freed from their daily tasks had the spare time to work on new services, such as video content creation, which was also found by the Network of European Museum Organisations (2020b). This in turn led to more Product Innovations, thus also showing a complementarity-in-performance.

“It was a huge administrative effort to manage those employees who were normally busy with visitors or school classes. [...] Employees learned about different areas in the museum, which raised interest in continuing doing different tasks. We also found out more about the capabilities of different employees.” - Participant F

It became quickly clear that in countries with high labour regulation such Organisational Innovation proves to be more difficult, which yet again shows the strong influence of national legislation on the type of innovation as described by Sakowski et al. (2019) and draws attention to the national context, which was also found in the case of Ballot (2015).

“In our department we had no change in tasks or roles, maybe there are some exceptions. We have the right according to our guidelines and labour law-related claims to conduct tasks that are written in our work contracts. However, our student assistants who are normally working at the entrance area, [...] had no work anymore and thus were helping out with other tasks such as, for example, filming live educations or doing technical support can also be done by student assistants.” - Participant E

It was difficult to come across obvious Marketing Innovation. Most museums seemed to have focused on solving their acute problems but often did not try to advertise them more efficiently but rather used their existing channels, such as e-mail distribution lists, news articles and their already existing social media. As one employee put it:

“I say we have to market ourselves more efficiently. Who is reading those articles about our museum? Probably the same people who are visiting the museum anyways. We are doing a good job regarding the amount of people we have, but we definitely should have a stronger presence on the internet as well as on social media.” - Participant I

A structured approach of Marketing Innovation could not be found but an interesting single usage of Market Innovation was the cooperation of a museum with an influencer. Although this approach might catch the interest of younger age groups, museums are and might want to be careful about that kind of format to not sacrifice the mission of the museum for bigger publicity.

“We were working with an influencer who made videos with our curator. It could be something we might continue in the future, but we have to be careful that we don’t sacrifice our values to become more populist.” - Participant H

An example of the potential of proper Market Innovation was found in an area that was not related to the museum’s core activities since it happened in a museum shop that saw a big increase in online sales.

“During the first period between 16.03. – 17.05. we almost tripled the revenue of our online shop. We marketed the webshop more vigorously than before, offered weekly discounts, did video advertisements for books where the authors themselves talked. We also renewed the assortment by offering food from the Museum’s bakers and cooks.” - Participant B

“The e-shop contributed 11% to the whole sales in 2019. In 2020, this number rose to 21%.” - Participant C

Summing up, it was challenging to identify not only non-technological innovations but also Process Innovation due to its lack of conception of the interviewees. Table 8 gives an

overview of the identified innovation types across interviewees, where it can be clearly seen that PI and OI were prevalent.

Table 8

Innovation types identified during interviews

Participant	PI	PrI	MI	OI
A	Yes	No	No	Yes
B	Yes	N/A	Yes	Yes
C	Yes	No	Yes	Yes
D	Yes	No	No	Yes
E	Yes	No	No	No
F	Yes	Yes	Yes	Yes
G	Yes	Yes	No	Yes
H	Yes	No	Yes	Yes
I	Yes	Yes	No	Yes
J	Yes	Yes	No	No
K	Yes	Yes	No	Yes

Source: Compiled by author

As graphically displayed in *Figure 3*, PI was found across all museums, with PI&OI encountered in most. PI&PrI were found in only one museum but might most likely be found even more frequently if researched more deeply. Museums who employed complex innovation seem to perform the best in terms of reaching their audience, confirming Arundel et al. (2008). The study is therefore in line with Damanpour et al. (2009b), finding that focusing on one innovation type (especially sequentially) may not be as effective as a combination of multiple types.

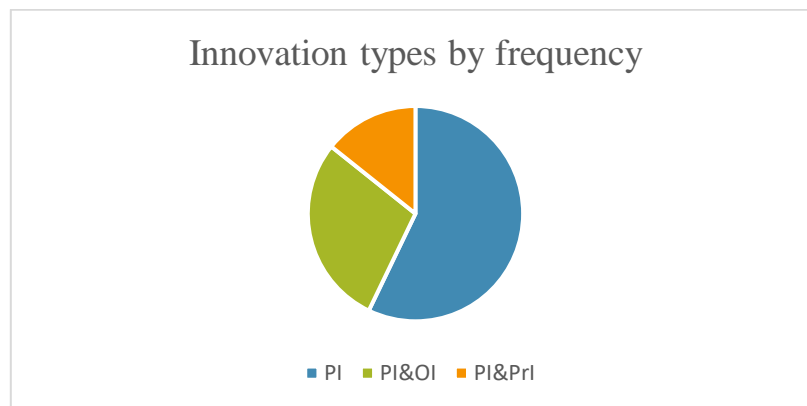


Figure 3 - The most frequently encountered innovation types (by author)

Comparing the interviewed museums, a pattern could be found, which allows to categorize the museums into three different categories according to their behaviour directly after the crisis:

- The Fast-Reactors (A)
- The Reactors (B)
- The Laggards (C)

This pattern is displayed graphically in Figure 3 and shows only the initial reaction. The Fast-Reactors are museums with strong digital capabilities before the crisis that just went to finding innovative product solutions as soon as the situation happened. 3 Museums were found to behave as such.

The Reactors are museums that had strong digital capabilities before the crisis but was first assessing its internal capabilities and went on to finish work where no time was found during normal operation. This type shows an Organisational Innovation in the beginning and then moves on to start with Product Innovation.

The Laggards are museums which had little or almost no digital capabilities and were investing a lot of time into gaining them, with innovations rather happening incrementally and much slower than the first two groups. Only one of the interviewed museums has been identified as such.

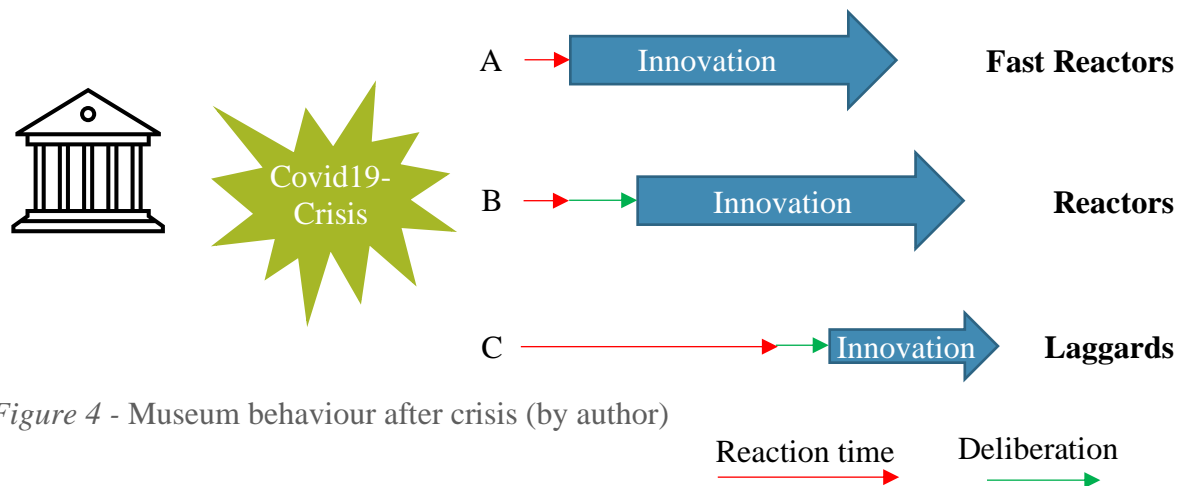


Figure 4 - Museum behaviour after crisis (by author)

During the interview phase it became clear that countries with a high level of digitalization even within the state (Estonia, Luxembourg) belonged to the class A (Fast Reactors) and B (Reactors) whereas it is assumed that in countries with a high level of regulation and lagging digitalisation, such as for example Germany and Austria, rather the type C (Laggards) will be encountered if researched further, drawing attention to the national context and social capabilities (Abramovitz, 1986; Fagerberg & Srholec, 2015). In this case, a museum in Austria was rather classified as type B, which might also be due to the novelty of the museum. It is recommended to do further research with a bigger sample of museums to confirm this assumption.

Museums which had established digital and technological capabilities before the crisis but haven't been actively pursuing it, saw an accelerated digitalisation by converting idle time into productive work.

“225 536 files, containing 95 744 film footages were uploaded digitally. We added 22 times more descriptions to digitally uploaded material compared to 2019.” – Participant B

All museums produced some kind of (digital) web offering. It could be observed that the first offerings were rather simple and became more sophisticated and expensive over time, especially in countries closer to the Frontier. Due to the reduction in public interest over time, a decline in the amount of new product innovations took place and most museums reduced the amount of diversity, focusing on one or two approaches that were deemed as most helpful.

“The finished videos have together been watched over 65.000 times, which is a really great number. Our first two web tours were watched over 12.000 times. But the next ones were watched only around 4000-5000 times. Already in April we saw that there was generally such a huge digital offering that the digital offering was not followed as much anymore.” – Participant C

It could be observed that museums that already had a strong online presence went a step further and created offerings that were not bound to the physical or online presence. This might count as Marketing Innovation since the museums showing that they are not only bound to their physical location.

“The institution has from the very beginning been conceptualized to have a web platform, which is not a simple website showing only opening hours or alike but rather works as a digital extension of the museum.” [...] “There is a wandering exhibition about the Great War which is moving from city to city. We are trying to go physically outside at least two times per week to stay in contact with our audience and the Corona Crisis has encouraged us to do so even more.” – Participant F

“We thought let's do something that speaks to the people. And that means not watching something that they won't be able to visit. We had great weather, so our motto was: Let's get outside! We have projects like an app where you can make pictures of plants and amphibia.” – Participant K

Although one might be inclined to think that the rise of digital offering will see museums operating a whole new level, this could not be found, therefore disagreeing with Navarrete (2019), at least for the researched museums. Reasons for that are the over-saturated market of online offerings, coming not only from museums, and the lack of adaption from potential virtual visitors. Whereas there has been a short, extreme spike in interest in the

beginning of the crisis, this curve flattened shortly after as graphically displayed in *Figure 5*, discouraging many museums from further persuasion of expansion, since they cannot compete with bigger institutions. It should also be noted that some museums did not have the resources or capabilities to measure efficiently the stream of clicks, confirming the survey of the Network of European Museum Organisations (2020b).

“Although there is a huge online offering, everyone is fed up with it. We shouldn’t overstretch marketing and say ‘watch more’. It is also difficult to market when we don’t have much money coming in. Museum must also keep in mind its mission or legal obligation - the museum is a support and platform for the educational system - for this purpose commercial marketing and sales must be left in the background” - Participant A

“During the first lockdown there was an interest from the press and people who wanted to support the museum. But after all, these digital offerings have not been as accepted as one would like to hope. People do not want to sit at home watching a 3D model, they want to go to the museum. For example, people want to relax in the evening with ‘Netflix&Chill’, not ‘Museum&Chill’.” - Participant I

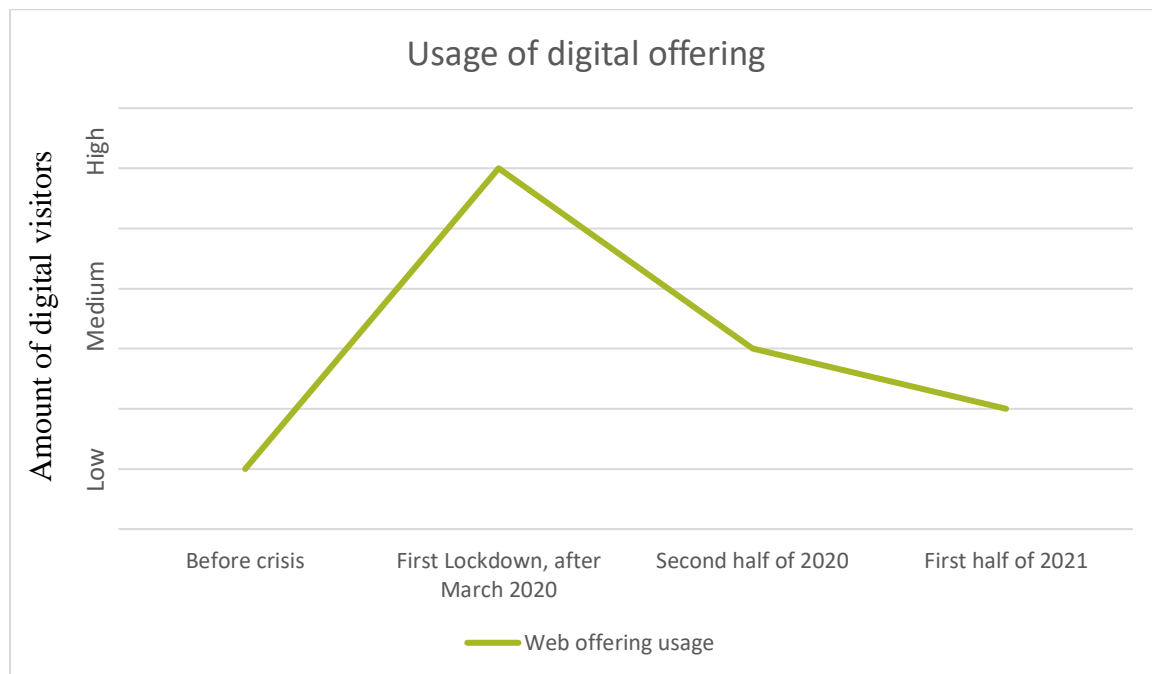


Figure 5 - Interest in Web Offering (by author)

This rather unexpected finding that measuring performance is difficult or obligated might shape the future of museums more than scholars currently realize. Museum directorates might come to the conclusion that the digital offering has not been a threat but also not beneficial nor disruptive; therefore it will be interesting to see in which direction museum

innovation will shift after the crisis – will the focus be on inhouse offerings and internal improvements or will it move into a different direction? Suggestions such as from Samaroudi et al. (2020) to increase virtual visits may seem theoretically like a good idea but in practice be in vain for many institutions due to the vast amount of resources needed compared to the modest outcome. For example, in one museum three employees were needed for a virtual tour where previously only a single person would guide. As soon as normal operations will continue, most employees will return to their normal tasks and will not be able to spend as much time on new formats as during the crisis.

“The virtual offering is exhausted and less and less people make use of the services. Therefore, we will not develop any new formats in the near future.” – Participant J

Since some formats caught indeed attention and success, it is likely that the variety and frequency of the offering will reduce but not disappear because many advantages were found along the way.

“We had 1,200 views for a video where a guide was talking about one piece of the exhibition and she said that it would never be possible to have that many people at once in front of it. In the future we want to include more offerings, such as a video guide from the artist of the exhibition.” - Participant H

It was found that although solutions the museum came up with did in most cases not solve the problem of gaining visitors back entirely, they regardless were seen positively as enrichment of existing offering. If time and staffing allow it, some innovations will persist but with a different intention than in the first place.

“Although our guided tours are running again, I believe it is an enrichment to have a parallel digital offering because not every visitor wants to be taken by the hand. Some people want to discover the exhibition by themselves and are thankful for additional background information which they can view whenever they want. This will also help them to prepare their visit or dig deeper into a topic.” Participant G

In general, it was difficult to even measure the success of digital offerings. Where before the crisis, the amount of physical visitors and guided groups was giving a comparable number, this approach proved to be more difficult with online statistics, as was also found by the Network of European Museum Organisations (2020b).

“Online statistics are difficult to measure, especially because our way of analysing statistics changed.” - Participant F

Many museums did either have no or a varying quality of statistics, in some cases even questioning the accuracy of the compiled data.

“Let’s take for example our 3D model. We had 3000 visits (longer stay) and 17.000 impressions (short stay) since the model has been online. But how expressive is this number?”

- Participant I

It could also be observed that although the huge offering (in one case a museum made 100 videos), the number of clicks varies extremely, in this case with some videos not even reaching 10 clicks. This leads to the assumption that museums who employ a thought-through Marketing Innovation, also analysing the possibly newly gained customer segment as described by Rebane (2018), alongside their Product Innovation may be far more successful in terms of web attention compared to those who just produced new services but promoted them through their traditional channels.

“In an exhibition where we would expect 10,000 visitors, we may generate 100 clicks.”

- Participant J

As promising as looking into Marketing Innovation may seem, museums might not adapt it by wide since there might be a conflict of interest if done too “populistic”. If done correctly, it could however help museums to gain more attention among the younger age group. One problem with Marketing in general was the lack of resources and the age of employees, who might not be as digitally capable. It can be noted that although employees did adapt to digital solutions, the usage of social media was gaining momentum but still underdeveloped, which confirms the findings of Newman et al. (2020). As one interviewee put it:

“Anyone above 28 should not promote a company on social media.” - Participant I

Time-wise it was difficult to measure when each innovation started but it became clear that with the exception of one museum, where a sequential introduction of Product Innovations was found, all museums tried different innovations and also forms of innovations at the same time, as displayed in *Figure 6*. Due to the lack of physical visitors, especially employees engaged with visitors had to restructure their activities and an Organisational Innovation was observed as first reaction in most museums, where employees’ tasks changed and had to develop new capabilities. Product Innovation happened throughout most of the time, with multiple PIs generally happening at once. Towards the end of the crisis, a Process Innovation could be observed in the case of one museum and others may follow, mainly implementing the digital aspect from the beginning of an exhibition, instead of adding it later on.

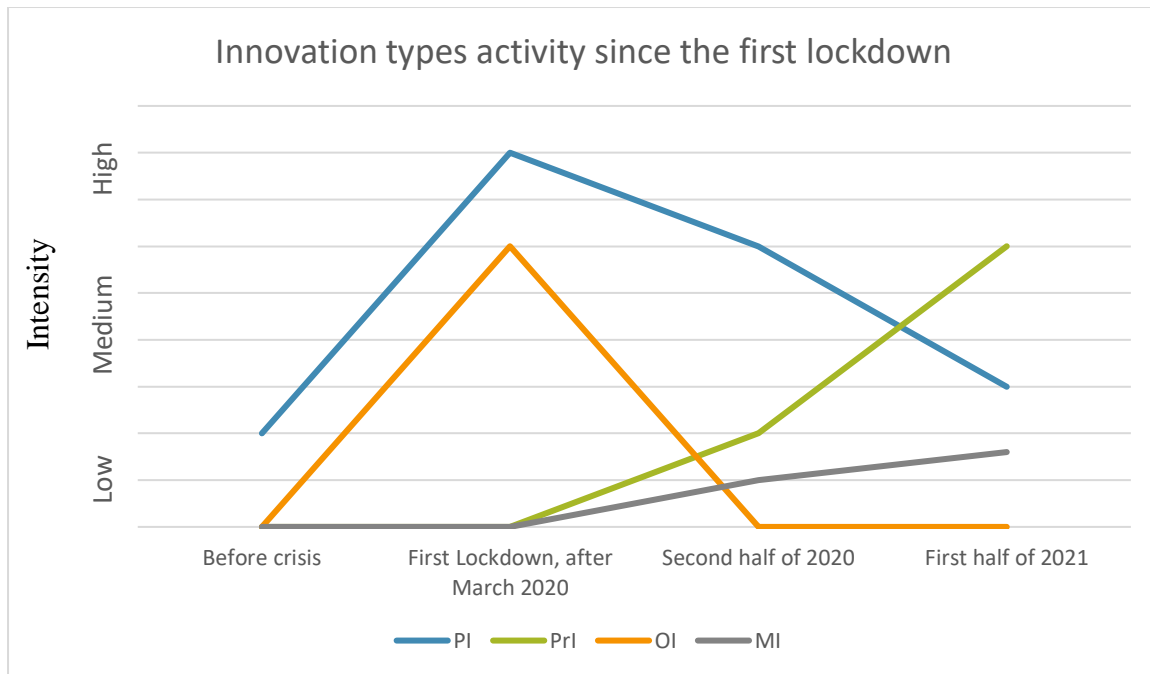


Figure 6 - Innovation Activity (by author)

The interesting finding is that although there has been a massive spike in Product Innovations, it was not equivalent to success in terms of reaching their audience. In the beginning, every digital offering has seen a spike in interest, which then disappeared as exponentially as it rose. Those museums that managed to employ Product Innovations differently compared to their intended use of reaching their audience, saw it later enabling Process Innovation thus as complementarity-in-use and also enriched existing offerings. Hence, it was found that Process Innovation was enabled through Product Innovation and is likely to appear in museums that are able to enable new innovation through existing innovation. This can also have a positive impact on performance since for example adding Product Innovations (such as videos with the creator or curator) to the process of creating exhibitions can not only help saving time but also draw more visitors, thus also showing a complementarity-in-performance between PI and PrI.

Organisational Innovation was one of the first innovation types to appear, sometimes even preceding PI. It certainly accelerated PI, suggesting complementarity-in-use since employees were freed from their everyday work and thus able and willing to try new formats, confirming Azar & Ciabuschi (2017).

“Around one third of the pedagogical department is now engaged with creating videos, which has not been planned by far before the crisis. All that would not have been possible if there hadn’t been this disruption through Corona. Surely not.” - Participant K

The prevalent lack of Marketing Innovation may have been one of the reasons why Product Innovations did not show the desired outcome of reaching more visitors, since researchers showed in previous studies a complementarity-in-performance between PI and MI (Junge et al., 2016; Rebane, 2018). Especially the communication with the different customer segments was often lacking. On the other side, one museum managed to keep in touch with one of their clientele; namely schools. Thanks to a nation-wide school platform, the museum was able to reach out to teachers and inform them about their offering, which found was used. Once again, this underlines the importance of the national factor.

The extend and complexity of the digital offering was differing to a huge degree, where institutions further away from the frontier were seen as using rather simple and open-source technology, such as a virtual tour implemented in google maps, whereas complex 3D models were encountered in two museums in Luxembourg alone, even before the crisis. This stands in line with the findings of Sakowski et al. (2019).

„The Vernisage (exhibition) had 6,7 cameras and an own direction. The challenge here was to convince the direction that ‘in the beginning it will not have the amount of people who would usually come to a Vernisage. [...] But on the long run will this presence, that is distinguishing itself with quality, bring a number of visitors that will accumulate.’ Later on, we saw that we were right.” - Participant K

One interviewee told that in his country the state has been financially supporting the national-wide digitalization, which helped during the Corona crisis greatly because a digital infrastructure was already available. This finding draws the attention towards the importance of social and technological capabilities (Abramovitz, 1986; Ali et al., 2018; Fagerberg & Srholec, 2015).

Looking at the broader picture, different forms of success in terms of reaching the audience could be found. Whereas the interest in digital offerings has gradually declined over time, museums were able to establish themselves digitally and gain from all innovation types. Some found new internal capabilities, some developed new offerings that they want to implement in the future and in one case, even a completely new customer segment could be reached.

“We have now more possibilities to offer lessons abroad. The Museum has, broadly speaking, established itself an own virtual building.” – Participant D

“We have different online formats but not only, we also introduced guiding over phone, which was especially interesting for blind and visually impaired and has been received very well. This is a solution our museum has been in the forefront with.” - Participant E

*“We want to continue using online workshops for school classes that don’t have the possibility to visit us.” - **Participant F***

Although classical guiding tours could not be conducted during the crisis, it could not be observed that they would disappear, as described by Akbar (2019a). Rather a transformation of the guide’s work could be seen with guides being involved more in the creation of short learning videos, especially for school groups. On the long term, the work area of guides will be wider, also considering new tools such as a guide robot or simple live streams, where the guide can show the museum to an international museum from home.

Two more factors were found, which helped museums to be more innovative: Previous digital capabilities and an open management style. The open management style refers to the top management of museums, allowing employees to come up with new ideas and execute them without bigger interference.

*“Our director allowed us to try new things and even fail, trying again, so we could eventually create offerings of high quality.” - **Participant F***

*“From management level we only got the information what restrictions were existing. Our job was to find solutions to that.” - **Participant G***

In contrast to this open management stands the case of one museum that shows a clear aversion of top management towards digital offering. According to the participant, the digital offering is on top management level believed to stand in competition to the physical museum, which might be the reason for a rather low level of overall innovation. However, the young team was still able to gradually implement new offerings, which certainly aided.

*“Ideas came from the department team itself, not the museum management. The practical implementation came from our quite young team, what surely was an advantage. Although some initiatives came from our team, the decision was always lying at a higher authority.” - **Participant F***

Whereas Product Innovation was the most common encountered innovation type, all types of innovation have been encountered, although at different stages and intensity. Organisational Innovation was quite common since employees in the visitor department lost their regular occupation with the abrupt loss of visitors and were thus engaging in different activities, sometimes even different departments. This freed-up time allowed them to actively engage in new formats, thus finding a complementarity-in-use with Product Innovation. Since this in turn lead to an increase in the digital offering, a complementarity-in-performance was also found. It is believed that guides -who are often freelancers- saw and will see the biggest

Organisational Innovation because their future activities will not only stop at physical guiding but extend to the creation of short learning videos and video-guiding.

Process Innovation was difficult to measure but especially towards the second lock down in autumn 2020 and even in 2021, a stronger focus was lying on this type since previous Product Innovations allowed a different approach when planning, organising and archiving exhibitions. Thus, Process Innovation was enabled through Product Innovation, showing a complementary-in-use and in some cases a complementarity-in-performance. Marketing Innovation was difficult to detect and usually employed alone. It could be found in the case of a cooperation with an influencer, and in the case of a e-shop of a museum which resulted in stronger sales. Another museum is planning to advertise their institution during a temporary exhibition, which is held outside. Most museums were advertising through social media channels as before the crisis, reaching mainly the audience they had before. It is the least observed innovation type and the author believes that museums who would advertise their new offerings differently will find a stronger impact of Product Innovations in terms of reaching audience, thus implying a complementarity-in-performance as found by Junge et al. (2016) and Rebane (2018).

It was possible to find innovations that interviewees were not aware of and therefore may not have found their way into surveys, which are often used by researchers as a basis for their models. Another advantage of a qualitative approach was that the timeline of the introduction of different innovation types could be observed. Organisational Innovation and Product Innovation were dominantly used in the beginning, whereas Process Innovation has been observed earliest in the second half of 2020. One example is the usage of Process Innovation that happened, but museums did not perceive as such. For example, many respondents want to keep certain Product Innovations as part of future exhibitions, thus changing the delivery of the exhibition. When asked about any changes in processes, most interviewees denied any change in processes, maybe because it was only received as Product but not Process Innovation.

4. Discussion

The aim of this paper was to find complementarity-in-use of innovation types during the Covid-19 crisis in 2020. Different museums were interviewed, and it became clear that throughout the crisis, museums have shown to be able to innovate with different types of innovation. The motivation and approach for innovation is complex and differing between each museum, although parallels could be seen. In one museum that employed only Product Innovation it could be seen that, compared to museums that used Organisation Innovation, the quantity and release rate of new services was lower. In some museums, Process Innovation was initiated through Product Innovation, where the initial purpose of reaching the audience was converted into quality improvement of existing exhibitions or easing the archiving process. The most important finding is the importance is that the combination of different innovation types creates a synergy, leveraging the effect compared to the use of a single innovation type.

An overview of museums' actions according to the timeline during the crisis will be given, followed by an evaluation of the single combination types and their complementarities.

In the beginning of the crisis the first actions aimed to quickly come up with solutions, even though the quality might be underperforming, such as a simple facebook live stream filmed by a smartphone, thus showing a potential disruptive innovation with the rise of video offering that went as far as to filming an exhibition with 7 professional cameras and an own direction, confirming the general thought of Akbar (2019a) and also the drawing the attention to the importance of management to enable change as advocated by Peacock (2008). The thought of finding disruptive innovation was confirmed by many participants who said that the creation of audio-visual material will continue even when the museums are opened again; although not with the same intensity due to the lack of resources. This study stands partially in line with the findings of Cioppi et al. (2020), Crooke (2020), Newman et al. (2020) and Samaroudi et al. (2020), who see museums creating own content, which will at least partially persist even after the crisis. Employees were only able to spend so much time with content creation and online presence because their main work has been disrupted but will not have time once museums are opening again. It could however not be found that the communication with visitors has changed drastically and in most cases a one-way communication was persisting, as described by Orlandi (2020). Therefore, this study disagrees partially with (Cioppi et al., 2020; Newman et al., 2020) who claim that an active and regular online engagement is effective for keeping in touch with a museum's clientele. It was rather found that the clientele that was reached through the new offering is difficult to keep interested on the long run, also because

competition for digital offering is vast. Museums that were able to communicate with their audience, for example with active participation parts on their website or who had an exchange with schools, were seen to have more success with their offering in terms of usage. It was also found that the public interest decreased drastically after the first lockdown and may not rise again in the near future; especially from those freshly acquired customer groups, pointing out the importance of innovating in the marketing area, as suggested by Rebane (2018).

As the crisis proceeded and the new services showed not to be as successful, they were used in a different context. With the existing innovations it was found that some of them enriched the offering, so they will be implemented in upcoming exhibitions. For example, before the crisis there would be special tours or one-time events with the curator(s) and artist(s) of an exhibition. With the possibility to film them, they can now be integrated as a video into the physical exhibition or website.

Product Innovation could be found across all museums and seemed to perform well only for a short duration in terms of reaching audience. Process Innovation was mainly enabled by Product Innovation, thus finding a strong complementarity-of-use between the two. Because new products such as the 3D scanning helped saving time and money in the process of archiving (see also *Figure 2*), a complementarity-of-performance is suggested as well. It was found that Organisational Innovation aids Product Innovation due to the dedicated time employees were able to spend on innovation, confirming Ballot et al. (2015) and partially Sakowski et al. (2019), since only a complementarity-in-use between Product and Organisational Innovation could be observed, with Organisational Innovation supporting Product Innovation. Since it led to an increase in products (videos, video guiding), as also found by the Network of European Museum Organisations (2020b) survey, a complementarity-in-performance is suggested. It is worth repeating the importance of Organisational Innovation for innovative capacity as described by Evangelista & Vezzani (2010) and Gunday et al. (2011). Although Marketing Innovation was barely observed, it is suggested as major influencing factor for the success of Product Innovation, as described by Junge et al. (2016) and Rebane (2018), displayed in *Figure 7*, with the annotation that museums may need to build up marketing skills to succeed.

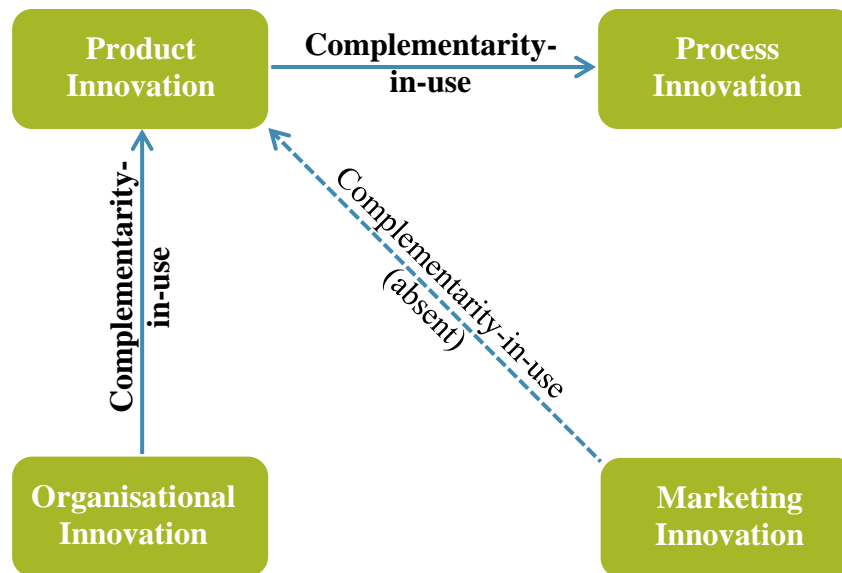


Figure 7 - Complementarities between innovation types (by author)

For example, in one museum a huge offering of over 100 videos created within a year was almost unnoticed (with only an accumulated 9000 views on youtube), whereas another museum achieved a four times higher number with fewer produced videos because they marketed it more efficiently, showing the strong synergy between the two. One has to be careful jumping to conclusions, since factors such as museum size and market size have to be taken into account when defining success, but just by finding a handful of videos with less than 5 clicks proves that there is an enormous lack of marketing. It also shows the importance of Marketing Innovation for Product Innovation. Most Product Innovations seemed to go by unnoticed simply because museums often stuck to their traditional communication, although the new offering had the potential to reach a completely new customer segment as was shown in one case where visually impaired are now also able to visit the museum through audio guided tours.

The complementarity between Product and Marketing Innovation may be even further exploited by understanding the customers as described by Rebane (2018), since museums seem to have reached new customer segments but were unable to keep them interested on the long run. With this small sample, similarities and differences in the frequency of innovation types were found compared to Karlsson & Tavassoli (2015), with the most notable difference that a higher amount of Organisational Innovation, and smaller amount of Process and Marketing Innovation was found.

The previously acquired “Absorptive Capacity” (Cohen & Levinthal, 1990) and previously acquired capabilities played a huge role in a successful mastering of the crisis, where museums that were lagging behind had to first catch up with their own digitalization before

they could even think of new innovations. As described by Newman et al. (2020), the digital literacy of museum staff greatly helped overcoming the situation and generating new ideas.

What could be taken from the crisis is that all museums saw an accelerated digitalization, although on different levels. Museums with previous digital capabilities were able to come up with many ideas but the true value was captured not necessarily with the new digital offering but rather internal innovations, such as the 3D documentation of exhibitions, the implementation of digital contribution of the audience in the physical museum or facilitated ways of teaching school classes through remote courses. Even a museum with low digital capabilities managed to gain from the situation by reaching visual impaired as a completely new customer group. This confirms the works of Chesbrough (2010) and Leoncini (2016) that although the overall innovation, in this case for web offering, may not have reached its expected outcome in reaching larger audiences, those museums who continued innovating had eventually a positive outcome. More complex innovations, such as 3D Models were employed closer to the frontier whereas those further away used open source technology, such as google maps to achieve a comparable result, which confirms the works of Acemoglu et al. (2006), Griffith et al. (2004), Hölzl & Janger (2014), and Sakowski et al. (2019).

Altogether, it could be seen that all museums innovated, even if to different degrees. The transformation of museums into a digital age with a strong focus on online offerings that was expected by many did not occur. However, the crisis has shown that even governmental institutions are able and willing to innovate, and despite the inevitable loss of physical visitors during the crisis museums have gained a lot of competences that may in the future attract even more visitors, even new segments, to make use of the offering.

For the field of complementarity, the most important findings are that Product Innovation initiated Process Innovation and Organisational Innovation supported Product Innovation; and using Product Innovation alone has not such a strong positive outcome as if combined with other types.

5. Conclusion and further research

The main conclusion was that all museums innovated, and complementarities-in-use were found, where the synergy of two single innovations was more beneficial compared to the deployment of one innovation only. This was shown by Product Innovation that enabled Process Innovation and Organisational Innovation that supported Product Innovation. The absence of Marketing Innovation was prevalent and a complementarity-in-performance with Product Innovation can be strongly suggested, as shown by Junge et al. (2016) and Rebane (2018). The difference between innovations was owed to previously acquired capabilities and the national context, which also falls under social capabilities. Museums that were digitalized to a higher degree were able to react quicker to the first closure.

Looking at the timeline, different innovation types appeared at different points of time, with Organisational and Product Innovation appearing in the beginning of the crisis. By the second half of 2020, the amount of Product Innovation decreased, and Organisational Innovation disappeared gradually at the same time. Since Process Innovation was enabled by Product Innovation, it started to appear in the second half of 2020 and 2021.

This paper contributes to the field of complex innovations in the international context, as done by Tether & Tajar (2008b) and Ballot et al. (2015) but with a qualitative approach and hence smaller sample size and focus on the service sector alone. From this study we can learn that museums and the service sector can indeed innovate, and non-technological innovations are still difficult to grasp. A bigger sample size could shine more light on the factors that are influencing innovation – for example it appeared that change and innovation are not a single event but rather an incremental momentum that can be kept going or initiated through new buildings or even the complete restructuring of the main exhibition.

The diverse background of the interviewees helped getting a wider picture since different insights could be gained, where sometimes people from different departments had strongly different opinions on the same topic. Hence, the author believes that especially in the service sector a qualitative approach with a bigger number of samples would greatly contribute to the field of complementarity (both in use and performance) and help the service sector make better use of their innovations by showing them the possibilities of combining Product Innovation with non-technological innovations.

For further research it is suggested to investigate how those museums, that did not put much effort in innovating, will perform after the crisis in comparison to those institutions that did. A quantitative study comparing museums between countries with high and low level of

bureaucracy could also shine light on if museum governance should be rethought in those countries and how innovation can be accelerated despite restrictions. It is also suggested to conduct further quantitative research about the effect of Marketing Innovation on Product Innovation in museums who actively employed it.

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7. Appendices

Appendix 1

Interview Questions

TOPIC	QUESTION	DECODED QUESTION	REFERENCE
<i>Introduction</i>	<p>Dear participant!</p> <p>Thank you for taking your time and participating in this interview! The questions will be general and you are encouraged to answer as much and broadly as you want. Please be aware that you will be recorded for a detailed post-analysis.</p>		
<i>Crisis</i>	<p>- What were the overall effects of the Corona crisis for your museum?</p> <p>Follow-Up Questions:</p> <ul style="list-style-type: none"> - <i>Did you see any difference in Autumn 2020 compared to Spring 2020?</i> - <i>Do you believe the Corona crisis has changed your museum?</i> - <i>How much were your finances influenced through the Corona crisis?</i> 	<ul style="list-style-type: none"> - How much did the Covid-19 crisis affect your mission, also in financial terms? - How did you tackle the loss of visitors during the Corona Pandemic in Spring 2020? - How did you tackle the loss of visitors during and after the Corona Pandemic in Autumn 2020? - Did you see a difference when the crisis happened in Spring and Autumn 2020? - What are the long-term effects of the Corona crisis? - How much was the Corona crisis affecting museum's finances? 	(Crooke, 2020; Mairesse & Mohnen, 2010; Network of European Museum Organisations, 2020b; Orlandi, 2020; Samaroudi et al., 2020; Tully, 2020b)

<i>Museum mission</i>	<ul style="list-style-type: none"> - How important is the education of visitors in comparison to other missions, such as preservation of the collection? 	<ul style="list-style-type: none"> - What are the main missions for your museum? - How important is the educational mission to your museum? - What is your museum orientation? - Who are your external stakeholders? 	(Camarero & Garrido, 2009; Gurian, 2006; Kotler et al., 2008)
<i>Methods</i>	<ul style="list-style-type: none"> - How were you trying to reach your visitors when museums are closed? <p>Follow-Up Question:</p> <ul style="list-style-type: none"> - Is it possible for visitors to communicate with you? 	<ul style="list-style-type: none"> - How are you trying to reach your audience? - Is there any form of visitor engagement? 	(Orlandi, 2020)
<i>Innovation</i>	<ul style="list-style-type: none"> - Could you name examples of what you did try to overcome problems associated with the Corona pandemic and which of those worked and which did not? - What was the biggest challenge you encountered? <p>Follow-Up Questions:</p>	<ul style="list-style-type: none"> - Have you introduced any Product Innovation? - Have you introduced any Process Innovation? - Have you introduced any Organisational Innovation? - Have you introduced any Marketing Innovation? 	(Gault, 2018; <i>Oslo Manual</i> 2018, 2018)

	<ul style="list-style-type: none"> - Have you introduced any new products or services during the crisis? - Have you introduced any new procedures within your organisation? - Have you changed your organisational structure or responsibilities? - Have you introduced new ways of marketing? 	
<i>Complementarity of innovations</i>	<ul style="list-style-type: none"> - Have you tried different approaches step-by-step or multiple at once? <p>Follow-Up Question:</p> <ul style="list-style-type: none"> - Did you try different approaches at the same time? 	<ul style="list-style-type: none"> - Was there any innovation complementarity? <p>(Ballot et al., 2015; Evangelista & Vezzani, 2010; Expósito & Sanchis-Llopis, 2019; Hervas-Oliver et al., 2015a)</p>
<i>Influencing factors</i>	<ul style="list-style-type: none"> - Did new incentives/ideas come from management or also staff and how easy or difficult was it to adapt those new solutions? <p>Follow-Up Question:</p> <ul style="list-style-type: none"> - What exactly did the staff suggest? 	<ul style="list-style-type: none"> - How are your innovative capabilities? - Was it easy for the institution and staff to adapt to new solutions? - What was the driving force behind innovation? - Was any PrI initiated by the staff? <p>(Arundel et al., 2008; Newman et al., 2020)</p>
<i>Outlook</i>	<ul style="list-style-type: none"> - What were your main learning points? 	<ul style="list-style-type: none"> - Are there any innovations or procedures that were especially beneficial or did not work?

- Do you believe
that your museum has
changed

Is there anything more you would
like to add?

-

Source: By author

Appendix 2

Interview Questions – translated versions

TOPIC	QUESTION	GERMAN
Introduction	Aitäh, et te osalete selles uuringus. Küsimused on üldised ja teil soovitatakse vastata nii palju ja laialt kui soovite. Pange tähele, et see kõne lindistaks järel analüüsi jaoks.	Sehr geehrter Herr/Frau X, vielen Dank, dass Sie an der Studie teilnehmen! Die Fragen sind sehr generell und offen gestellt, damit sie möglichst frei und so viel wie Sie mögen antworten können. Ich möchte Sie darauf hinweisen, dass das Gespräch zur späteren Analyse aufgezeichnet wird.
Crisis	- Kuidas mõjutas koroonakriis üldiselt teie muuseumi?	- Wie hat die Coronakrise ihr Museum beeinflusst?
Museum mission	Kui oluline on külastajate harimine võrreldes muuseumi teiste eesmärkidega, näiteks kogude hoidmisega?	Wie wichtig ist die Bildungsmission des Museums, auch im Vergleich mit anderen Missionen wie der Konservierung und Forschung?
Methods	- Kuidas olete püüdnud oma külastajateni jõuda ajal, mil muuseum on suletud?	- Wie haben Sie mit ihren Besuchern kommunizieren können, als das Museum geschlossen war?
Innovation	- Kas saaksite tuua näiteid, kuidas proovisite lahendada koroonapandeemiaga seotud probleeme? Millised lahendused töötasid ja millised mitte?	- Könnten Sie mir ein Beispiel nennen, wie Sie die mit Corona verbundenen Probleme versucht haben zu lösen? Welche Lösungen haben funktioniert und welche nicht?

		-	Was war das grösste Problem, welches Ihnen vorgekommen ist?	
Complementarity of innovations	-	Kas teie proovisite mitu lahendusi ühe korraga või järgi?	-	Haben Sie mehrere Lösungsansätze auf einmal oder nacheinander ausprobiert?
Influencing factors	-	Kas uued ideed tulid juhtkonnalt või ka töötajatelt	-	Kamen Initiativen für neue Ideen und Lösungsansätze von der Führungsebene oder gab es auch aus Ihrem Team Initiativen?
	-	Kui lihtne või keeruline oli nendega kohaneda	-	War es schwierig oder leicht diese Ideen umzusetzen?
Outlook	-	Kas teie arvate, et koroonakriis mõjutas muuseumi pikas perspektiivis?	-	Glauben Sie, dass die Coronakrise Ihr Museum langfristig verändert hat? Falls so, wie?
	-	Mis olid teie peamised õppepunktid?	-	Was waren Ihre Lernpunkte?
	-	Kas teie tahate midagi lisada?	-	Möchten Sie noch etwas hinzufügen?

Source: By author

Appendix 3

Interview request English

Dear Sir or Madam,

In the frame of my Master Thesis at the University of Tartu I am researching how national museums in different European countries reacted to the closures during the Corona pandemic in 2020 and what internal measures helped them to mitigate the associated problems. This includes a qualitative assessment of the museums by conducting interviews with different institutions.

Interviews with the Estonian National Museum have already been conducted and now I am looking for more innovative National Museums which suit the topic.

Since your museum looks like a perfect example of an innovative institution, I kindly ask you to participate in this research through an online interview during March 2021. In order to achieve quality results, it would be highly appreciated to conduct interviews with different members of your institution, preferably with:

- (Head of Museum)
- Someone responsible for or working with Innovation/Innovation Processes
- Someone responsible for or working with Visitor Engagement
- Someone responsible for or working with Marketing Activities

The interviews would be conducted via skype, zoom or a similar program that suits your organisation's guidelines. The time frame is around 30 minutes per person. Questions can be sent before the interview. All interviews will be kept anonymous; only participating museum names will be mentioned in the thesis. Interview transcript will be shared with the interviewee before quoting.

My supervisors of the thesis are Prof. Maaja Vadi (maaja.vadi@ut.ee) and Krista Jaakson (krista.jaakson@ut.ee).

This research might also be a great possibility for you to reflect on the actions that were taken during the last year and if you're keen on more information I will gladly

share my preliminarily findings verbally or the final research result as digital file with you.

I am looking forward to your feedback!

Yours sincerely,

Patrick Weyer

Source: By author

Appendix 4

Interview request – translated versions

Sehr geehrte Damen und Herren,

Im Rahmen meiner Masterarbeit im Studiengang "Innovation und Technologiemanagement" an der Universität Tartu untersuche ich, wie Museen in verschiedenen europäischen Ländern auf die Schließungen während der Corona-Pandemie im Jahr 2020 reagiert haben und welche internen Maßnahmen geholfen haben, die damit verbundenen Probleme zu lösen.

Dies beinhaltet eine qualitative Bewertung verschiedener europäischer Nationalmuseen in Form von Interviews.

Zum Beispiel wurden bereits mit dem estnischen Nationalmuseum Interviews durchgeführt.

Daher würde ich Sie darum bitten, im März 2021 über ein Online-Interview an dieser Forschung teilzunehmen.

Um qualitativ hochwertige Ergebnisse zu erzielen, wäre es sehr hilfreich, Interviews mit drei verschiedenen Mitgliedern Ihrer Institution durchzuführen.

Für die Befragung wären folgende Positionen wünschenswert:

- Jemand, der bei Innovation / Innovationsprozessen involviert ist
- Jemand, der für den Bereich der Besuchservice verantwortlich oder involviert ist
- Jemand, der für Marketingaktivitäten verantwortlich oder involviert ist

Die Sprache des Interviews wäre aufgrund der Masterarbeit zwar vorzugsweise Englisch, aber als Muttersprachler kann ich Ihnen auch Deutsch anbieten, sollten Sie das bevorzugen.

Die Interviews werden über Skype, Zoom oder ein ähnliches Programm durchgeführt, welches den Richtlinien Ihrer Organisation entspricht. Der Zeitrahmen beträgt ca. 30 Minuten pro Person. Die Fragen können bei Wunsch

vorab gesendet werden. Alle Interviews werden anonym gehalten; in der Arbeit werden nur die teilnehmenden Museen erwähnt.

Das Interviewprotokoll wird dem Befragten vor dem Zitieren mitgeteilt.

Meine Betreuer sind Prof. Maaja Vadi (maaja.vadi@ut.ee) und Krista Jaakson (krista.jaakson@ut.ee).

Diese Forschung könnte auch eine großartige Möglichkeit für Sie sein, über die im letzten Jahr ergriffenen Massnahmen zu reflektieren.

Wenn Sie am finalen Resultat oder vorläufigen Ergebnissen interessiert sind, teile ich diese gerne mit Ihnen!

Ich freue mich auf Ihre baldige Rückmeldung!

Mit freundlichen Grüßen aus Estland,

Patrick Weyer

Source: By author

Appendix 5

Interview request – Estonian version

Tartu Ülikooli magistratöö raames uurin, kuidas reageerisid Euroopa rahvusmuuseumid 2020. aasta Koroonapandeemia ajal toimunud sulgemistele ja millised sisemised meetmed aitasid nendega seotud probleeme leevendada. Uuring hõlmab intervjuusid erinevates rahvusmuuseumides.

Kutsun teid üles osalema selles uuringus veebiintervjuu kaudu märtsis 2021. Kvaliteetsete tulemuste saavutamiseks oleks väga teretulnud intervjuude korraldamine oma asutuse erinevate liikmetega, eelistatavalt:

- Muuseumi juhataja (Aivar Karis)
- Keegi, kes vastutab innovatsiooni / innovatsiooniprotsesside eest (Kristjan Raba)
- Keegi, kes vastutab külastajate kaasamise eest (Kaari Siemer)
- Keegi, kes vastutab turundustegevuse eest (valikuline)

Intervjuu võime korraldada Eesti või Inglise keeles.

Intervjuud viiakse läbi skype'i, zoomi või muu sarnase programmi kaudu, mis sobib teie organisatsiooni juhistega. Kestus on umbes 30–45 minutit inimese kohta. Küsimused võin saata enne intervjuud. Kõik intervjuud hoitakse anonüümsetena;

lõputöös mainitakse ainult osalevate muuseumite nimed.

Intervjuu transkriptsiooni jagan intervjueeritavaga enne tsiteerimist.

Minu töö juhendajad on prof Maaja Vadi (maaja.vadi@ut.ee) ja Krista Jaakson (krista.jaakson@ut.ee).

See uuring võib olla suurepärane võimalus mõtiskleda viimase aasta jooksul tehtu üle.

Kui olete huvitatud lõpptulemusest, saadan teile magistritöö valmisversiooni digitaalse failina.

Ootan teie vastust!

Lugupidamisega,

Patrick Weyer

Source: By author

Resümee**ERINEVAT TÜÜPI INNOVATSIOONIDE ROLL JA NENDE TÄIENDUSED
RAHVAMUUSEUMIDES 2020 AASTA COVID-19 KRIISI AJAL****Patrick Weyer**

Käesolev magistritöö keskendub rahvusmuuseumite poolt kasutusel olevate toote-, protsessi-, organisatsiooni- ja turundusinnovatsioonide komplementaarsusele 2020 aastal oleva Covid-19 kriisi ajal. Selle uurimiseks viidi läbi 11 intervjuud viie erineva rahvusmuuseumiga neljas erinevas riigis. Intervjuude tulemuste analüüsist osutus tooteinnovatsioon kõige populaarsemaks, kuid ainuüksi selle kasutamine ei lahendanud väheste külaliste probleemi. Lisaks leidis analüüs, et üksteist täiendavad nii toote- ja organisatsiooniinnovatsioon kui ka toote- ja protsessiinnovatsioon. Magistritöö toob ka välja erinevate innovatsioonitüüpide mõõtmise raskused koos turundusinnovatsiooni kasutamata võimalusega, mille parendamisele peaksid rahvusmuuseumid tulevikus keskenduma. Lisaks leiti, et erinevate innovatsioonitüüpide täiustamine on tugevalt mõjutatud eelnevalt omandatud oskustele ning geograafilise asukoha poolt.

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Quo vadis, historia?

The role of innovation types and their complementarities in national museums during the

Covid-19 crisis in 2020

supervised by *Prof Maaja Vadi (Ph D)* and *Krista Jaakson (Ph D)*,

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