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Art Insurance: Exploring New Tendencies in Relation to Emerging Technologies, Crypto Art and Climate Change

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Introduction

The art insurance industry is at a crossroads between tradition and innovation, dealing with a dynamic interplay that shapes its present and future. This research aims to provide a thorough understanding of the adaptability of the art insurance industry in the face of evolving challenges and opportunities in the contemporary art world. In the complex and constantly changing world of fine art and cultural heritage, insurance is essential to protect and highlight the vulnerability of these priceless assets.

In the realm of fine arts, insurance plays a crucial role in the preservation of cultural heritage. However, its significance is often underestimated, and it remains relatively unexplored in areas such as art economics and finance, cultural heritage management, and art administration studies. This incomplete understanding hinders its potential contribution to various aspects of art management. Recognising the interconnection between fine art and insurance is imperative for cultivating a comprehensive approach that effectively addresses the intricacies of risk management and enhances the overall protection of cultural treasures. This research aims to shed light on this often-overlooked aspect and contribute to a comprehensive understanding of the dynamics between art, risk management, and the preservation of cultural heritage, proposing a collaborative framework between art professionals and insurers, recognising the essential role of insurance in preserving our cultural legacy.

The ability of the insurance industry to adapt to the changing needs of the art world is examined in this study. In this constantly evolving landscape, the responsibility of insurance in protecting artistic assets is heightened by the complex and ever-changing risks associated with artworks. These risks are closely linked to both the specific artistic material and the contextual environment in which the pieces are located. A comprehensive insurance framework is essential in addressing the nuanced challenges of the art world. Such coverage encapsulates detailed information about the inherent risks of each artwork, ensuring adaptability to the ever-changing dynamics of the industry.

This study emphasizes the need for proactive measures to manage the evolving risks posed by advances in artistic materials and methods of creations. The transformative influences within the artistic domain extend beyond traditional artistic paradigms to incorporate multifaceted advancements in technology. From the creation of works to their evaluation and exposure to risk, this definition addresses the impact of technological advances

on the artistic field. Furthermore, the study also recognizes the importance of considering broader contextual changes, such as global factors like climate change, which can affect the survival of cultural assets. This comprehensive approach is essential for maintaining insurance strategies that are robust and adaptable to the nuanced dynamics of the contemporary art scene.

Given the irreplaceable nature of certain artworks, where their loss signifies not just a material forfeiture but a unique cultural and aesthetic diminution, the precision of insurance policies is paramount. The intricacies of artistic valuation, which are often subjective and nuanced, underscore the necessity for meticulous policy formulations. It is essential to have a tailored insurance policy that is specific to the characteristics and value of the artworks to ensure accurate financial protection. This precision facilitates a seamless and comprehensive indemnification process, safeguarding the collector against the irrevocable loss of both artistic and economic significance.

The research methodology adopted for this thesis was characterized by a holistic and thorough approach, incorporating a wide range of scholarly sources. Various references were consulted, including insurance law manuals, writings authored by distinguished scholars, articles from reputable academic journals, and insights from direct interviews. These sources were used to examine the intersection of the insurance sector and art in detail. The study analysed reports on different aspects of the art market, insurance industry, emerging technologies' influence on insurance practices, crypto art, and the impact of climate change on indoor and outdoor cultural heritage, all in relation to insurance coverage. The synthesis of these multifaceted insights facilitated the construction of a thesis organized into four chapters, thereby presenting a comprehensive exploration of the contemporary landscape of the art insurance sector.

The first chapter explores the fine art insurance market, analysing the factors that are currently influencing its trajectory. This niche sector is experiencing significant expansion due to economic, social, and technological factors. It is worth noting that there is a dual trend of increasing economic valuation of artworks and a growing network of art enthusiasts, which is amplifying the demand for fine art insurance policies and shaping market dynamics. The increase in the number of high-net-worth individuals is further driving demand for art insurance, as their investment potential helps to stimulate the market. To meet the growing demand, the industry is expanding its product portfolio with new and customized solutions. The following section of the chapter provides a detailed analysis of insurance options offered by ARTE Generali, covering private collectors, institutional clients, and temporary

exhibitions. Before delving into specific offerings, the chapter addresses foundational components of fine art insurance policies, including the concept of risk, key professional figures operating in the sector, and primary valuation methods for artworks.

The second chapter of the thesis examines the current digital transformation in the art insurance market, which is being driven by technological advancements. In 2023, insurers prioritised customer-centric approaches, emphasising qualitative digital interfaces to differentiate their value propositions. Partnerships between art professionals and technology platforms in the art insurance sector are increasingly prominent, offering tools for managing collections and enhancing service accessibility. Case studies, such as ARTE Generali App and Assicura l'Arte, demonstrate the art industry's drive for operational efficiency. The use of artificial intelligence and machine learning, particularly in predictive analytics, improves underwriting, claims processing, and risk management. The thesis emphasises artificial intelligence's potential for new valuation models and unbiased analysis of the art market, as demostrated by Art Recognition and Wondeur AI. Blockchain technology is transforming luxury goods operations by providing secure documentation and comprehensive provenance tracking in the art world. The integration of Internet of Things (IoT) technology in fine art insurance, as illustrated by LeakBot and location tracking systems, enhances environmental monitoring and minimizes the risk of damage during transit or loans, as exemplified by See Your BoxTM Ltd. These technologies collectively represent a significant evolution in the art insurance landscape.

In the constantly evolving art market, technology presents both challenges and solutions that are crucial to its progress and sustainability. Technological advancements are reshaping collectors' practices, asset management, and the creation and storage of art. The third chapter explores crypto art, which introduces novel challenges to the art insurance landscape due to its unique structures and reliance on Non-Fungible Tokens (NFTs). The intangible nature of digital assets necessitates a nuanced understanding of provenance, ownership, storage and valuation. Insurance plays a vital role in mitigating risks associated with crypto art, requiring tailored coverage against cyber threats, digital fraud, and dynamic NFT market trends. Insurers must navigate this dynamic landscape, adapting policies to cover emerging risks and provide comprehensive protection against potential losses.

The final chapter of the thesis discusses the impact of climate change on cultural heritage, specifically artworks in museums, historical sites, and private collections. The adverse effects of rising temperatures, extreme weather events, and sea-level changes can cause damage, deterioration, or loss of valuable cultural artifacts. The research highlights the

importance of insurance as a tool to protect cultural heritage from climate change challenges. The thesis analyses methodologies for risk assessment, adaptive measures, and insurers' support for protection projects and disaster recovery efforts in the face of challenges posed by climate change. The study recognises the seriousness of climate-related threats and advocates for financial risk-sharing mechanisms through comprehensive insurance schemes. The proposed framework aims to mitigate the impact of extreme weather events on cultural heritage assets and enhance overall disaster resilience by strengthening the insurance sector's involvement in risk mitigation and improving preventive and adaptive measures. The Sant' Emidio Project is presented as a compelling example, demonstrating the importance of insurance in fortifying cultural heritage against climate change challenges.

Chapter 1. Overview of fine art insurance nowadays

Fine art insurance is a very niche market that is currently increasing its presence in the more general insurance industry. The largest percentage of customers of fine art policies can be identified in the private sector, while the public one is still a marginal source of revenues.

The development of fine art insurance can be traced back to the early 1960s, when some of the high-level executives of Nordstern Insurance Company in Berlin decided to provide their clients with a specific policy for fine art[1]. They understood that for this kind of collectibles the ordinary replacement-value insurance was not enough. The original and unreplaceable nature of works of art brings to the fore new challenges that need to be addressed and covered by specialized insurance policies. The Nordstern Insurance Company expanded rapidly among Europe before and United States, Canada and Asia after. It will be incorporated by AXA Group in the mid-nineties, and it can still be identified in the AXA XL department, the AXA's P&C and Specialty Risk division, specialised in managing the most complex risks.

Nowadays, hundreds of insurance companies added fine art policies to their portfolio of services, supporting the coverage of museums, private collections and temporary exhibitions. In addition to the aforementioned AXA XL, other famous companies have enriched their offer by integrating it with specific products dedicated to the sector of cultural heritage, as is the case with Allianz, Helvetia, Hiscox, Zurich, Arte Generali, just to mention some of the most famous ones. The rising presence of companies' sectors dedicated specifically to fine art insurance is strictly related to the increasing demand for this kind of products by public and private clients. The reasons that are behind the purchase of coverages for artworks are numerous and, despite the motivations guiding the acquisition of such items, they are mostly related to the increasing awareness of the incredible advantages to receive a compensation in case of damage in order to preserve their properties. Competition among the different companies and the growing interest from customers is leading to an opening of the market toward new types of guarantees that are more and more comprehensive and customized.

Fine art has specific problems, market and technical requirements that make necessary the presence of art experts to complement the standard insurance process, providing companies with advice and support from the phase of asset evaluation, appraisal and policy

[1] ARNOLD J., FISCHER C., *Insurance and the art market*. In: C. McAndrew, ed. *Fine art and high finance: expert advice on the economics of ownership*. New York: Bloomber Press; 2010: 197-210

underwriting to the phase of damage appraisal following a claim. Insurance companies offer to their clients a wide range of services thanks to a network of experts in art history, conservation, risk management, transport or restoration, in order to guarantee ad hoc solutions in various areas of expertise. A very close dialogue is needed between the insured party and the insurance intermediary in order to ensure the best possible security, taking into consideration elements such as the specificity of the artworks, their installation, the location where they are displayed, safety precautions and so on. It is also of fundamental importance to take into account the way people interact with the artwork in order to prevent any damage and to provide ad-hoc guarantees and exclusions in the policy. For example, criticalities are different between contemporary and ancient art, in particular because of the ephemerality of some recently used materials and also due to the necessity of many modern artworks to be touched or displayed in specific ways in order to permit the right enjoyment of the asset from the spectator[2]. Form this point of view, the insurance sector is required to be creative and responsive to new tendencies and emerging risks, with the aim of being always prepared to provide the right coverage for any kind of artwork and situation.

The support and collaboration of these experts, as well as the demand for specific standards to be met before providing cover, make insurance a way to stimulate virtuous circuits that incentives prevention of cultural heritage. Fine art policies can be interpreted as a useful vademecum of good practices for protection and conservation of works of art[3]. In fact, on one hand, insurance coverage reduces the risk held by the owner of the work of art, on the other hand it constitutes an additive form of protection for the property itself. This is because the insurance contract offers not only an indemnity coverage but also a risk management service including the identification of security and control measures and their meticulous observance to protect the integrity of the cultural property[4]. Moreover, looking at the phenomenon in general, there is no doubt that the use of insurance schemes encourages underwriters to carry out restoration and consolidation works on their properties in order to pay lower insurance premiums.

Despite the undeniable benefits of fine art insurance, cultural heritage is under-insured. For instance, the fire at Notre Dame Cathedral on 16 April 2019 brought to the

[2] ARTE GENERALI (curated by), *Palazzo Strozzi*, 28 September 2022, available at https://www.youtube.com/watch?v=34nOYMbWjio (last consultation 29/05/2023)
[3] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali. Buone pratiche dai musei ai collezionisti*. Modena: Palombi Editori; 2021: 13
[4] MORBIDELLI G., *L'assicurazione dei beni culturali e dai beni culturali*. In: G. Morbidelli, ed. *Tutela assicurativa del patrimonio culturale*. Bologna: il Mulino; 2021: 7-26

public's attention how 83 out of 93 of the French state's cathedrals are uninsured[5]. The insurance system is not recognised as playing a concrete role in the preservation of cultural heritage, especially in the public sector, and this kind of approach leads to increased difficulties in raising funds and delays in intervention times.

An excellent example of how underwriting an insurance policy can make a difference in the event of a major claim is the case of the diocese of Mantua, in Italy. Here, after the 2012 earthquake, thanks to insurance contracts previously concluded, the diocese was able to reopen 125 out of 129 churches without public aid[6].

In the Italian context, an awareness of the importance of securing cultural heritage in order to protect it, emerges from the document "*Linee guida per la tutela dei beni culturali ecclesiastici*", produced by the Ministry of Cultural Heritage and Activities and Tourism, now the Ministry of Culture, and the Carabinieri Command for the Protection of Cultural Heritage and the Italian Episcopal Conference. The document proposes the most appropriate practical measures to guarantee the protection of ecclesiastical cultural heritage, and insurance is considered one of them[7].

1.1 Fine art insurance market

The overall insurance industry experienced an increase in gross premiums written after the pandemic, which are forecast to grow by as much as six times by 2030, with China and North America in the lead[8]. The hike of premium volume is given both by the rise of rates and by the expansion of the market itself. However, insurance claims costs are heightened by the effects of inflation, the impact of catastrophic weather events and cyber risk, leading to an overall net underwriting loss despite the strong premium gains. Moreover, the positive market's growth level is not homogeneous among the individual country markets and the product lines. For instance, the growth of personal lines was less robust than the one of commercial lines and more than two-thirds of the composition of premium growth were generated in Western Europe and North America[9].

[5] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali*, cit.: 59
[6] *Ivi*: 63
[7] MIBACT, CEI, CARABINIERI TUTELA PATRIMONIO CULTURALE, *Linee guida per la tutela dei beni culturali ecclesiastici*. Roma; 2014: 25
[8] DELOITTE (curated by), *2023 insurance outlook. Global insurance industry at a crossroads to shaping long-term success*. London: Deloitte Centre for Financial Services; 2022: 7
[9] *Ibidem*

The war in Ukraine and the pandemic are wake-up calls for better risk management, and they also lead to more demand for protection. By offering innovative solutions for rising and new risks, the insurance industry must succeed in retaining its economic and social relevance, and it is doing so mainly thanks to the upgrade in IT services and accelerated digitalisation of processes as a consequence of the restrictions due to the COVID-19[10].

Particularly, the fine art insurance sector has undergone major growth over the last few years. This niche market is expected to enlarge its size and its revenues at a noteworthy CAGR[11] during forecast period 2023-2030, and its size was valued at US$461.25 million in 2020 and is projected to reach US$795.65 million by 2028[12].

According to the market research report by Verified Market Research titled "*Global fine art insurance market by type (property insurance, title insurance), by application (private, commercial), by geographic scope and forecast*", the market is expected to grow at a significant rate across various regions. More specifically, the global fine art insurance market is categorized into North America, Europe, Asia Pacific, and Rest of the world. On the basis of regional analysis, Europe is projected to have the highest market share of fine art insurance during the forecast period, with North America following closely and the Asia Pacific region witnessed to register the fastest growth[13] (see figure 1.1).

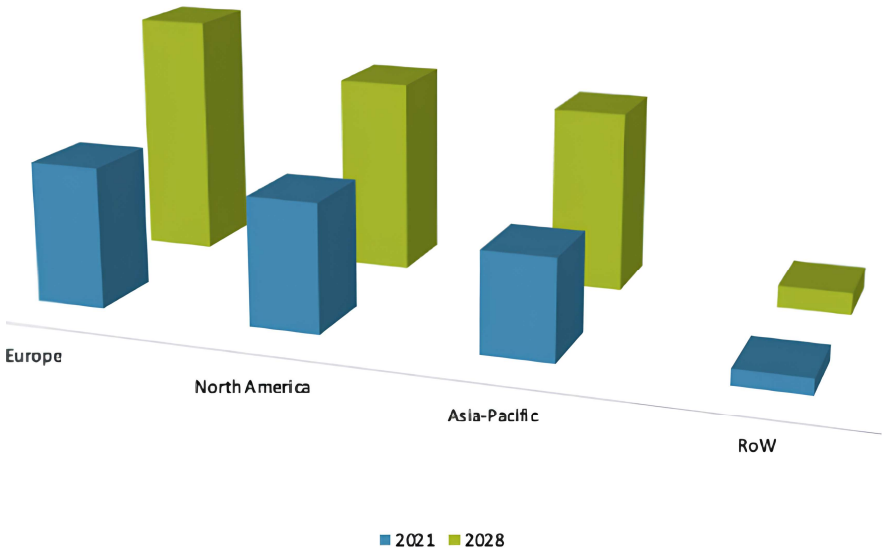

Figure 1.1. Global fine art insurance market, by geography (USD million). Source: VERIFIED MARKET RESEARCH (curated by), *Global fine art insurance market size by type (property insurance, title insurance), by geographic scope and forecast*. 2022

[10] OECD (curated by), *Global insurance market trends 2022*. 2023: 7
[11] Compound annual growth rate.
[12] VERIFIED MARKET RESEARCH (curated by), *Global fine art insurance market size by type (property insurance, title insurance), by geographic scope and forecast*. 2022
[13] *Ibidem*

The report underlines that the demand both for title[14] and property fine art insurance has been growing, in particular with property insurance accounting for the largest market share in 2021 and projected to maintain its leading position until 2028[15] (see figure 1.2).

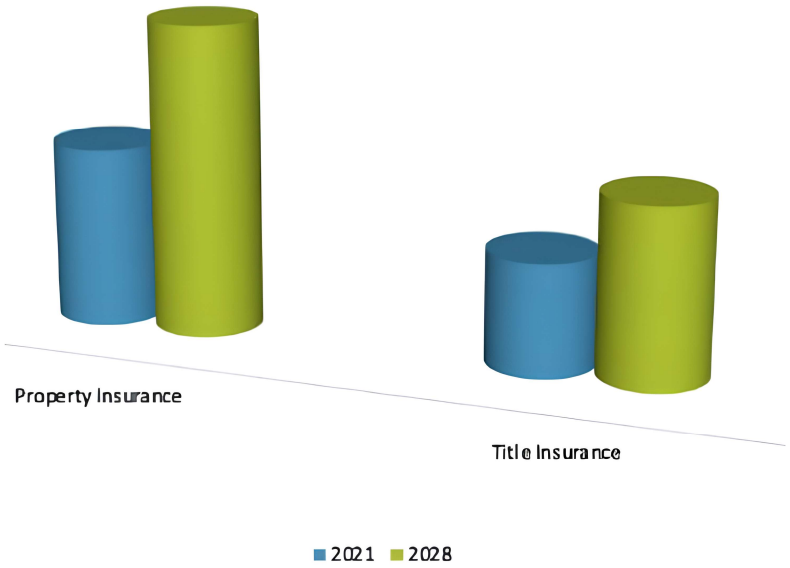

Figure 1.2. Global fine art insurance market, by type (USD million). Source: VERIFIED MARKET RESEARCH (curated by), *Global fine art insurance market size by type (property insurance, title insurance), by geographic scope and forecast*. 2022

It should be noted, however, that the 2020 pandemic and lockdowns negatively impacted on companies' revenues, it slowed down the growth targets of companies active in the field of fine art insurance, postponing them for twelve months. The fine art insurance market, relying on a stable stock of works to be insured, was less affected by the pandemic than other ambits related to art logistics; there was only a decline in the exhibition circuit, which accounts for 20-25% of the insurance market[16].

Despite a challenging year in 2020, the global fine art insurance market recorded a positive trend which is due to a combination of economic, social and technological factors that drive an increasing demand for comprehensive protection for valuable artworks.

Firstly, the value of fine art has been rising in recent years, which has led to greater risks and potential losses for collectors, galleries, and other art-related businesses. For instance, the report by Deloitte "*Il mercato dell'arte e dei beni da collezione*", underlines that

[14] The concept of title insurance will be further explained in the next paragraphs. For an in-depth analysis see VEIGA COPO A., *Problemi legati al titolo: le dispute per la proprietà e l'assicurazione*. In: G. Morbidelli, ed. *Tutela assicurativa del patrimonio culturale.* Bologna: il Mulino; 2021: 67-79
[15] *Ibidem*
[16] NOMISMA (curated by), *ARTE, il valore dell'industry in Italia*, 2021

the average price of the top fine artworks sold by the major auction houses in 2021 has increased and 14 lots were sold for more than $50 million, compared to only one lot in 2020[17]. As a result, there is a growing demand for insurance coverage that can help mitigate potential losses.

Secondly, the global art community has been expanding over the past few years. In particular, there is a growing interest in art as an investment leading to a greater demand for protection against financial losses related to artwork. In spite of the financial crises, now is a great time to purchase works of art: being a tangible investment, works of art serve as a means of storing value because they can keep their financial worth despite unfavourable external circumstances[18]. The largest international auction houses recorded around 40% of new buyers in 2021 succeeding in returning to and exceeding pre-covid turnover levels, and the total volume of sales grew by 67% compared to 2020[19]. Generally speaking, the sales of art and antiques by dealers and auction houses reached US$65.1 billion in 2021, up by 29% from 2020, with US and China art markets in the lead[20]. In particular, the online art market is continuing its expansion with online sales accounted for 20% of the overall sales in the art market[21]. Investors and collectors are increasingly looking for insurance coverage that can help protect their investments.

Moreover, the rising number of high-net-worth individuals has also contributed to the growth of the fine art insurance market. The Credit Suisse Global Wealth Report 2021 underlines that, despite the global recession triggered by the COVID-19 pandemic, the global net wealth increased by 7.4% from US$390 trillion in 2019 to US$418 trillion in 2020[22]. The surge in the number of high-net-worth individuals (HNWIs) and their associated wealth is triggering new demand for alternative assets among investors looking for diversification in the face of rising inflation. In this context, art is increasingly seen as an alternative asset class, with 40% of collectors surveyed by Deloitte Art & Finance Report 2021 saying that one of the key reasons why they buy art is portfolio and asset diversification[23]. The report concludes that HNWIs' wealth associated with art and collectibles amounted to approximately US$1,481

[17] DELOITTE (curated by), *Il mercato dell'arte e dei beni da collezione, report 2022*. Italy: Deloitte creative team – Italia; 2022: 26
[18] BIALYNICKA-BIRULA J., *Investment in art – specificity, risks, and rates of return*. Ostrava: Cracow University of Economics; 2013: 1
[19] DELOITTE (curated by), *Il mercato dell'arte e dei beni da collezione*, cit.: 10
[20] ART BASEL & UBS REPORT (curated by), *The art market 2022*. Switzerland: McAndrew; 2022: 14
[21] *Ibidem*
[22] DAVIES J., LLUBERAS R. and SHORROCKS A., *Global wealth levels 2020*. In: Credit Suisse Research Institute, ed. *Global wealth report 2021.* 2021: 5-16
[23] DELOITTE (curated by), *Art & finance report 2021*. Luxembourg: Deloitte private; 2021: 33

trillion in 2020, and that in 2025 this figure could grow to an estimated US$1,882 trillion[24]. Consequently, because art and collectibles account for a substantial portion of HNWIs' wealth, the protection of art-related wealth have grown in importance in recent years.

Another driving force that is contributing to the expansion of fine art insurance market is technological advancements. The development of new technologies such as blockchain technology, artificial intelligence and the improvement of mobile applications, with possibilities of new methods of service provision as well as greater opportunities for data collection, fraud detection and risk management, is making insurance offerings more attractive and comprehensive[25].

Overall, the growth of title and property insurance for fine art reflects the increasing awareness of the importance of protecting valuable assets and the growing demand for insurance coverage that can help mitigate potential losses. As the value of art collections grows, collectors and institutions are becoming more aware of the potential risks associated with owning, transporting, and displaying their artworks.

Due to the rising demand, the fine art insurance sector is broadening its portfolio of products to include a wide range of customized solutions. There is a general rise in common understanding of the importance of insuring a work of art. Insurance has become a critical part of any art investment and its role is necessary to cover unexpected risks as well as to raise awareness about preservation, proper maintenance and restoration. Survey findings by Deloitte Luxembourg and ArtTactic Art & Finance Report 2021 show that 67% of collectors

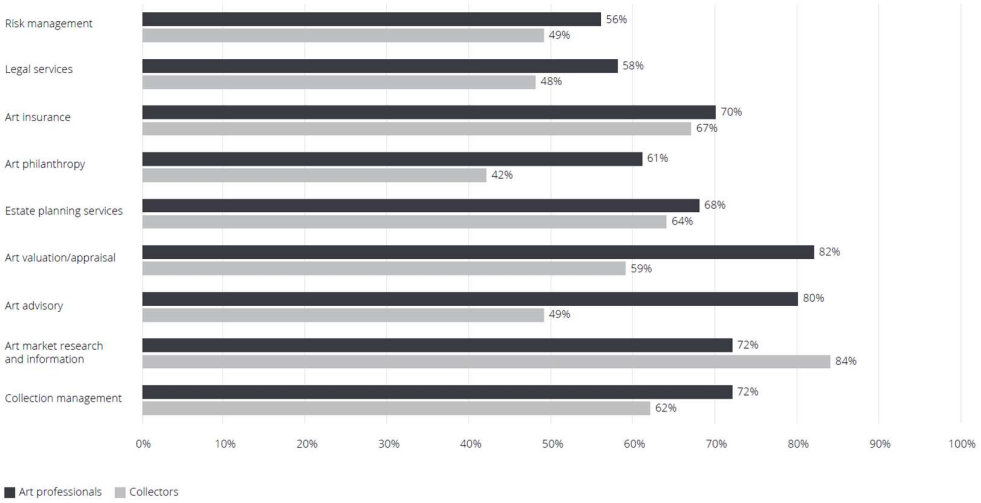

Figure 1.3. Art and wealth protection: which of the art wealth management services most relevant? Source: DELOITTE (curated by), *Art & finance report 2021*. Luxembourg: Deloitte private; 2021: 132

[24] *Ivi*: 38

[25] OECD (curated by), *Technology and innovation in the insurance sector*. 2017: 7. The topic will be explored in more detail in the next chapter.

identify art insurance-related services as the most relevant art wealth management service and 70% of art professionals said this was the most relevant service to their clients[26] (see figure 1.3).

Art is increasingly seen as a value to be protected, both when it is bought for its investment potential and when it is purchased for its emotional value. In the first case, the owner wants to protect and maximize the value of the investment and insurance has a core role in doing so. In the second case, when art is seen as an emotional purchase, the owner's utmost concern is the protection of the work of art because of the sentimental meaning it embodies. Giovanni Liverani, CEO of Generali Deutschland, underlines how in both cases, reimbursing claims is no longer enough. Clients demand for other services in the perspective of a more holistic approach to fine art insurance fuelled by the adoption of new technologies. «This new approach puts the human being and his or her life quality at the centre of the insurance business model, ushering in a "new humanism in insurance"»[27].

Nomisma's research "*ARTE, the value of the industry in Italy*", carried out for the Apollo Group in collaboration with Intesa San Paolo, shows that Italy is ranked fourth in Europe after United Kingdom, Germany and France, in terms of fine art insurance market size[28]. In an interview to Italo Carli, head of ARTE Generali Italia, published by il Sole24Ore, we learn that the country is estimated to be among the top seven art markets in the world, but its insurance penetration is considerably lower than in other markets, which means that Italian customers are underinsured. The uncovered market share is calculated to be around 60-70%[29].

Without adequate tools for the transfer of heritage risks, the art market would be inefficient and, of course, insurance is the essential tool to ensure its successful operation. The specificity of fine art insurance and the close link that this type of policy has with the uniqueness of the cultural asset, puts this sector of the insurance market in a position of constant and necessary evolution. This is exactly what William Fleischer CIC, president of Bernard Fleischer & Sons Inc, stated during the interview with the Insurance Business Magazine «Artists love working with new materials, and with that comes different risks and exposures. […] Insuring art and technology requires thinking outside of the box»[30].

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[26] DELOITTE (curated by), *Art & finance report 2021*, cit.: 132
[27] *Ivi*: 131
[28] NOMISMA (curated by), *ARTE, il valore dell'industry in Italia*, cit.
[29] PIRELLI M., *Generali nelle polizze dell'arte – Il mercato vale 2,3 miliardi $*, «Il Sole 24 Ore», 4 Dicember 2020
[30] MOORCRAFT B., *Art insurance needs brokers who can think outside the box*, «Insurance Business Magazine», 11 August 2017

1.2 Main concepts of fine art insurance policy

In order to understand which are the building elements of fine art insurance policy, it is first necessary to outline what an insurance policy is. Insurance is a legal contract by which one party (insurer), in return for the payment of a monetary compensation (premium), undertakes to indemnify another part (insured), within the limits agreed in the contract, at the time of loss[31]. Insurance is a transfer system by which a risk-neutral party (the insurance company) bears the risk of an uncertain situation in exchange for an insurance premium from a risk-averse party (the policyholder)[32].

The solutions provided by the insurance industry can be divided among three general lines which specify their area of action, and they function as umbrella terms to group similar risks into a single category. In particular, we can identify the property, casualty and life sectors. Insurance policies underwritten to cover damage to cultural goods, works of art and collectors' items, can be inscribed within the property line, the sector that specifically covers the destruction, loss and deterioration of assets[33].

The roots of the fine art insurance contract can be traced back to the policies known as "floaters", namely inland marine policies. These policies originated in the United States in the 19th century as an extension to marine insurance, with the aim of indemnifying against the physical loss or damage to property during the non-ocean portion of a sea journey[34]. Inland marine insurance policies were designed to provide coverage for property that was in transit or temporarily stored in warehouses. This included goods such as textiles, furs, jewellery, and other valuable items that were susceptible to loss or damage during transport or storage. Over time, inland marine policies began to include coverage for a wider range of property types, including fine art. These policies were designed to provide all-risk coverage for fine art while it was in transit, in storage, or on display.

Generally speaking, property insurance provides protection against basic risks such as fire, theft, water and some weather damage. These elements constitute the basis of fine art insurance which is, however, much more specialised and equipped with clauses covering, for

[31] Article 1882 of the Civil Code
[32] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210
[33] This is the initial classification of private insurance after the separation of the Civil Code, namely property insurance (articles 1904 ss. of the Civil Code). Casualty insurance has instead to be referred to insurance for damage to third parties. In particular in art. 1917 C.C. we read that "*In casualty or liability insurance, the insurer is obliged to compensate the insured for anything paid to a third party as a result of an event happening during the insurance period. Exclusions apply to damage caused by malicious acts*." The final type of private insurance is life insurance (articles 1919 ss. C.C.) where the responsibility to pay emerges only when the event specified in the contract happens. This event may either be the death or the survival of the insured.
[34] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210

instance, appreciation of market values, newly acquired items, international transit, defective titles etc. The greater specialisation of fine art policies is made necessary by the fact that many of the risks associated with ownership and investment in art do not exist for other asset categories. There are some perils that are beyond the control of a collector and that can compromise the specific value of the work of art. In fact, the main difference between fine art and other asset classes is that when a piece is lost, damaged or stolen, it can never be replaced because the concept of uniqueness does not allow us to do so[35].

In the world of insurance, the term "art" extends far beyond sculptures and paintings. It includes also monuments, photographs, valuable historical books, rare coins, antique pieces and basically everything else that has value beyond its function[36]. The extensive survey carried out in 2015 by Imperiale F., Adamo S. and Luperto I., in the Italian insurance market of fine art and jewellery, reveals that the insured objects are mainly: «works of art, such as paintings, sculptures, reliefs, statues, mosaics, tapestries (35%); historical buildings (27%); books, such as manuscripts, incunabula and prints (14%) and archivistic items, like maps and parchments (6%); archaeological objects, such as prehistoric materials, bronzes, terracottas (8%), and restoration works (5%)»[37].

The intrinsic value of a work of art, its unicity and the consequent irreplaceability, as well as causing quite a few difficulties in taking out an insurance policy, it also determines the extreme importance of safeguarding the work of art itself by every possible means. Private and public owners, possessors or holders of cultural heritage assets, are obliged by law to ensure their conservation as explained by Article 1(5) of the Italian "*Codice dei beni culturali e del paesaggio*"[38]. Insurance helps in this custodial activity, contributing to the generational succession of art over time.

1.2.1 The concept of risk in fine art insurance

One of the first activities that the insurance company is required to perform when taking out an insurance contract is risk assessment. Risk is the basic premise of the contract, it is the reason why the fine art owner is led to underwrite an insurance policy, and it is

[35] *Ibidem*
[36] AXA XL (curated by), *An introduction to fine art*. 2022: 5
[37] ADAMO S., IMPERIALE F., LUPERTO I., *Heritage values: some evidence from the Italian insurance market*. In: conference proceedings (Valencia, 5-7 October 2016), curated by ENACT, ed. *Cultural management education in risk societies – towards a paradigm and policy shift?!*. Brussels; 2016: 168-182
[38] D.L. 22 January 2004, n. 42, *Codice dei beni culturali e del paesaggio*, article 1(5)

generally defined as the possibility of a future, uncertain event[39]. Not all risks are technically insurable, but the development of insurance technique and the spread of insurance have resulted in a gradual expansion of the types of risks that can be insured.

Fine art is exposed to a number of different perils, some of which are similar to diverse types of assets and others which are particular and linked to the specificity of the artwork. Generally speaking, we can divide the risks to which the work of art is subjected into a number of categories: risks directly relating to the physicality of the work of art, market risks, legal risks, crime risks and force majeure risks[40]. The main aspects identified through these perils can be highlighted as being damage and deterioration, thefts and acts of terrorism, legal issues arising from the ownership of fine art, fluctuations in value and changes in the art market. Fine art insurance policies were generally articulated into three main sections, fire, theft and water damage; therefore, they did not cover even half of the risks outlined above[41]. However, competition between the various companies, an increased focus on customer needs and the emergence of new contemporary perils have, in recent years, led major insurance companies to broaden the spectrum of covers offered.

The different motivations that persuade museums, private collectors or galleries to get cover for their fine art properties are mainly the fear of incurring a loss due to an accidental damage and deterioration, followed closely by art fraud and forgery and art theft[42]. These concerns of policyholders are to some extent confirmed by Adrew Mitchell, the former fine art underwriter at Hiscox in London, who stated, during an interview with the Insurance Business Magazine, that «the main driver of fine art claims is accidental damage […] About 50% of our claims come from accidental damage»[43]. In particular, according to the president and CEO of Huntington T. Block, an operating unit of Aon plc, «85% of our claims are derived from transit losses»[44].

The risk of transporting works of art is one of the major epicentres of fine arts insurance, as it is precisely there that the highest levels of loss probability occur. In fact, in some countries, such as Italy, the authorisation to organise exhibitions is subordinated to the

[39] DONATI A., VOLPE PUTZOLU G., *Manuale di diritto delle assicurazioni*. Milano: Giuffrè Editore; 2016: 113
[40] BIALYNICKA-BIRULA J., *Investment in art*, cit.: 14-15
[41] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210
[42] PAVIA, C., S. GRIMA, I. ROMANOVA and J. V. SPITER, *Fine art insurance policies and risk perceptions: the case of Malta*. Journal of risk and financial management, 14, 66; 2021: 8
[43] MOORCRAFT B., *Art insurance needs brokers who can think outside the box,* cit.
[44] *Ibidem*

insurance of the objects and assets by the applicant[45]. The necessity to guarantee an insurance coverage to travelling artworks is linked to the number of elements that concur to the safety of the cultural asset during transport, such as: the type of means of transport used; the packing and wrapping, with all the associated conditions of humidity, thermo-insulation and impact protection; the safety conditions of the place where the works are transferred.

There have been some claim stories in the past that demonstrate the physical dangers that art can face even in "safe" and ordinary situations, such as when a painting is simply hung on a wall with all the necessary security systems for its proper preservation. Unforeseeable situations can always happen, which is why it is necessary to take out an insurance policy when owning fine art and collectibles. For example, during an interview Cristina Resti, art expert and art network manager of ARTE Generali Italia, recounts how one of the most unusual incidents she has had to deal with during her career was one involving a painting by Giorgio De Chirico: a wrecking ball mistakenly demolished the wall on which the famous metaphysical artist's painting was hanging. It was only thanks to the insurance policy that the collector was able to pay a team of restorers who recovered some parts of the painting (about 30%) so that it could be kept as a historical document of the presence of that masterpiece[46]. Fine art insurance is made to compensate the insured for a monetary loss to items that are damaged and frequently hard to replace, it covers artistic devaluation or depreciation that an item can experience due to an insured risk[47].

Despite the fact that a major source of concern for art collectors and owners is the material deterioration of their cultural properties, fine art insurance policies generally do not cover «loss or damage caused by wear and tear, gradual deterioration, inherent defect, rust or oxidation, moth or vermin, warping or shrinkage»[48]. Ageing and wear affect all art, but the ephemeral nature of some contemporary artworks has made their conservation more problematic since the materials from which they are made are perishable and brittle. This is the case, for example, of the butterflies in a painting by Damien Hirst, where the insects' wings have deteriorated but they came from a rare butterfly species and could not be replaced[49]. Collectors and insurers face particular challenges in protecting the value of such artworks made with delicate and fragile material: video art incorporates electronic and digital

[45] D.L. 22 January 2004, n. 42, *Codice dei beni culturali e del paesaggio*, article 48(4). The Code allows the State to assume the risk arising from the loan of cultural goods for exhibitions and events (D. M. 9/02/2005).
[46] ART TEST (curated by), *Cristina Resti – Art expert Arte Generali, Tra l'arte – Interviste al mondo dell'arte*, 16 February 2021, available at https://www.youtube.com/watch?v=y_s3-FtrgVs (last consultation 25/04/2023)
[47] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210
[48] HISCOX (curated by), *Fine art – policy wording*, February 2021 edition
[49] MCQUEEN M. P., *Perishable art: investing in works that may not last – Collectors struggle to preserve, insure contemporary pieces; replacing the dead shark*, «The Wall Street Journal», 16 May 2007

devices that may stop working; dead animals decompose; acrylic paints dry out and flake[50]. Some art insurers are charging up to twice the amount they would for more durable works like oil paintings due to the difficulty of restoring some delicate contemporary artworks. As a condition of granting coverage, insurance may also require collectors to make rigorous conservation efforts, including as regulating the amount of light and temperature in the environment[51].

The second biggest concern of collectors is that of art fraud and forgery. Yann Walther, head of the Fine Art Expert Institute (FAEI) located within the Geneva Freeport, a highly supervised free zone where collectors from all over the world keep more than one million works of art, declared to Nina Larson, journalist of the Agence France Presse (AFP), that more than 50% of the works circulating on the market are forged or misattributed[52]. The number of artists who have fallen victim to forgery is uncountable. Forgery of a work of art is a frequent practice, and therefore the work of experts in the evaluation phase of the insured art object is extremely important. The discovery of possessing counterfeit works of art can in fact bring the policyholder quite a few problems from an insurance point of view. That is what happened to Joseph Guttman, who is seeking hundreds of millions of dollars in coverage from six European insurance brokers for paintings attributed to Amedeo Modigliani and Moïse Kisling discovered as fakes in 2017. The paintings at the centre of the dispute were among a group of 21 paintings loaned by the US dealer and other collectors that the Italian police took from a 2017 Modigliani exhibition at Genoa's Palazzo Ducale, after the art critic Carlo Pepi questioned their authenticity. The insurers, backed by the German fine art insurance agency Kuhn & Bülow, have refused to fund the costs of retrieving the confiscated pieces despite insuring them for more than $107 million, and so the dealer sued them before the Manhattan federal court. Additionally, the insurers contend that Guttman only has the right to request compensation in the event that the Italian government determines that the paintings are authentic[53].

Generally speaking, art crime is ranked by the INTERPOL's Stolen Works of Art Department as the fourth-largest criminal enterprise in the world, right after drugs, arms and human trafficking[54]. Art forgery and art theft are much more frequent occurrences than we

[50] *Ibidem*
[51] *Ibidem*
[52] LARSON N., *Half of all artworks in circulation today could be fake*, «Agence France Presse», 8 October 2014
[53] CARRIGAN M., *Insurers fight $107m claim for Modigliani paintings seized by Italian police*, «The Art Newspaper», 24 September 2020
[54] CHARNEY N., DENTON P. and KLEBER J., *Protecting cultural heritage form art theft – International challenge, local opportunity*, «FBI Law Enforcement Bulletin», 1 March 2012

might realise, for instance around 20,000 to 30,000 thefts take place in Italy every year, and the recovery rate is very low (around 2-6%)[55]. Burglar alarm systems, inventory control and an effective cataloguing are some of the main forms of risk management against the peril of theft from museums, galleries and private collections. The safety conditions of the building and therefore an effective risk assessment project can be the starting point for reducing the insurance premium.

Another risk, faced by both the demand side and the supply side of the art market, is that of defective title, which is directly linked to the problem of the high rate of art frauds and thefts. Collectors, museums or galleries are not always the rightful or legitimate owners of fine art that can come from an illicit trade of which neither the seller nor the buyer is aware. Art title insurance protects the insured against defects in legal title of fine art and collectibles and it covers the legal costs of an ownership dispute and, if necessary, compensation for the policyholders if they lose the dispute and have to return the work of art to the legitimate owner.

Market risks, such as fluctuations in value and changes in the art market, are usually not covered by fine art insurance policies. However, most companies provide the agreed value coverage which means that if the value of the artwork declines, the policyholder is still covered for the agreed-upon value which is determined at the time of underwriting[56].

According to the academic research taken out by L. Pavia, S. Grima, I. Romanova and J. V. Spiteri, many art collectors emphasize the importance of the risk during the restoration process since it might significantly damage or devalue a work of art if it is not done properly[57]. In this case, the liability insurance of the restorer who is found guilty of damaging the work comes into play.

In general, other risks that need to be covered in a reliable insurance policy are those related to terrorism and catastrophic risks (such as earthquake, flood and inundation). These and other coverages are not always provided for by the underwriters, so it is necessary to carefully check the exclusions section of the document, where all the events and risks that are not covered by the policy are listed, as a claim that occurs in these circumstances is not protected and does not allow the indemnity to be paid.

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[55] *Ibidem*

[56] ARNOLD J., FISCHER C., *Insurance and the art market,* cit.: 197-210. About the concept of value in fine art insurance policies see paragraph 1.2.3

[57] PAVIA, C., S. GRIMA, I. ROMANOVA and J. V. SPITER, *Fine art insurance policies and risk perceptions,* cit.: 13

Creating an insurance policy requires one-on-one consultation since every art collection, every artwork, is unique, as are the risks to which it is exposed. Thanks to their collaboration with art experts, major insurance companies guarantee their customers the possibility of preventing or reducing undesirable events that can compromise the safety and preservation of their assets by creating a risk management plan and tailor-made insurance products. In particular, this activity is called risk management and it aims to identify all those risks that may, directly or indirectly, threaten the policyholder's artistic heritage and, at the same time, to propose solutions to reduce them, either through specific insurance coverage or through targeted prevention activities. The risks that will be assumed by the insurer in exchange for a premium must be assessed and estimated since their magnitude, intensity and frequency will contribute to the definition of the premium itself. The insurance company requires in the policy-wording that all propriate security measures have been taken. In fact, taking out an insurance policy does not exempt the owners of the assets from their respective duties of protection, security and preservation. On the contrary, all measures put in place to safeguard the property must be explained in detail by the insurer and carefully examined by the insured. The policy always provides for the prescription of special precautions that are contractualised and without which the insurance cover does not operate[58]. Moreover, the policyholder is obliged to inform the insurance company of any development or alteration affecting the risk, otherwise the claim will not be paid because such non-compliance may cause an increase in the possibility of the covered event occurring[59]. This is the main reason why fine art insurance contracts are usually written on an annual basis, with renewable pricing and terms[60].

The market is moving towards an increasingly integrated risk assessment process in order to create forecasting models that are as accurate as possible and in which the margin of error is minimised: the ability to imagine creative and innovative risk profiles thanks to new developments in technology, makes it possible to further increase the precision of risk definition and its segmentation, according to the different events that cause it[61]. Moreover, the advent of NFTs and crypto art is causing the emergence of new risks that insurance companies need to face[62] (see table 1.1).

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[58] BENVENUTI G., RESTI C., *L'assicurazione delle opere d'arte durante i prestiti*. In: Axa Art, APICE, studio legale LCA, ed. *IN & OUT Guida pratica al prestito di opere d'arte*; 2018: 55-63

[59] VEIGA COPO A., *L'assicurazione di opere d'arte e del patrimonio culturale*. In: G. Morbidelli, ed. *Tutela assicurativa del patrimonio culturale*. Bologna: il Mulino; 2021: 43-130

[60] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210

[61] OECD (curated by), *Technology and innovation in the insurance sector,* cit.: 8

[62] This topic will be discussed in Chapter 3

Kind of risk	Risk characteristics
Physical risk	damage, deterioration, mishandling, transportation, restoration
Legal risk	defective title
Market risk	fluctuations in value and changes in the art market
Crime risk	theft, art fraud and forgery
Force majeure risks	natural disasters, vandalism and terrorism

Table 1.1 Summary of kind of risks and their related characteristics

1.2.2 Professional figures involved in fine art insurance

The professional figures involved in fine arts insurance are many and with different areas of expertise. Indeed, insurance acts as a trade d'union between professionals dealing with cultural heritage and those who hold and deal with risks, creating an irreplaceable system of protection and prevention[63]. The main figures revolving around fine art insurance are the insurance intermediaries, loss adjuster, and art experts.

Firstly, insurance products can be sold through direct contact with insurance companies thanks to the intermediation of agents, or through third parties, as for example independent brokers who typically work with multiple insurance carriers to find the best coverage options for their clients. Insurers work closely with clients to assess their insurance needs and develop customized insurance policies that provide the appropriate level of coverage for their art collections by negotiating the best terms and premium rates. Agents and brokers have also the responsibility of providing information to their clients about policy terms, conditions, exclusions and costs. In the event of a claim, agents and brokers support clients throughout the claims process. They help customers understand their policy coverage, submit required documentation, and communicate with the insurance provider on behalf of the client. They also review policyholders' insurance needs regularly to ensure that their coverage remains appropriate as their situation evolves. Depending on the jurisdiction and the type of insurance being offered, there may be different rules governing brokers and insurance

[63] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali*, cit.: 30-31

agents. However, generally speaking, insurance brokers and agents must hold a licence from the State in which they operate, and must comply with a range of regulations designed to protect consumers and ensure fair and ethical business practices. In Italy, they are regulated by the Italian Insurance Code (Codice delle Assicurazioni) and by the standards issued by the Istituto per la Vigilanza sulle Assicurazioni (IVASS)[64].

The process of writing a policy is a major part of an insurer's job and is called the underwriting phase whose fundamental tasks include assessment of risks and their economic valuation. Underwriters analyse factors such as the artwork's value, provenance, condition, and security measures in place to determine the appropriate coverage and premium rates. Underwriters in fine art insurance also typically have expertise in the art market and the specific risks associated with insuring art. For example, they may have knowledge of the likelihood of damage or loss based on factors such as the age of the artwork, the materials it is made of, and the conditions in which it is displayed or stored[65]. The figure of the underwriter may both coincide or not with that of the risk manager. In any case, they collaborate with customers to identify potential threats to their artwork and offer mitigation methods and this can entail providing guidance on safety precautions, storage requirements, and transit options. Most losses are preventable if a correct and complete risk management plan is taken out. Whether they are two different professionals, the risk manager and underwriter may collaborate closely throughout the process to make sure that the risks connected to owning and insuring the artwork are appropriately assessed and handled[66].

Claim adjusters respond when an insured work of art is damaged or stolen in order to review the claim, identify the degree of the loss or damage, and determine the appropriate level of compensation. To determine the value and condition of the artwork, they usually collaborate with art specialists and conservators as well as with brokers and insurers in general. In fact, as Sean Ball, Fine Art & Specie specialist at Criterion Adjusters, underlines: «our interaction with a broker is critical to the smooth operation and progression of a claim»[67]. The particularity and specificity of the role of the loss adjuster have led to the emergence of companies dedicated exclusively to the provision of this type of service, such as the aforementioned Criterion Adjusters.

[64] DONATI A., VOLPE PUTZOLU G., *Manuale di diritto delle assicurazioni*, cit.: 91-100
[65] KOBLENSKY W., *The art of art underwriting*, «Insurance Business Magazine», 16 December 2016
[66] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali*, cit.: 70
[67] WALLACE M., *Exploring the role of the loss adjuster in the fine art and specie space*, «Insurance Business Magazine», 23 July 2021

Art experts act as independent or external collaborators of the company and are called upon not only in the case of appraisals, but also in the process of verifying the authenticity of the works, research and bibliographical studies, resolution of claims, organisation of eventual transports.

In particular, art appraisers play a crucial role in the fine art insurance industry by determining and updating the market value of an artwork or collection, especially for contemporary art collections that are highly conditioned by market fluctuations. Their expertise is essential for underwriting and claim processes, as it helps establishing the appropriate coverage and compensation amounts. The "*Uniform Standards of Professional Appraisal Practice*" (USPAP) defines an appraiser as a person who is responsible for competently evaluating an object and providing an unbiased and objective assessment of its value[68]. To ensure accuracy, a thorough written report should be included with the appraisal, detailing information such as cataloguing aspects, provenance notes, condition, and appropriate value of the item.

Art conservators or restorers are specialized in the preservation and restoration of artworks. They can be consulted either before or after an insurance claim is filed to evaluate the condition of the artwork, ascertain the level of damage, suggest the best conservation practises and restore the art piece if necessary. In the insurance world, the restorer is best known as the one who writes the condition report, fundamental document that accompanies every work that is subject to movement. It defines the state of conservation of a fine art piece before it is packaged, on its arrival at the exhibition premises, at the end of the exhibition and on its return to its original location and is therefore crucial in the event of a claim[69]. Restores work closely with art handlers and transporters which are responsible for the safe packing, handling, and transportation of artworks. They play a crucial role in minimizing the risk of damage or loss during transit, which is often a key concern for fine art insurers. It is recommended to work with transport companies which are specialized in fine art: successfully shipping artwork, especially when dealing with delicate and sizable pieces, necessitates the use of expert knowledge, meticulous planning, and accuracy in all shipping procedures to ensure swift, effective, and secure delivery. The two leading art shipping associations are

[68] GOODMAN R., von HABSBURG E., JOHNS G., MCANDREW C., *Art appraisal, prices, and valuations.* In: C. McAndrew, ed. *Fine art and high finance: expert advice on the economics of ownership*. New York: Bloomber Press; 2010: 31-62. The concept of art appraisal will be further discussed in the next paragraph.
[69] BENVENUTI G., RESTI C., *L'assicurazione delle opere d'arte*, cit.: 55-63

ICEFAT or Artim, they operate worldwide thanks to a global network of partnerships which are accurately chosen for their professionality and quality of services[70].

In conclusion, these professional figures can merge, overlap or be separate from each other, but they are all necessary in order to provide the best service as possible to anyone who is looking for a complete fine art insurance policy.

1.2.3 The concept of value and appraisal in fine art insurance

Valuation is a critical aspect of fine art insurance, as it helps determine the appropriate coverage, outlines the compensation the policyholder will receive in the event of damage or loss, as well as the payment method utilized by the company. Regular appraisals and updates, as well as understanding the factors affecting the artwork's value, are essential in ensuring the artwork is adequately protected.

A broker can assist in determining the most suitable valuation clause for the policyholder's needs and this selection depends on the collection's nature, risk tolerance and premium cost.

The first valuation option available is the agreed-value one, which indicates the commercial value attributed to the items by mutual agreement between the parties in accordance with article 1908 of the Civil Code[71]. In the event of a total loss, the insurer will pay the agreed value without any adjustment for depreciation or appreciation and, because of this, it provides a high level of certainty for the policyholder. The agreed-value policy is often used for rare, unique, or high-value pieces of artwork and it offers faster claims settlement as the insurer has already agreed to the value before any loss occurs. Usually, to determine the agreed value, insurance companies employ their own in-house art experts or external reputable appraisers to evaluate a work of art or collection and to review and adjust it periodically to ensure that it remains accurate and up to date[72]. The art expert is called upon to establish and justify the concrete value of the works to be insured and it is in accordance with

[70] ICEFAT (International Convention Of Exhibition & Fine Art Transporters) is an international network of trusted alliances. Founded in 1977, ICEFAT is the oldest, largest and most active art logistics company. They only accept members who have been vetted and approved based on their merit, longevity, history and commitment.
ARTIM (Art International Meeting) is a global gathering of the world's leading fine art logistics companies, providing museum quality fine art packaging, transport, shipping, storage and installation services to museums, galleries, dealers, corporate and private collectors and auction houses.
[71] Article 1908 of the Civil Code concerning the "*Value of the insured property*"
[72] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210

this value that the company calculates both the cover premium and the indemnity. It is important to note that the agreed-value option typically comes with a higher premium cost than other valuation options, as it provides a higher level of certainty and protection for the collector[73].

The second valuation alternative is declared-value or stated-value appraisal which corresponds to the commercial value of the works of art declared by the insured at the moment of the claim[74]. This value is not explicitly accepted by the company, which usually makes downward valuations in the reimbursement[75]. In this case, the insured is only required to prove the actual value of the insured item at the time of the claim by providing the company with documents and information proving the real commercial value of the property.

Lastly, the market-value basis or actual cash value corresponds to the replacement cost minus any depreciation. The replacement cost refers to the cost of replacing the property with a similar one of the same material and quality, used for the same purpose, on the same premises. This replacement cost represents the amount of money that a client could receive for the insured property if they were to sell it in the market. The current market value option is useful because it takes into account the current state of the art market, which can experience fluctuations in value over time and it ensures that the policyholder receives adequate compensation for their artwork in case of loss or damage. However, it also requires regular monitoring and updates to ensure that the agreed-upon value remains accurate over time[76].

The policyholder should decide whether a blanket policy or a scheduled policy is the best approach to insure the artworks. The blanket coverage option covers a collection of fine art items at their current market value, rather than insuring each item individually. It is a policy that provides comprehensive protection for a large quantity of small objects and is based on the estimated total value of the group of items, thus eliminating the need to appraise and insure each piece separately. In the scheduled policy, on the other hand, each item is listed independently with a specific insured value assigned to it[77].

Before illustrating the methodologies used by art experts to value items for insurance purposes, a distinction must be made between insurable and insured value. The former refers to the measure of value of the item exposed to risk, for instance the financial worth of the insured painting; while the latter corresponds to the actual sum insured for that specific

[73] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali*, cit.: 54
[74] Commercial value is the current value of the item or that which could be attributed to it on the art market at the time of the claim. BENVENUTI G., RESTI C., *L'assicurazione delle opere d'arte durante i prestiti*, cit.: 55-63
[75] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali*, cit.: 53
[76] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210
[77] *Ibidem*

object[78]. When the two values coincide, the item is totally insured; when the insured value is lower that the insurable one the artwork is underinsured; on the contrary, if the insurance coverage exceeds the insurable value there is an overinsurance. In case of underinsurance, in accordance with Article 1907 of the Civil Code, the insurer will only pay an indemnity equal to the full sum insured in case of total loss, for example if the object is completely destroyed, whereas in case of partial loss it will pay an indemnity equal to the proportionally reduced sum insured[79].

The process of obtaining insurance appraisals is crucial in maintaining an up-to-date and precise valuation of insured assets, thereby guaranteeing an equitable settlement with the insurance provider in case of any claims. However, valuing works of art financially can be challenging due to their intrinsic value as one-of-a-kind pieces with significant historical, cultural, or religious importance. Valuing works of art inevitably involves a degree of subjectivity, as each piece is distinct and lacks close substitutes or comparable that can be used for objective benchmarking. Evaluating the multiple elements that comprise the value of an artwork can pose a challenge, and, because of this, the appraisal must be taken out by experienced and qualified experts who have expertise in the specific type of artwork being insured.

During an appraisal for insurance purposes, the comparative market data approach is used. It is based on the analysis of comparable sales from the same artist or, alternatively, if they do not exist, the value of the work of art can be determined based on sales of works by other artists of the same period, style and value[80]. Based on comparable market data, the appraiser can provide various types of valuation. When it comes to insurance appraisal, the most commonly used approach is replacement value. This refers to the amount of money required to replace an item with a similar one that possesses similar qualities, characteristics, and value in a relevant market[81]. Another type of appraisal is fair market value, an assessment of the price that a work of art would sell for between two parties who are fully informed, at a specific point in time, based on relevant market data of the past[82].

Moreover, there are other factors that are relevant in assessing the value of an art piece. Firstly, the value of a work of art is strictly related to its authenticity which is usually

[78] DONATI A., VOLPE PUTZOLU G., *Manuale di diritto delle assicurazioni*, cit.: 145
[79] Article 1907 of the Civil Code concerning the proportional rule.
[80] GOODMAN R., von HABSBURG E., JOHNS G., MCANDREW C., *Art appraisal, prices, and valuations,* cit.: 31-62
[81] ADAMO S., IMPERIALE F., LUPERTO I., *Heritage values*, cit.: 168-182
[82] GYORGY S., MC ANDREW C., *Art Banking*, In: C. McAndrew, ed. *Fine art and high finance: expert advice on the economics of ownership*. New York: Bloomber Press; 2010: 117-134

confirmed by gathering information on the item and its provenance. The work's ownership history is significant in raising the commercial value of the object both because it provides reassurance regarding its value and authenticity and also because of the prestige and emotional appeal. In addition, also size, author, medium, historical period of creation and condition are of fundamental importance in determining the artwork's value during an appraisal[83].

1.2.4. Main types of fine art insurance policies

There are several types of fine art policies available in the market, each catering to different needs and preferences of collectors, museums, galleries, and artists. It is crucial to keep in mind that the insurance coverage a collector obtains for their personal belongings at home differs greatly from the coverage they would need for their art collection. Homeowner's insurance is intended to cover the cost of repairing or replacing a damaged home using comparable materials and quality. On the other hand, fine art insurance is meant to compensate the collector for financial losses incurred due to damage or loss of objects that are often unique and irreplaceable[84]. Moreover, standard home insurance policies impose monetary limits on the amount of coverage available for fine art, and they are not specifically designed to provide comprehensive coverage for artworks.

The various types of insurance that cover artworks and collectibles can be grouped into two main categories: all-risks and named-peril policies.

The named-peril policy covers all risks that are specifically listed in the contract. It only protects against losses explicitly named and, for this reason, when taking out a policy of this type it is important to make explicit the perils that you want to cover. Basically, the named risk policy lists the individual risks assumed by the insurer, leaving unnamed events to be borne by the insured. Significant is the case of the theft from the Munch Museum in Oslo of the world-famous painting by Edvard Munch, "*The Scream*", that took place in August 2004. The museum had taken out an insurance policy, but this was of the named-peril type and it was designed to cover only water and fire damage, but not theft. The painting was finally recovered but incident brought to light the fact that a significant number of valuable

[83] GOODMAN R., von HABSBURG E., JOHNS G., MCANDREW C., *Art appraisal, prices, and valuations*, cit.: 31-62
[84] ARNOLD J., FISCHER C., *Insurance and the art market*, cit.: 197-210

pieces, especially those in public collections, were not adequately insured because of named-peril policies[85].

Precisely because of the inherent limitations of this type of coverage, these contracts are increasingly rare and are generally replaced by the all-risks model which is more extensive and versatile with respect to the complexity of the risks to which works of art are subject[86]. An all-risks fine art policy is a type of insurance policy designed to offer comprehensive protection from a wide range of risks or perils that may cause damage or loss to fine art pieces. This type of policy typically covers accidental damage, theft, fire, water damage, and other unforeseen events, unless they are explicitly excluded in the policy. Precisely for this reason, it follows that it is always advisable to check the "exclusions" article in policy contract in order to clarify the actual scope of the guarantees provided and to request, if necessary, any coverage extensions. While specific exclusions may vary depending on the insurer and the policy, some common exclusions in fine art insurance policies include loss or damage caused by natural processes such as wear and tear, gradual deterioration, inherent defects, rust or oxidation, infestation by moths or vermin, warping, or shrinkage. In the exclusion section it is usually mentioned also confiscation, nationalisation, nuclear hazard, acts of terrorism. In particular, insurance companies usually do not cover for loss, damage or liability directly or indirectly caused by war, invasion, act of foreign enemies, hostilities (whether war be declared or not), civil war, rebellion, revolution, insurrection, military or usurped power. Intentional acts such as damage or loss caused by the policyholder, their employees, or any person acting under their direction or control, intentionally or maliciously, is generally excluded. In terms of natural disasters, the majority of insurance policies will not cover any damages caused by earth movement, which includes events such as earthquakes, sinkhole collapses, mine subsidence, landslides, or the shifting, sinking, rising, expansion, or contraction of the earth. These policies will also exclude coverage for damages caused by volcanic eruptions, explosions, lava flow, or particulate matter. However, there are a few insurance providers who offer coverage for catastrophic events-related losses, and the policies they offer will come with an additional cost. The tendency to be removed from exclusions also concerns restoration and cleaning damage, as some insurance companies include them as additional services in policies following the philosophy of comprehensive risk prevention and damage protection.

[85] *Ibidem*
[86] PIMPINELLA G., *L'assicurazione e la tutela dei beni culturali*, cit.: 13

The all-risk model is generally applied to nail-to-nail or wall-to wall policies, that type of insurance coverage taken out in the event that a work of art participates in an exhibition. It is usually activated with the first handling, meaning the removal of the artwork from the original location, and it ends when the property returns to its initial position. It includes packing, unpacking, transport, possible set-up and storage at the exhibition venue, ceasing only when the asset is returned to the lender. It follows that the nail-to-nail policy in the all-risks formulation insures the works of art against all risks to which they are subject during the temporary exhibition, except for those expressly excluded[87]. As has already been mentioned, the transport of works of art is one of the major causes of insurance claims due to the complexities of organising an exhibition, the articulated process of managing the loan of works of art, their handling, safekeeping and surveillance. This is why, in 2018, the experts at AXA Art, in collaboration with the law firm LCA and APICE Milano Srl, published "*IN & OUT Guida pratica al prestito di opere d'arte*", a guide aimed at covering the need of collectors and institutions to have a useful and agile tool to better manage the loan of their works of art[88]. As underlined by this informative guide, there are two main documents that are of necessary importance when taking out nail-to-nail cover and in particular when filing a claim.

The first and most important one is the condition report, a document in which are reported the results of the evaluation carried out on an artwork in order to establish its state of conservation[89]. It is preferable that it is drawn up by a restorer and accompanied by an appropriate photographic documentation. It must be drawn up at the different stages of handling of the work of art recording its status quo before the start of packing at the lender's premises, on arrival of the works at the exhibition premises, at the end of the exhibition before the works are packed again and, finally, on their return to the original location. This is a crucial document for insurance purposes as, if correctly completed, it could prevent possible disputes during the loss adjustment investigation in the event of damage or changes in the condition of the insured object. In fact, by accurately certificating the state of preservation of the artwork, it represents a useful testimony to establish more easily when the damage occurred and to determine the relative liability at the various moments of the management of the lent property. Each Condition Report can be tailored to one's needs, but it must contain a

[87] BENVENUTI G., RESTI C., *L'assicurazione delle opere d'arte durante i prestiti*, cit.: 55-63
[88] AXA ART, APICE, STUDIO LEGALE LCA (curated by), *In & Out. Guida pratica al prestito di opere d'arte*. AxaArt; 2018
[89] For a better understanding of the topic see MENSI L., *La scheda di riscontro o condition report*, In: Axa Art, APICE, studio legale LCA, ed. *IN & OUT Guida pratica al prestito di opere d'arte*; 2018: 31-36

series of technical data on the artwork including: author, title, measures, material and technique, type of packaging, types of damages found on the work and their mapping, its protection or packaging.

The second relevant document is the facility report, used by insurance companies to verify the security of exhibition premises. In particular, this type of certificate is a technical document that provides a detailed description of the characteristics of the exhibition venue, focusing on security, surveillance and conservation parameters of works of art. This report is written by experts in the field and provides an analysis of the risks and threats to the security of the building and the exhibits as well as the security measures needed to prevent them by describing the building and the activities that take place there, the surveillance methods and the fire alarm system. In addition, the facility report provides information on the environmental conditions necessary for the preservation of works of art, such as temperature, humidity and air quality, and on techniques for monitoring and controlling them[90]. In fact, the guarantees provided by the nail-to-nail policy also cover all those damages that may occur during the static exposure of the work; it is therefore fundamental to analyse the place intended for the temporary storage and enjoyment of the asset because any poorly protected risk cannot be insured. If there are any discrepancies or shortcomings with respect to the information provided in the facility report, the insurance company will consider them as an aggravation of risk in the event of damage. Unreported aggravation of risk exposure admits the total or partial loss of the right to indemnity and for this reason it is important to pay attention to the truthfulness and up-to-datedness of the information contained in the document[91]. It is important that the insurance company asks for the facility report and approves its contents; if it does not make this type of request, in the event of a claim, after verifying the inconsistency between the means of closure and security provided for in the policy and the security measures actually in place, it is possible that the insurer will dispute the characteristics of the place where the work was damaged or stolen.

[90] Each venue can create a customised facility report, but there are some standard models as for example the UKRG standard facility report (UK Registrar Group: https://www.ukregistrarsgroup.org/).
[91] BENVENUTI G., RESTI C., *L'assicurazione delle opere d'arte durante i prestiti*, cit.: 55-63

1.3 Analysis of the insurance offer provided by ARTE Generali

ARTE Generali came into existence as a result of Generali Group's endeavours as a patron of the arts, a legacy demonstrated, for instance, by initiatives such as Valore Cultura and the partnership between Generali Deutschland and some of the most successful exhibitions in Germany. Assicurazioni Generali was founded in Trieste, Italy, in 1831 and is one of the largest insurance providers worldwide, located in more than 50 countries with a total premium income exceeding €81 billion in 2022[92]. ARTE Generali stems from the Generali Group's aspiration to broaden its offering to customers by opening up to the art segment and it was developed thanks to Giovanni Liverani, CEO Generali Deutschland and Jean Gazançon, CEO of ARTE Generali worldwide. The new business unit was announced for the first time in 2018 and the starting block was founded in Germany in 2020, which is home to the largest art market in Europe, with an estimated total value of art holdings that ranks second globally after the United States. ARTE Generali's headquarters are situated in Munich and the new platform of services dedicated to fine art insurance was immediately expanded in United Arab Emirate thanks to the launch of a joint solution for High Net Worth Individual between ARTE Generali and Oman Insurance Company. France, Austria, Italy and United Kingdom were soon included among the countries where the fine art insurance segment of the Generali Group was provided, and it will soon be extended to additional European and global markets[93].

In particular, following the Group's ambition to become life-time partner to its customers, ARTE Generali offers customised insurance solutions for private collections, corporate and public institutions and temporary exhibitions. The comprehensiveness and professionalism of their offer is further enhanced by the *Concierge Service* section which is always included in every policy contract, and ARTE Generali App. The objective is to provide a network of experts available 365 days a year, 24/7, able to advise and assist clients with knowledge in all aspects of protection, conservation, appraisal and valorisation of their artworks. In the area of protection, ARTE Generali's service is developed along two main lines: risk analysis and security valuation. Moreover, in the case of conservation, the proposal is established in the fields of restoration, transport and storage. Then, the evaluation service is provided by means of cataloguing, appraisal and updating services. Finally, the network of

[92] GENERALI (curated by), *Principali dati finanziari*, 2022, available at https://www.generali.com/it/investors/financial-highlights (last consultation: 10/05/2023)

[93] ARTE GENERALI, *Nasce Arte Generali, la nuova offerta assicurativa dedicata ai collezionisti d'arte*, press release 12 November 2019

valorisation specialists will deal with issues such as market access through art advisor services and direct contact with galleries and auction houses; and collection valorisation by means of collection management services, asset management consulting, curatorship and loans. The services provided by ARTE Generali are limited to the research and selection of the various specialists and, if necessary, to the organization and coordination of them according to the client needs. However, the insurance policy premium does not include payment for the services provided by individual professionals, the cost of which remains the responsibility of the policyholder[94].

The innovative insurance all-risks solutions for private collections, corporate collections and museums provided by ARTE Generali will be analysed below. For the purpose of this research, only those policy sections strictly related to the cultural heritage of the insured will be examined, comparing them with those of two other major fine art insurance companies, Hiscox[95] and AXA XL[96], where considered appropriate.

1.3.1 Private collections

ARTE Generali Private is an all-risks insurance solution dedicated to works of art and valuables, it is built ad-hoc with the support of a team of art experts according to the collector's specific needs. Starting with the always-included modules of *Concierge Service* and *Art*, where the first one is devoted to the provision of fundamental services by professionals selected by the company itself, the insurance solution dedicated to private collectors allows the policyholder to add in the same insurance contract: home contents, jewellery and valuables, buildings and third-party liability. Each of these sections can be customised both in terms of cover and excess for the individual work of art. For the purposes of this research, only the module *Art* within the ARTE Generali Private Policy Wording, updated version in November 2022, will be analysed[97].

[94] ARTE GENERALI (curated by), *Condizioni di assicurazione ARTE Generali Private*, November 2022 edition
[95] Hiscox is a global specialist insurer founded in 1901, with headquarters in Bermuda and operations in 14 countries including the UK, Europe, the US and Asia. The company provides a wide range of insurance products but it is particularly known for its focus on high net worth clients and speciality risks, specially in fine art insurance.
[96] AXA XL is a subsidiary of the multinational insurance company AXA, focused on providing property, casualty and specialty risk products, specialising in the management of the most complex risks. The company was founded in 2018 when AXA acquired XL Group.
[97] ARTE GENERALI (curated by), *Condizioni di assicurazione ARTE Generali Private*, November 2022 edition. The articles to which this paragraph will refer to are all present in this document.

Articles 1 and 2 of section A – Art in the policy wording of Arte Generali Private, begin by explaining which objects are insured, specifying that the insurance covers not only fine art legally owned by the policyholder, but also that kept by him/her on behalf of third parties or for which the insured is legally responsible. In any case, the covered objects must be located within the location insured in the policy, unless they are kept and exhibited at public cultural institutions with which there is a long-term loan or commodate agreement.

Unlike the general policy structure that insures against all-risks for material and direct damage caused by events that are not expressly excluded, in the case of works of art exhibited outdoors, the insurance cover only applies to the risks explicitly named, thus becoming a named-peril type of policy, which are: fire, lightning, explosion; storm and ail but in this case only damage caused by the direct impact of the storm on the insured property is covered and the fall of parts of buildings, trees or other elements caused by the storm on the insured property; earthquake, floods and inundations (only if the optional coverages have been activated).

Article 3 lists the additional covers, that are the supplementary indemnifiable losses that ARTE Generali makes available to its customers.

Firstly, new possessions are covered, meaning that the insurance policy will automatically extend to assets acquired by the policyholder during the insurance period, on condition, however, that the policyholder has given notice of their acquisition within 60 days thereof. However, there is no increase in the indemnity limits. At the end of the insurance year the company will adjust the renewal premium on the basis of the changes that have occurred. In this regard, confronting the policy with insurance solutions provided for private collectors by AXA XL and Hiscox, it is relevant to note that new possessions cover functions in another way. In the case of AXA XL, the company will allow an increase in the total amount insured up to 20% to cover any fine art item acquired during the period of insurance, provided that the insured notifies the new acquisition within 45 days of the date of the new purchase. AXA specifies that during this period the new objects are insured at declared value, while once the company has been notified of these new acquisitions, the insurance terms and conditions for these works of art will be agreed with the policyholder[98]. With regard to Hiscox, the company will raise the maximum insurance coverage up by 25%, but no more than £100,000 to account for any new items acquired by the policyholder during the coverage period. If the policyholder does not request any adjustment to the policy, there will be no

[98] Article 3, AXA XL (curated by), *Assurances des collections priveées. Conditions générales*, September 2022 edition: 4

additional charge during the coverage period. Anyhow, at the renewal of the policy the insured is obliged to notify the new possessions and the company reserves the right to increase the premium to reflect the value of the additional possessions[99]. In any case, both ARTE Generali, AXA XL and Hiscox underline that in the event of non-reporting by the deadline, the new possessions will no longer be insured.

Secondly, ARTE Generali provides cover also for the death or disability of the artist. If the commercial value of any insured property on the basis of an accepted valuation increases as a result of the artist's death during the period of insurance, the company will indemnify a higher amount up to 200% of the accepted value for that item. This revaluation will only be effective for six months following the artist's death on condition that the insured person submits an appraisal report drawn up by an independent expert and documents the increase in the market value of that asset. In addition, the insurer will also indemnify irrecoverable expenses incurred by the insured for artworks commissioned by him/her and left incomplete due to the death or permanent physical disability of the artist, up to the amount indicated in the policy schedule. Comparing this policy with the one provided by Hiscox, it is relevant to notice that in this case the increase of the amount insured is lower, in particular up to 100%. The time limit of six months is always present and so it is for the professional valuation. The company will also reimburse for any cost expenses paid by the policyholder for artworks commissioned, but only if the artist dies and not in the case of disability[100]. Generally speaking, the death of the artist clause is interesting because it refers to a typical episode in the contemporary art system where the value of artworks often experiences a sudden increase in the period immediately following the artist's death. This principle is called "the death effect" and has been analysed by R. B. Ekeldun, R. W. Ressler and J. K. Watson in their article "*The "Death-Effect" in art prices: a demand-side exploration*" published in 2000 in the Journal of Cultural Economics where, by analysing auction prices of a sample of Latin American artists dead between 1977 and 1996, the authors demonstrate how the quantity of artworks sold and their corresponding prices tend to surge during the years immediately following an artist's death, as the cessation of the artist's production leads to a decrease in supply and subsequently drives up demand and value[101].

Furthermore, following Article 3 on additional coverage, the Generali fine art business unit will indemnify the amount paid by the insured party for the purchase of an item that was

[99] HISCOX (curated by), *Fine art – policy wording*, February 2021 edition: 8
[100] *Ivi*: 8-9
[101] EKELUND R. B. JR., RESSLER R. W. and WATSON J. K., *The "Death-Effect" in art prices: a demand-side exploration.* Journal of Cultural Economics, 24; 2000: 283-300

part of the collection and that him/her was subsequently obliged by law to relinquish due to: a defective title or lack thereof on the part of the seller; any charge or encumbrance placed on the item prior to its purchase and of which the owner was unaware. The absence of fault on the part of the insured is paramount. Generali shall also indemnify the legal expenses incurred by the insured party, with the prior consent of the company, to defend itself in civil proceedings against claims for damages or restitution based on a defective title or lack of title. Any further economic loss resulting from the lack of availability of the asset will not be reimbursed. The maximum amount indemnified shall correspond to 10% of the sum insured for the collection, only on condition that the insured has verified the ownership and history of the item prior to purchase; that the purchase took place after the date indicated in the policy statement; that he/she has promptly informed the company of any claim made against him/her. With regard to the insurance provided by Hiscox, the policy terms and guarantees correspond to those of ARTE Generali, but legal expenses are not covered[102].

Article 4 of section A is devoted to the description of insurance coverage outside insured locations. This coverage operates worldwide, for a maximum duration of six months. It also applies during transport to restorers, auction houses, galleries, exhibitions and between different insured locations and for works of art purchased, before being transferred to the insured location. It is the insured party's obligation to ensure that the packaging is professional and suitable for the type of goods covered. The article also applies for artworks in storage at a third party's premises provided that the means of protection of the premises are suitable and include an alarm system[103]. As regards the territorial scope, AXA XL specifies that the coverage applies only to insured assets located in the premises indicated in the policy declarations, excluding courtyards, terraces and gardens. The coverage also operates in all countries of the European Union, Switzerland, the principality of Monaco, the United States and Canada. The guarantee is also extended to professional premises for the sale, custody, evaluation or restoration of works of art for a maximum period of 45 days, provided they have the same means of protection as those indicated in the declarations related to the insured location. It also applies to the transport of property under the supervision of the policyholder, for delivery or collection to the above-mentioned professionals; however, this coverage is

[102] HISCOX (curated by), *Fine art – policy wording*, February 2021 edition: 9

[103] This type of guarantee is intended to give the customer basic coverage regarding the movement of works of art, but ARTE Generali Exhibition policy is necessary for any coverage in excess to the aforementioned.

limited to damage caused by a serious accident, by fire in the means of transport or by theft with assault during transport[104].

Article 5 – section A of ARTE Generali Private is dedicated to the insured sum and value of fine art covered by the policy. The policyholder may decide whether to use the accepted or declared value option. In any case, the works of art are insured within the limits of compensation agreed in the policy contract. Items of more than 15,000€ must be individually described in a list to be given to the company. With regard to couples or series of works of art that can be identified as a single work, in the case of accepted value, following partial and/or restorable damage affecting an item that is part of this set, the company will indemnify the value of the damaged asset in an equal proportion to the total value of the work of art and thus taking into account the greater value deriving from its artistical belonging to a whole. In the event of total loss affecting an item part of a set, if the insured returns to the company the part of the whole not damaged, the latter will pay the full amount of the pair or set. On the contrary, if the insured opted for a declared value coverage, the value of the pair or series shall not exceed that indicated in the policy schedule. The corresponding article in the Hiscox insurance contract specifies that «Items, pairs or sets worth more than £50,000 each must be specified individually» and that the amount insured for each specified item must be agreed by the company. In addition, with regard exclusively to pairs or sets of works of art, the company only informs that in the event of damage, at the time of payment they will take into account the added value derived from the fact that it was a whole[105].

The article number 6 of section A refers to the indemnity settlement in the event of a claim. In the case of total loss, whether caused by destruction, loss or theft, in declared value case ARTE Generali shall indemnify the client for a sum equal to the commercial value of the insured good at the time of the claim. Otherwise, in the event of an accepted appraisal, the value shall be that established in this valuation and shown in the inventory attached to the policy. If the item is partly damaged and if it can be restored, the company shall indemnify, subject to authorisation, the cost of restoration and transport, if any, plus any depreciation[106]. In any case, the total sum indemnified shall not exceed the sum insured indicated in the policy schedule. If the artwork cannot be restored or reproduced, the insurer shall only indemnify the depreciation, which needs to be ascertained and quantified by the company or by an

[104] Article 8, AXA XL (curated by), *Assurances des collections priveées. Conditions générales*, September 2022 edition: 6
[105] HISCOX (curated by), *Fine art insurance - policy wording*, February 2021 edition: 9-10
[106] The term depreciation means the difference between the value the asset had at the time and place of the loss or damage and the value of the item in its restored state.

independent appraiser authorised by it. On the contrary, Hiscox allows the policyholder whether to repair, replace or receive a payment for the loss in value of the damaged item if specified, otherwise if the item is not specified the decision whether to repair, replace or make a cash settlement is up to the company. Moreover, if the specified item has had a professional appraisal conducted within the past three years and if the policy specification's agreed-upon value reflects this valuation, the insurance company agreed to cover these items on an increased value basis, meaning that they will pay the item's value at the time of loss, even if it is greater than the value established in the specification[107]. If the insured decides to repair the damaged specified artwork, Hiscox will pay for any loss in value within the limits agreed in the policy.

ARTE Generali also provides optional cover for catastrophic events such as earthquake, floods and inundations, flooding and water bombs. However, the insurance policy excludes catastrophic disasters like volcanic eruptions, bradyseism, ground subsidence or landslides; rockfalls and avalanches; tidal waves, storm surges, seawater penetration and high tide phenomena. They will also not indemnify loss or damage caused by war, invasion, hostilities, civil war, insurrection, military or usurper power, acts of terrorism; accidental pollution damages derived by gradual contamination of water or soil; inherent defects; wilful misconduct of persons living with the insurer or the policyholder, of supervisors or of persons related to the policyholder or the insured by kinship or affinity; loss or harm resulting from gradual processes such as wear and tear, rust or oxidation, moth or vermin infestation, warping or shrinkage, or any other gradual occurrence. The company will also not indemnify damage caused by restoration work carried out by non-specialised personnel, as well as damage resulting from lack of or inadequate packaging during transport.

1.3.2 Institutional sector

ARTE Generali Institutional is an all-risks insurance solution aimed at the private or public customer who manages exhibition venues dedicated to or used to exhibit a collection such as museums, ecclesiastic institutions, foundations, corporate collections, archives and libraries. This solution provides insurance coverage for works of art and other valuable items, with a specific focus on the building housing them. The coverage offers extensive and

[107] Hiscox states that the most they will pay for the increase in value is «an additional 25% of the value shown for that item in the specification; or 100,000£ in total for each incident of loss, whichever is the lower», HISCOX (curated by), *Fine art insurance - policy wording*, February 2021 edition: 9-10

customizable options tailored to meet the specific needs of the insured. The policy has 4 sections, each of them characterised by specific guarantees: art and collectibles, restoration costs, building and contents, building and management liability. Art and collectibles and restoration costs are, with the concierge service, the always-included modules. This research will exclusively examine the *Art and Collectibles* module and the *Restoration Cost* one[108].

Article 3 – section A, specifies the indemnity settlement at the time of a claim and the guarantees correspond to those in the ARTE Generali Private solution, namely that the value of the insured goods can be determined on the basis of accepted or declared value, and that in the case of partial damage the company, taking into account the interests of the insured, will decide whether to pay for the restoration with any transport and depreciation costs, or to pay the difference between the market value of the item before and after the loss. Moreover, article 4 of the Institutional policy indicates that if the insured item turns out to be a contemporary copy or misattribution at the time of the claim, its insurance value shall correspond to its real commercial value; no indemnity shall be due if the item turns out to be a reproduction, counterfeit or fake.

With regard to the special conditions of insurance operating in the art section, articles 1 and 5 underline that the guarantee is subordinate to the fact that uninterrupted surveillance appropriate to the number of rooms and the type of set-up must be organised on the exhibition premises during the opening hours. The influx of the public must be adequately regulated in relation to the surface area and cubage of the exhibition space. Visitors must not be permitted to use, touch or move the artworks; such operations are permissible only if they are carried out within the scope of the locations indicated in the policy and by specialised personnel. Furthermore, for protection against potential flooding or liquid spills, all insured items must be positioned at a minimum height of 10 cm above ground level. However, this requirement does not apply to furniture, carpets, and works of art that are either naturally placed on the ground or arranged as such for specific reasons. The guarantee for accidental breakage of fragile art objects due to falls or impacts of persons or things shall only apply if the small art objects are placed in closed showcases or cases or anchored to walls or plinths. It is interesting to note that this type of guarantee obliges the policyholder to pay considerable attention to the measures necessary for the proper preservation and maintenance of the insured items, so as to be certain of receiving compensation in the event of a claim.

[108] ARTE GENERALI (curated by), *Condizioni di assicurazione ARTE Generali Institutional*, September 2021 edition

Articles 3 and 4 – section A, under the special conditions of insurance category, states that limited to audio/video installations, the indemnification by the company is restricted to the costs of replacement with other identical or, if no longer in production, similar media/elements. Similarly, in the case of works and installations with parts consisting of replaceable and/or industrially manufactured materials, in the event of damage that is indemnifiable under the policy, the indemnity shall be limited to the costs sustained for the replacement or the quantitative and qualitative restoration of the material itself, the depreciation of the work itself always remains excluded.

Article 10 declares that policy cover is extended to frames, supports, plinths and any other element with a supporting or display function for the object.

Coverages already explained in the private sector concerning pairs and series of art objects and defective title are repeated. The same applies to the coverage on new acquisitions, with the only variation that the company must be notified within 30 days, according to articles 7 and 9. However, cover for the death of the artist is not included in the guarantees of ARTE Generali Institutional policy. In this respect ARTE Generali differs from Hiscox in that the latter guarantees museums and institutions an increase in the agreed indemnity of up to 100% for a period of one year from the date of the artist's death[109].

According to article 8, installations and sculptures may be installed outdoors within the fenced and guarded perimeter pertaining to the locations indicated in the policy. In this case, cover is extended to the indemnification of the costs of restoration or replacement of individual elements due to vandalism, accidental damage and atmospheric events, the latter limited to hail and whirlwinds.

The desire to provide its customers with comprehensive cover adapted to every need is evident in article 12, which affirms that the insurance coverage is automatically extended, at no additional cost or prior notice, to include any material or direct damage incurred by insured works of art during the filming of a movie or television production. However, this coverage is subject to the condition that the works are under the supervision of museum staff and handled by specialized personnel. The same applies to material and direct damage occurring during the setting up, dismantling and holding of events organised by the museum (article 13). The filming or photography guarantee is also provided by AXA XL within their policy dedicated to museums and institutions. In this case, however, the company is stricter about the conditions of insurability, emphasising that, in addition to the same terms requested by ARTE

[109] HISCOX (curated by), *Gallery & Institutions*, January 2022 edition: 9-10

Generali, the contractor is obliged to ensure that the location is closed to visitors during filming, and that the video team's equipment must be placed and secured in such a way that it does not constitute a risk to the insured property[110].

Moreover, according to article 14, the coverage provided by ARTE Generali is extended to the costs of packing and transporting the insured works of art to and from other indoor or outdoor locations in cases where the policy locations are uninhabitable, if the security of the works of art is compromised as a result of an indemnifiable loss or if an impending threat forces the works of art to be moved for conservation or security reasons to temporary storage outside the location considered to be at risk. Following the articles 16 and 17, the same applies to maintenance and protection costs if the insured property has suffered an indemnifiable damage and for the recovery of works of art after their theft. The coverage is also extended to the costs of guarding the insured property if the security measures no longer provide adequate protection following a loss eligible for indemnification under the policy.

It is of interest to note that article 18 extends the cover also to books and archives stored at the insured location and also includes damage caused by digitisation activities and manipulation due to consultation.

The supplementary coverage part is dedicated to the storage of third-party works at insured locations or to the storage and transport of insured works at third-party locations. In the first case, it is specified that prior notification is not required in the case where artworks of third parties are at the insured premises for temporary loans for the purposes of temporary exhibitions, restoration, scientific investigations, study, etc. In the event that they exceed the value stated in the policy schedule, a prior notification must be made followed by the issue of an appropriate cover appendix. In the second case, the cover is extended to stock and transfer of the insured artworks at third party locations in order to restore or expose them. There is no obligation to give prior notice if the above-mentioned locations are in Italy, the Republic of San Marino or the Vatican City. Transport is also covered within the territories of the European Union, Switzerland, Monaco and the United Kingdom, but only on condition that it is entrusted to specialised personnel with professional packaging, that the goods are not visible from outside the means of transport and that the latter is equipped with an anti-theft device and is attended by at least two persons. In the event that the value of the works exceeds the limits set out in the terms of the policy, or in the event that the transport and storage at the

[110] Article 18, paragraph 2, AXA XL (curated by), *MuseumPLUS*, January 2020 edition: 19

premises of third parties takes place in a territorial area other than those indicated above, cover will be provided under a special Nail to Nail policy. In any event, in order for the transport guarantee to be operative, the contractor shall draw up the condition report for insurance purposes before the packaging operations begin, upon arrival of the works at the third party's premises, at the end of the dismantling operations and upon their return to the provider's premises.

These covers are also included in the insurance solution made available by AXA XL in relation to museums. In particular, for incoming and outgoing loans, the duration of insurance is limited to a maximum of 180 days. Transport by sea and rail is also included in the insurance where a limit of €500,000 and 30 days of duration are specified[111]. The area of validity for loans and transport is the European Union and Switzerland. This is not the case with the solution provided by Hiscox, where there is no mention of coverage for assets lent by or to third parties. Instead, it is specified that any transport must be expressly insured with an appropriate nail-to-nail policy[112].

An interesting guarantee made available by AXA XL but not by Hiscox and ARTE Generali is that of indemnity up to a maximum of €50,000 in the event that a planned exhibition at its venue is cancelled, interrupted or changed in its execution due to a circumstance beyond the museum's control[113]. Expenses incurred in the event of cancellation, termination or interruption, or additional costs in the event of postponement, as well as sponsorship funds demonstrably lost as a result of the cancellation, shall be reimbursed. No compensation shall be paid if the cancellation is due to lack of financial support of any kind, lack of interest on the part of the public or breach of contract by the contractor or its representatives.

Section C is dedicated to the rules governing insurance in relation to the costs of restoring valuable architectural and decorative elements. In fact, the company indemnifies the restoration costs incurred for the recovery of assets such as: frescoes and/or wall paintings, stucco, plaster, wall mosaics, marble cladding, bas-reliefs and decorative inserts, boiseries, mirrors, stained glass and coffered ceilings, valuable architectural elements, artistic parapets and railings, fabrics and wallpaper, as well as leather upholstery. This also includes three-dimensional sculptures, doors made of various materials such as wood, bronze or painted, paintings on wood or board that serve as decorative elements, as well as furniture. The cover

[111] Article 1, paragraphs 1 and 2, AXA XL (curated by), *MuseumPLUS*, January 2020 edition: 9
[112] Article 5, paragraph 2, HISCOX (curated by), *Gallery & Institutions*, January 2022 edition: 5
[113] Article 4, paragraph 9, AXA XL (curated by), *MuseumPLUS*, January 2020 edition: 12

extends, within the indemnity limits, to the costs of transport, assembly, laboratory analyses, restoration documentation costs provided that all restoration costs are authorised in advance by the insurer. Damage to valuable architectural and decorative elements located outside or partially outside the building is excluded. Furthermore, in the event of total loss and consequent objective impossibility of restoring the elements in this policy section, the cover does not apply.

With regard to the general policy exclusions, they are the same as those set out in the coverage dedicated to private collections. However, the company is held responsible for damage caused by socio-political events, strikes, riots, vandalism and terrorism. In the event of theft, the cover shall apply on condition that the perpetrator has gained entry to the premises containing the insured items by breaching the external defences by breaking, burglary or use of forged keys; by other than ordinary means that require artificial means or particular personal agility. Theft committed by employees and surveillance staff is only insured if the perpetrator is not in charge of the custody of the keys to the premises, the theft is committed when the premises are locked. Partially derogating from the exclusions that apply to all sections, in the case of the Art section cover includes losses and damage resulting from abrupt changes in the climatic conditions as long as they are caused by the failure of air-conditioning and heating equipment, proven by appropriate technical documentation.

1.3.3 Exhibition sector

Arte Generali's Exhibition policy provides insurance cover for fine art lent for the purpose of participation in art exhibitions or similar temporary events and insures all material and direct damage caused by accidental or intentional events except those expressly excluded which are the same of the previously analysed polices. A list must be attached to this policy which identifies and values each insured asset individually. This is a nail-to-nail type of insurance provided in the all-risks form; it therefore operates from the moment the insured goods are removed from the place where they are normally located, continues without interruption during transport, during the exhibition period and on the return journey. Any extensions of the exhibition period must be notified to the company in advance[114].

[114] ARTE GENERALI (curated by), *Condizioni di assicurazione ARTE Generali Exhibition*, January 2022 edition

One of the most relevant sections of this insurance policy are the conditions of insurability listed in Article 17, in the absence of which indemnification does not take place. Firstly, in order for the guarantee to be valid, the insured items must be accompanied by a condition report that must be submitted to the company in the event of a claim. Secondly, for cover to be effective during transport, it is mandatory that the goods are entrusted to authorised transporters, that the packaging is professional and that the goods are kept in closed and protected premises during storage. More specifically, the insurance policy divides the conditions of insurability during transport into sub-sections devoted respectively to road, rail, sea or inland waterway transport and air transport. Article 17.3, on the other hand, is dedicated to the conditions of insurability during exhibition storage or in premises such as warehouses and storerooms, specifying what the security means must be, such as a fire prevention system, suitable locking systems, armed security service or anti-intrusion system, regulation of the influx of the public. The protective measures relating to the physical display of works of art in relation to the operation of the theft and flooding guarantee are also listed. In the first case, the goods must be securely fastened to the walls or exhibition stand or protected by a burglar alarm system, or be stored in showcases fixed to the walls or floor, or a closed-circuit camera service must be in operation that allows the insured goods to be monitored. In addition, for the cover to be operative in the event of theft, the perpetrator must have entered the premises containing the insured goods by breaching their external defences, either by other than ordinary means or in a clandestine manner. In the second case, cover for flood damage shall only apply if the insured artworks are not placed less than 10 cm above the floor (this provision does not apply to furniture, carpets and other goods that by their nature or for reasons of display need to be placed on the floor), and are not stored in underground or basement rooms.

According to articles 18 and 19, the valuation of the insured goods may be made at accepted or declared value and the determination of the indemnity corresponds to that explained for the previous policies, meaning that in the event of partial loss, the company shall pay the difference between the commercial value that the object had at the time of the claim and that of the object in its state after the claim. If the object can be restored, the cost of restoration, transport and depreciation up to a percentage of 100% shall be indemnified. In the event of destruction or total loss, the company shall pay a sum equal to the commercial value of the item at the time of the loss.

As provided for ARTE Generali Institutional, the policy coverage is extended to frames, climaboxes and climaframes, to material damage suffered by the artworks during

photographic and video shooting as well as during temporary activities organised on the exhibition premises (articles 21-23).

With regard to the rules governing insurance in general, and therefore also the two insurance products analysed above, it is important to note that inaccurate declarations or reticence on the part of the policyholder relating to circumstances that affect the assessment of the risk, may entail the partial or total loss of the right to indemnity as well as the termination of the insurance pursuant to Articles 1892, 1893, 1894 of the Civil Code. The insured must notify the company of any aggravation of the risk, otherwise he/her may risk the total or partial loss of the right to indemnity in accordance with Article 1898 of the Civil Code. Pursuant to Article 1897 of the Civil Code, on the other hand, in the event of a decrease in risk, the company is obliged to reduce the premium following notification by the policyholder. The truthfulness of the statements and answers and/or other information provided in the questionnaire and/or facility report by the policyholder is the basis for the company's assessments for the conclusion of the policy and is therefore an essential requirement for the determination of any liability of the company. With regard to the rules for the settlement of a claim, in the event of a loss, the policyholder or the insured must notify the company within three days of becoming aware of it, specifying the circumstances of the event and the approximate amount of the loss. It is mandatory for the insured to do everything possible to mitigate the loss, as well as to endeavour to recover the stolen or lost items and to preserve and take care of those that remain. The policyholder must also preserve the traces and residues of the claim until the claim has been settled. Either the insurance company or their appointed representative must come to an agreement regarding the claim amount with the policyholder or their appointed representative. Alternatively, two experts can be appointed, one by the company and one by the policyholder, to agree on the claim amount. If the two experts disagree, they must appoint a third expert and make decisions based on the majority vote. Each party bears the costs of its own expert, those of the third expert are shared equally. Additional individuals may assist and support each expert during the claim assessment process, but they will not have any decision-making power.

Chapter 2. New technologies supporting fine art insurance

Innovation through new technologies is a key driver of change into various aspects of society, including business, culture and communication. The insurance industry is also impacted by technological advancements, which have opened up new avenues for service delivery and improved risk management through increased data collection. This trend, referred to as InsurTech, involves the innovative use of technology within the insurance sector[115].

The InsurTech tendency can be traced back to 2010 as an outgrowth of FineTech, a similar endeavour in the banking field. The term is most commonly employed to describe or refer to the use of machine learning[116], technological tools, apps and big data to enhance and automate procedures throughout the complete insurance value chain, spanning from marketing and policy creation to underwriting, services, and claims. Some insurance companies focus their technological efforts on developing and streamlining back-end functions, such as how to assess and price risk, settle claims and perform loss control. While others seek to enhance the front-end customer experience, minimizing obstacles or difficulties in conventional insurance transactions. The pervasive trends of digitalization and connectivity have induced a transformational shift across all industries, a process that was markedly expedited by the advent of the COVID-19 pandemic, and the insurance business is no exception. Deloitte analysis dated back to July 1 2022, and published in "*2023 insurance outlook*" by the Deloitte Centre for Financial Services, exemplifies how, as demand for digital solutions rose during the pandemic, InsurTech investments soared in 2021, with a remarkable US$ 17.2 billion in funding[117].

Insurance firms dealing with fine art have been undertaking the complex and multifaceted process of adapting to the digital revolution, which involves the integration of digital technologies into their operations and strategies. In particular, the digital transformation is helping them to adjust to evolving conditions and emerging trends. In 2023, prioritizing customer centricity remains a crucial aspect for insurers. Understanding their customers and providing relevant interactions is vital for companies as the insurance market is extremely competitive and customer engagement helps in retaining current policyholders and onboarding new ones. Thanks to advancements in data-based technology, insurers can now

[115] OECD (curated by), *Technology and innovation in the insurance sector*, cit.: 8
[116] The concept of "machine learning" refers to the ability of statistical models to gradually improve their capabilities and performance without explicitly programmed instructions.
[117] DELOITTE (curated by), *2023 insurance outlook*, cit.: 16

leverage hyper-personalized offerings, which enable them to transition from a product-centric approach to a data-driven and customer-centric one. Furthermore, the maturation of artificial intelligence and machine learning capabilities has opened up numerous opportunities for the insurance sector. Through the use of Artificial Intelligence and Machine Learning (AI/ML), predictive analytics can facilitate enhanced underwriting, streamlined claims handling, and more effective risk management. Also, Internet of Things (IoT) devices have a vast potential for the fine art insurance industry, and their presence throughout private and public collectors is continuously expanding. For instance, IoT such as smart leak detectors are assisting policyholders in proactively preventing losses. Moreover, blockchain technology has a relevant role in changing the way luxury goods companies operate. In the art world, blockchains have the potential to enable the tracking of a work's provenance and secure the tracing of documents such as certificates of authenticity and proof of purchase. Although this technology may only be applicable to specific segments of the market, it offers significant benefits to certain fine art and specie clients, and insurers must adapt to these changes. Insurance firms are also exploring how blockchain can be integrated into their own business models and striving to comprehend the risks and opportunities that this technology presents to their clients. Finally, the ubiquity of mobile phones and the proliferation of applications designed for these devices (commonly known as "apps") have enabled numerous companies to expand their reach to a much broader audience than was previously feasible. More and more companies are developing apps for their customers, in order to provide them with an agile and easy-to-understand interface that can increase the quality of the services they offer and make them simple to access.

Generally speaking, the COVID-19 pandemic has catalysed a surge in digital innovation, experimentation, and risk-taking that surpasses all advancements made in the past. Better integration of art market analytics and collection management systems, together with other tools and technological services, is helping in mitigating authenticity risks, improve the provenance tracking and traceability of art and enhancing valuation processes[118]. The research carried out by Deloitte Private in 2021, points out that some of the technologies that have a major impact on the development of art and wealth management services are the ones regarding risk management devices, collection management tools, big data, analytics and artificial intelligence, and blockchain technology. More specifically, according to the analysis, some of the key areas where new technologies can make an impact are authenticity-related

[118] DELOITTE (curated by), *Art & finance report 2021*, cit.: 253-4

issues, provenance and traceability, improving evaluation and creating more transparency[119]. It is important to note that a combination of human expertise and digital devices is needed. In fact, as Jean Gazançon, CEO of ARTE Generali, states: «it is key to understand technology and use it with a purpose in mind, which should be that of providing operators with tools that support, but not replace human expertise»[120]. Although digitalization is a critical priority, insurers should not overlook the value of human interaction, given the complex nature of products and processes inherent in the insurance life cycle. The right approach for companies should be to strategically determine which insurance interactions require digital versus human intervention to create the optimal experience for each consumer. By implementing this attitude, insurers can ensure that their distribution and service strategies are aligned with the needs and preferences of their clients, for example by leveraging digital channels for routine transactions and inquiries, while reserving human intervention for more complex or emotionally charged tasks.

The introduction of novel technologies has engendered a paradigmatic revolution in the insurance sector, which is presently evolving into a comprehensive domain that not only provides reimbursement for claims but also offers holistic protection, preventive measures, assistance, and collaboration to its clientele. In addition, these services have the capacity to substantially mitigate insurance and valuation costs, as well as function as effective pricing and valuation instruments for art buyers. Insurers, supported by new technologies, have the ability to sustain stakeholders throughout the art value chain by providing enhanced and tailored services, as well as aiding art enthusiasts in fully embracing the collecting experience.

Insurance has historically relied on quantitative data to inform risk management decisions, but the emergence of data analytics has broadened the scope of information available to insurers. However, the use of data analytics in insurance can be a contentious issue, as it raises questions around privacy and bias. Underwriting and claims management are particularly data-rich areas, and insurers collect and analyse data for purposes such as fraud prevention, marketing, claims management, and risk pricing[121]. Insurers can leverage data management and analytics to accelerate innovation, differentiate themselves from competitors, and ensure profitable growth, provided that they adopt holistic data management systems, promote cross-team collaboration, and surpass basic risk and cost reduction objectives. Data analytics can help insurers granting more personalized and proactive services

[119] *Ivi*: 260-3
[120] *Ivi*: 266
[121] OECD (curated by), *Technology and innovation in the insurance sector*, cit.: 26

to their clients, identifying trends and preferences and tailoring their services accordingly. It can also help companies to optimize their internal operations and improve efficiency by examining data on claims processing times, customer service interactions and other key performance indicators with the aim of identifying areas for improvement and implementing targeted solutions. Despite the visible and undeniable benefits provided by data as strategic asset, rather than viewing data spending as a long-term commitment to enhance and sustain value creation, many insurers tend to consider it as short-term expense for individual projects or initiatives[122].

2.1 Online platforms and apps for a more efficient management of fine art insurance

The efficient management of fine art collections and the related insurance contracts and pertinent documents can be a complex and time-consuming process, especially for private collectors and public or private institutions with large and diverse selection of collectibles. In recent years, a growing number of online platforms and apps have been developed to support policyholders managing their inventories, obtaining specialized insurance coverage and meeting their emerging needs. From the insurance companies' point of view, proposing qualitative, user-friendly web interfaces and phone apps represent an innovative way to differentiate their overall value proposition beyond price and coverage. Partnerships between art professionals and technology platforms is an emerging and increasingly pervasive trend that gives insurance companies, among other art related businesses, the possibility of combining different services and expanding their offering to become an integrated service provider. There are several examples of this trend, such as the partnership between Artory and the Winston Art Group, the collaboration between Artory and Tagsmart, the merger of artnet AG and Artfacts.net, the alliance between ARTE Generali and Wondeur AI, the joint venture between Crozier Fine Arts and Arius Technology, and the partnership between Art Rights and FERCAM Fine Art, among others[123]. Particularly, digital devices and web platforms allow insurers to group different utilities under the umbrella of a single and readily accessible interface and service offering, which can streamline the insurance process with tailored and responsive services.

[122] FRIEDMAN S., MACFARLANE C. and SHARMA N., *How to walk the talk by treating insurer data as a strategic asset – Enhanced insurance data management can drive innovation, differentiation, and growth*, «Deloitte Insights», 26 July 2022
[123] DELOITTE (curated by), *Art & finance report 2021*, cit.: 129

2.1.1 ARTE Generali App

The pandemic has significantly hastened certain trends that were already emerging in the market for art collection management services. Specifically, the generational shift and the emergence of "millennial" collectors have been the major driving forces behind the digitalization of the sector, leading to the development and widespread adoption of tools for managing art collections. These tools also address the growing need for speed in the market by facilitating the exchange of information and documents. As a result of these systemic trends, there is an increasing demand for secure and protected storage and management of information about each individual artwork with as much detail and documentation as possible[124].

Offering such customized and facilitated experience to customers is the aim behind ARTE Generali App, the software program designed to perform specific functions such as virtually storing images and documents of their artworks, obtaining certificates of evaluation and analysing the value performance of an artist. The objective is to assist policyholders improving the quality of their experience of collecting art by using «technologies to transform the frustration into happiness and peace of mind»[125]. In particular, it is true that the central component of an all-inclusive solution is the reimbursement of claims, but there are also other essential services in which art enthusiasts are interested in and that need to complement the core insurance service, such as expert guidance and consultation, measures to ensure safety, restoration and so on. In situations where art is primarily viewed as an investment, the owner's goal is to safeguard and increase its worth. In such cases, art is considered an asset class, and the strategy for managing it is comparable to asset management. While insurance remains a critical element of a solution that shields the asset's value from unfavourable circumstances, it is not the only component. Additionally, insurance can aid in boosting its worth, for example, by offering the collector with detailed and valuable data on the performance of a particular artist[126]. Addressing these issues is precisely the purpose of ARTE Generali App, created by ARTE Generali to support its clients in enjoying their art collection to the fullest. It is designed to perform different tasks and offer varied services according to its different sections, dedicated both to meeting the needs of art lovers and those who see art as an investment. The app is available for free download to all users. ARTE Generali clients can

[124] GUERRINI A., *Valutazioni in digitale: MyEvaluation e la collaborazione con Art Defender*. In: ARTE Generali, ed. *L'ecosistema digitale dell'arte*. 2021: 44-46
[125] DELOITTE (curated by), *Art & finance report 2021*, cit.: 267
[126] *Ivi*: 130-131

enjoy unlimited access to all of its features while the other users can try the app by signing up for a trial version, which grants them an active account for 180 days and allows them to perform up to 50 artist searches for free. Afterwards, if they want to perform additional artist searches or continue using the software's services beyond the trial period, they will need to purchase a subscription or become an ARTE Generali client to enjoy unlimited access to all of its features (see figure 2.1).

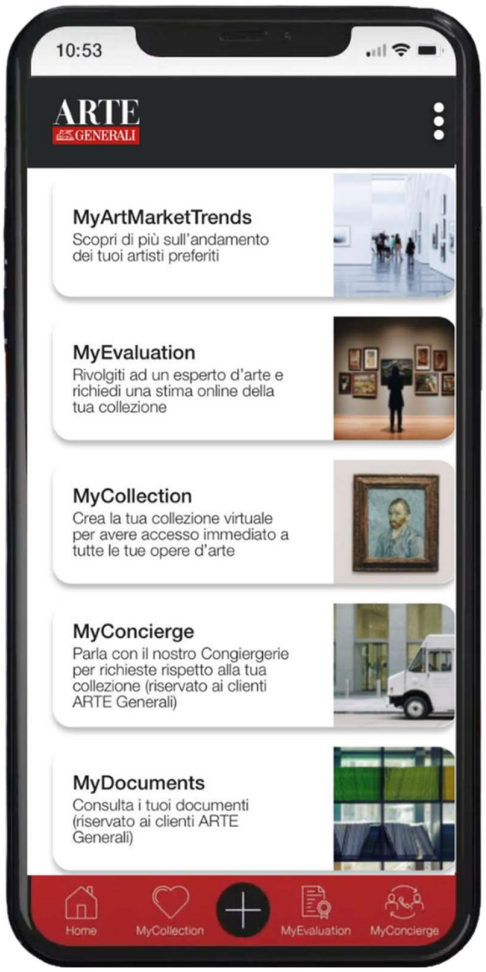

Figure 2.1. ARTE Generali App

The first section of the mobile application is *My Collection*, the one devoted to store and categorize the collector's art pieces. To create a virtual collection and maintain it up to date is only necessary to take some photographs of the artworks and to describe them according to some features such as: the category of the art piece, choosing among art object, paintings and similar items, antique or designer furniture, sculptures, jewellery or watches, and others; the name of the artist; title; year of creation; material and technique; dimensions;

edition; signature, date and number if present; other optional characteristics; monetary value of the artwork. These minimum requirements follow the line of the Getty ID system, an international documentation standard developed in 1997 by the Getty Information Institute for the information needed to identify cultural objects. The Object ID system was developed in collaboration with museums, valuers, police forces and the insurance industry through a series of surveys led to the identification of the characteristics considered most crucial to describe an art object for identification purposes. ICOM now holds the license rights to promote the use of this standard among museum professionals and this practical tool is now internationally recognised as a necessary and effective method when inventorying a collection[127]. If the work of art is not already insured, ARTE Generali gives to the user the possibility to directly apply for insurance or/and request an evaluation from a certified expert. In this way, even being at a distance, it is possible to consult one's own collection, to show it to interested parties, to compare it with other connoisseurs or art owners, and to have access to key information about one's own possessions. Properly cataloguing an artwork, which involves creating its "identity card" through photographic and descriptive documentation of its unique characteristics, is an essential starting point for serious and careful collecting. Digitalization further simplifies the identification process and facilitates operations such as artwork loans and movements, as well as supporting documentation for condition reports. From an insurance standpoint, digitalization also speeds up interactions with various parties involved and ensures quick customer response times during quote generation, claims reporting, or policy premium updates. Overall, digitalization is the best archival and documentary method for artwork, as it is less susceptible to deterioration than traditional paper-based documentation. Furthermore, documenting your collection is useful in managing artwork, such as during buying/selling or reporting theft/loss, and for verifying authenticity with archives or foundations[128].

The second section of ARTE Generali App is *My Evaluation*, which is the tool devoted to request a professional appraisal. The experts in partnership with ARTE Generali will assess the market value of the artworks required by the user of the app following a series of photo, after which they will produce a certificate that will be available directly inside the app itself. In particular, the evaluation request will be processed by art experts of Pablo Collection, a French company based in Paris and composed by a team of experts specialized

[127] THORNES R., DORRELL P., LIE H., *Object ID – Guidelines for making records that describe art, antiques, and antiquity*. Getty Information Institute; 1999

[128] GIURATO F., SANTORELLI F., *Digitalizzazione e beni culturali: obiettivi e vantaggi*, 28 January 2021, available at https://axaxl.com/it/fast-fast-forward/articles/digitalizzazione-e-beni-culturali-obiettivi-e-vantaggi (last consultation 26/06/2023)

in appraisal for insurance purposes. Their service is to draw up an estimated and descriptive inventory of the client's works of art and precious objects in total confidentiality, in order to enable the collector to benefit from appropriate cover under a specific fine art insurance policy which is of fundamental importance in the event of a claim. The document takes around two weeks to be drawn up and it provides proof of existence, authenticity and the value of the item. The customer will receive it in PDF format that will be available via the ARTE Generali App. The price for this service is €25 per artwork which will only be charged after verification of the customer's data and acceptance of the request by Pablo Collection. The interface provided by Generali allows the user to view the appraisals already requested and not yet accepted, the confirmed or declined ones, and finally the completed documentation.

My Claims is the unit of ARTE Generali App dedicated to report new damages through the compilation of a digital form that will be sent to a specialized claims managers who will provide immediate assistance to the policyholder. All the insurance documents are available on *My Documents*, a useful tool to organize and have immediate access to policy documents, certificates or invoices. These two sections are available only to paying customers who have purchased an insurance policy with ARTE Generali.

My Concierge is another service developed only for the insurance company's clients and it is used to request professional and unlimited concierge services. The app provides access to a qualified network of experts that will take care of every aspect related to an art collection, such for example transport, storage and restoration. In particular, the insured can reach the service 365 days a year through the app and the personal concierge will recontact him/her personally by furnishing the contact of the specialized expert in relation to the particular request.

Finally, *My Art Market Trends* tool is the ultimate release of ARTE Generali App in collaboration with Wondeur AI, a start-up enterprise that employs AI to analyse vast amounts of data associated with the art world and the art market. Through the use of AI-technology the user has access to an unbiased in-depth analysis on 95% of post-war or contemporary artists in the market and in particular on insights on real time information such as artist growth, benchmark value, liquidity value, recent auction transactions, recent dealer transactions, risk of change in value, museum support and future outlook[129].

[129] The use of AI technology in supporting fine art insurance will be further analysed in the next paragraph and in particular the Wondeur AI case will be taken into account.

2.1.2 Assicura l'Arte

Assicura l'Arte is an Italian digital platform launched with the circular of the General Directorate for Museums (DG-Mu) n. 19/1/2020 as a result of a technical sponsorship contract subscribed by the DG-Mu with the company MAG-JLT S.p.A, which offers insurance brokerage services[130]. The online portal "www.assicuralarte.it", is designed in order to provide a selection of insurance companies specialized in the fine art sector that the various actors involved in cultural heritage lending operations (applicants and lenders) will be able to access in order to orient themselves in their choice of insurance provider.

From the circular signed by Antonio Tarasco, Director of Service I - Museum Collections, we learn that the purpose of the sponsorship agreement is to encourage a widespread approach to managing insurance relations between those involved in the organization of exhibitions and the various insurance companies operating in this sector within the Italian government's broader efforts to promote and protect the country's cultural heritage and artistic treasures[131]. The aim is to improve the efficiency and effectiveness of the procedures for taking out insurance policies, reducing their time and cost, simplifying, streamlining and standardising the related operations, all with a view to ensuring greater transparency and impartiality and consequently reducing the risks of loss and damage to the loaned artworks. The article by Marilena Pirelli, published in Il Sole24Ore in 2020, reports that the insurance value of the goods loaned abroad in 2019 by the 470 Italian museum institutions reporting to the General Directorate for Museums is approximately €2,408,000,000[132]. Given the capital at stake, it is necessary to emphasise how officials and managers belonging to the MIBACT sphere are forced to deal with insurance issues that they often lack an accurate technical knowledge of, which is essential to avoid the risk of imposing conditions that are unacceptable to the insurance market and that could create risks of nullity of the insurance contract itself. Moreover, it is often the case that the various Italian museums dictate different rules regarding the lending of their works of art. The platform Assicura l'Arte offers itself as a solution to these problems, as it was created with the idea of developing an insurance product that would provide comprehensive protection for artworks loaned for temporary exhibitions, drafted by experts in the fine art insurance sector. More specifically,

[130] DIREZIONE GENERALE MUSEI (curated by), *Al via la piattaforma "Assicura l'Arte"*, 15 January 2020, available at http://musei.beniculturali.it/notizie/notifiche/al-via-la-piattaforma-assicura-larte (last consultation: 26/06/2023)
[131] DG-MU circular n. 09 January 2021
[132] PIRELLI M., *Il Mibact lancia un portale per assicurare i prestiti dei musei*, «Il Sole 24 Ore», 10 January 2020

the online portal, which can only be accessed by those involved in the lending operations so as to ensure maximum confidentiality for such practices, ensures uniformity with regard to the requirements of museums belonging to the MIBACT in relation to insurance conditions that are included in loan agreements, overcoming the common problem of individual guidelines. It also relieves officers and directors of the responsibility for choosing and evaluating insurance contracts, which is often carried out in a not fully informed manner. In implementation of the measures identified in the 2018 - 2020 Three-Year Corruption and Transparency Prevention Plan[133], and the 2019 - 2021 Three-Year Corruption and Transparency Prevention Plan[134], Assicura l'Arte guarantees maximum transparency of decision-making paths, since all insurance policies are the result of a tender process[135]. Finally, the platform creates a database that contains a history of all loans made by the museums of the MIBACT, including documents on the value of the items, condition reports, frequency of the loan of the individual artwork and the requesting museum. In addition, it allows a mapping of the location of loans updated in real time[136].

The insurance companies that can access the platform will be selected on the basis of financial strength (rating not lower than A or solvency index not lower than 150%); financial capacity (business volume or non-life premium income in the previous three years, in total, not lower than €900,000,000 and non-life premium income in the previous three years in the transport sector not lower than €30,000.000); technical capacity (premium income in the previous three years of not less than €1,000,000 in the art sector, availability of an international expert network, capacity to underwrite a risk policy with a maximum cover of not less than €200,000,000) and of course specific experience in the art sector. These insurance companies will be able to submit their economic offers to those involved in the organisation of exhibitions (ministerial institutes or companies that, on their behalf, undertake to organise exhibitions) who, in turn, are not obliged to use the platform, let alone to conclude insurance policies with the companies selected there.

[133] AUTORITA' NAZIONALE ANTICORRUZIONE (curated by), *Piano triennale di prevenzione della corruzione dell'A.N.AC. Triennio 2018-2020*, as per Ministerial Decree no. 75 of 31/1/2018
[134] AUTORITA' NAZIONALE ANTICORRUZIONE (curated by), *Piano triennale di prevenzione della corruzione dell'A.N.AC. Triennio 2019-2021*, as per Ministerial Decree no. 35 of 31/1/2019
[135] PIRELLI M., *Il Mibact lancia un portale per assicurare i prestiti dei musei*, cit.
[136] DIREZIONE GENERALE MUSEI (curated by), *Guida Assicura l'Arte – applicazione per la gestione assicurativa del prestito delle opere d'arte*, updated at 25 February 2020

The insurance conditions, agreed in advance with the General Directorate for Museums, are binding for all participants. In particular, the guarantee provided by the policy defined by MIBACT covers art objects during transport up to a maximum indemnity limit of €200 million, and during storage at the exhibition venue up to the sum of €500 million resulting from the sum of the individual insurance certificates[137]. It is a nail-to-nail insurance policy in the all-risks formulation, where are excluded damages and losses caused by normal use or gradual deterioration, inherent defect; unauthorised restoration, maintenance or cleaning work; radioactive or biological contamination; insurrection, nationalisation, acts of terrorism. The cover operates on the basis of the accepted value, and therefore, in the event of

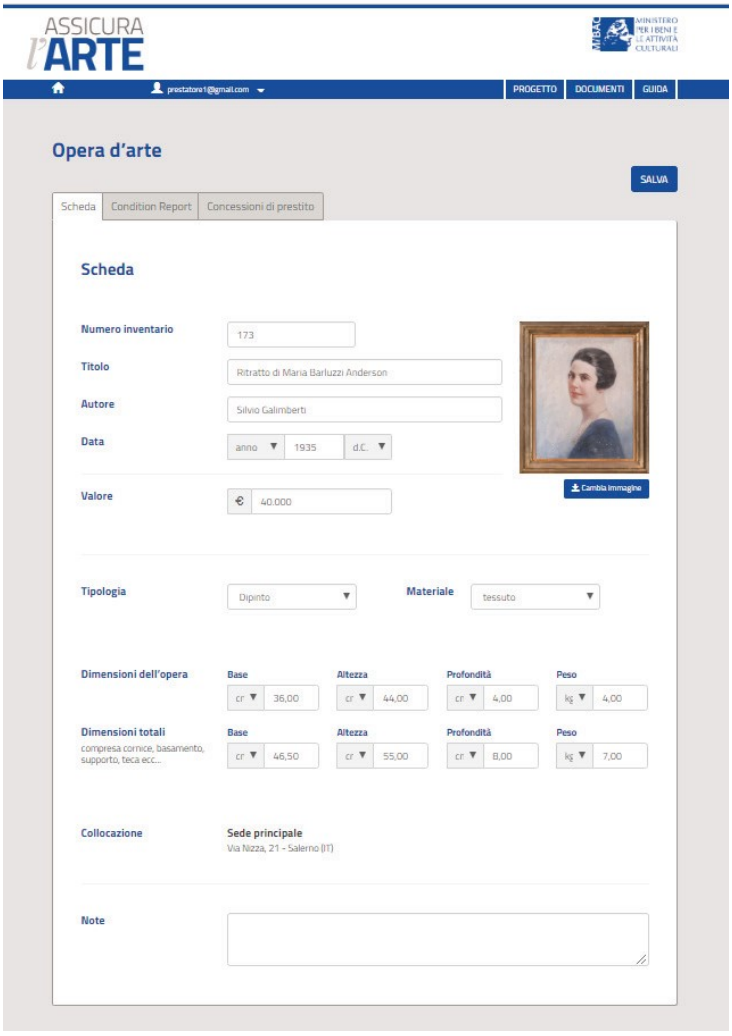

Figure 2.2. Identifying information about the artwork useful for insurance policy evaluation. Source: DIREZIONE GENERALE MUSEI (curated by), *Guida Assicura l'Arte – applicazione per la gestione assicurativa del prestito delle opere d'arte*, updated at 25 February 2020: 9

[137] PIRELLI M., *Il Mibact lancia un portale per assicurare i prestiti dei musei*, cit.

an indemnifiable loss, the insurers will proceed to pay the claim assuming the capital sum insured, without any deductible or excess.

The guide provided by MIBACT explains in detail how the platform works, starting with a description of the actors involved in the selection of the appropriate insurance contract. Firstly, the cultural institution that receives a request for the loan of one or more items and decides to accept it, should insert the relevant information regarding those artworks inside the dedicated area of the platform. Subsequently, the digital application will automatically notify the accredited insurance companies, providing them with access to the relevant information regarding the items to be loaned and the specificity about the exhibition venue, enabling them to prepare a quotation within the deadline indicated by the requesting institution (see figure 2.2).

When all the companies have entered their respective economic offers, the requesting institution will be notified of the completion of the insurance competition, and will then be able to exercise its discretion in selecting the most advantageous offer. Once payment has been made, the platform will make the insurance certificate covering the loaned works

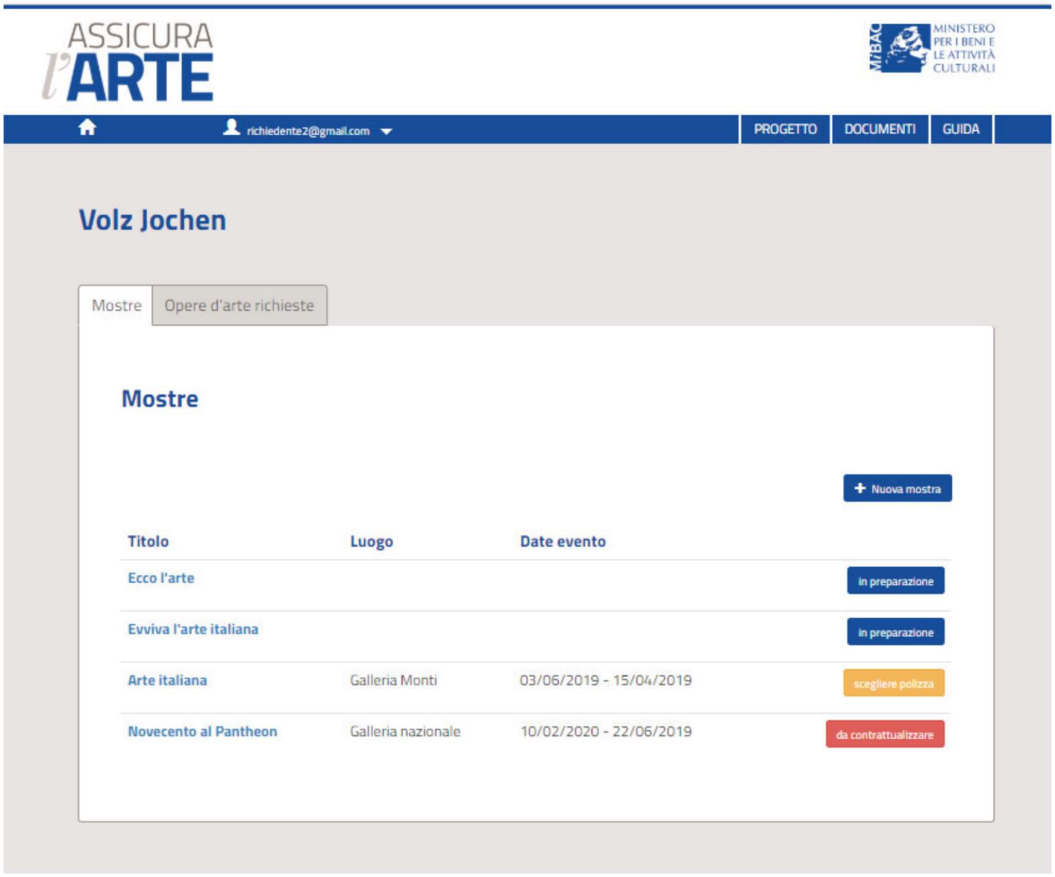

Figure 2.3. In the applicant's profile, for each exhibition, the link to open the relevant tab is active on the title and the status of the current concession is visible. Source: DIREZIONE GENERALE MUSEI (curated by), *Guida Assicura l'Arte – applicazione per la gestione assicurativa del prestito delle opere d'arte*, updated at 25 February 2020: 14

available to both the requesting and lending institutions.

In the lender's profile, as regards to the items catalogued in the application, the status of the current concession file, if any, will be visible for each of them. In addition, the institution can also access information such as the number of artworks loaned, the name of the loan applicant, the start and end dates of the exhibition and its status. On the other hand, the requesting institution's profile has access to the various occasions for which it has requested a loan, the information regarding the pertinent art pieces and the characteristics of the event which are relevant for insurance purposes, as well as data on modes of transport and packing (see figures 2.3 and 2.4).

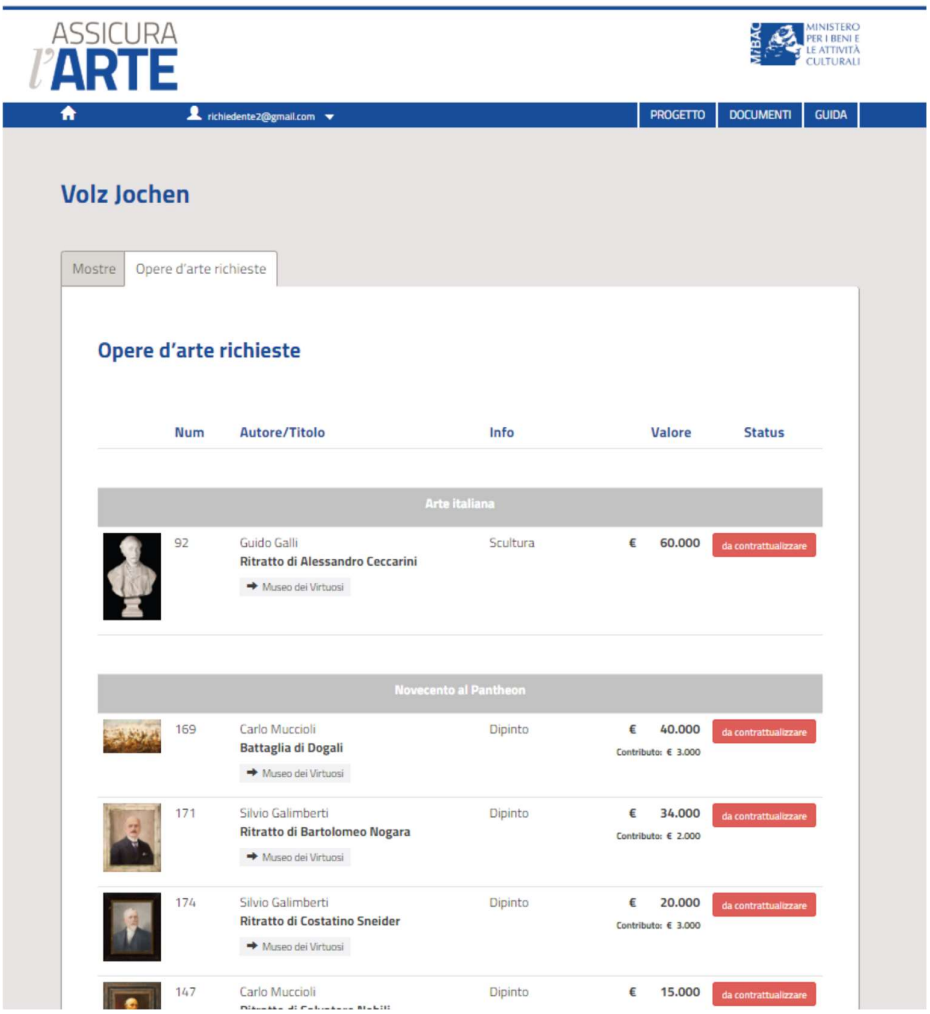

Figure 2.4. Artworks that have been included in the insurance coverage files are grouped by exhibition. For each item, the most important identifying information is visible. Source: DIREZIONE GENERALE MUSEI (curated by), *Guida Assicura l'Arte – applicazione per la gestione assicurativa del prestito delle opere d'arte*, updated at 25 February 2020: 15

In conclusion, the online platform addresses the need to connect the various actors involved in the organisation of exhibitions and events with insurance companies specialised in the art sector and facilitate the conclusion of nail-to-nail policies. This need is all the more imperative because this type of policy is required for the issuance of the ministerial authorisation necessary for the export of works of art pursuant to Article 48(4) of the Cultural Property Code.

2.2 Artificial Intelligence and its impact on fine art insurance

The insurance industry is undergoing a significant transformation thanks to the integration of Artificial Intelligence (AI), which is streamlining repetitive tasks and enhancing decision-making capabilities. Artificial Intelligence refers to the ability of machines to exhibit intelligence by analysing and responding to their environment. There are several definitions for AI and one of the earliest and broadest ones is that elaborated by the High-Level Expert Group on Artificial Intelligence of the European Commission according to which: «Artificial intelligence (AI) systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal»[138]. A machine is deemed "intelligent" when it can effectively assess its surroundings and take actions to maximize the likelihood of achieving its designated objective. Algorithms are a critical component of AI, providing a defined set of steps for a computer program to perform a task based on specific conditions to be executed at a speed and frequency that surpasses human capabilities.

The insurance industry has been quick to embrace machine learning due to its reliance on large amounts of data and repetitive procedures. First of all, AI can automate insurance processes, leading to quicker and more efficient policy issuance and claims processing for customers. As an example, insurance companies have integrated chatbot interfaces to streamline claims reporting. These interfaces employ natural language processing and draw upon historical claims data to increase efficiency and accelerate the claims processing

[138] HIGH-LEVEL EXPERT GROUP ON AI (curated by), *A definition of AI: Main capabilities and scientific disciplines*. European commission; April 2019

timeline. Contemporary AI technologies are proficient in tasks such as content recognition, smart prioritisation and prompt response time, consequently decreasing customer waiting times and augmenting satisfaction levels. A noteworthy illustration can be observed in Fukoku Mutual Life, a Japanese life insurance company that incorporated an AI application in 2017 to improve the effectiveness of its medical claims processing procedures. The app precisely computes payouts based on a range of factors, including the specific medical treatment, length of hospital stay, medical background, and insurance stipulations. The programme scans medical certificates, hospital invoices, and internal records of claims to avoid payment oversights by referring to the insurance contract for any unique cover conditions. A team member approves and releases the computed payout. This AI technology caused a 30% increase in productivity and significant enhancements in payout precision. To summarise, the use of artificial intelligence facilitates precise and effective claims processing, resulting in prompt pay-outs. This is achieved through the utilization of corporate data, including historical claims records and insurance agreements, and third-party data, such as medical certificates and hospital invoices[139].

Moreover, by leveraging data analytics, AI can also provide insurers and their clients with a more comprehensive understanding of their risks, enabling them to be mitigated more effectively and to create new insurance solutions that were previously not feasible. The pervasive digitalization of society entails a growing collection of data from various sources such as sensors embedded in properties and machines, interconnected devices, mobile devices, and the digitalization of many processes. Simultaneously, there is a noteworthy trend of customers displaying a greater inclination to share personal information. However, the efficient usage of this data to extract insights and value depends on the availability of appropriate tools for its processing. Here, AI plays a critical role in aiding data analysis and interpretation, thus enabling individuals and organisations to utilise the data to their advantage[140].

Artificial intelligence can also be used to create unique and customised insurance policies by analysing extensive company data such as past policies, customer feedback, claims data, public and demographic statistics. This analysis enables the AI system to generate diverse insurance products, which can be launched into the market at a faster pace and with reduced costs. By utilizing diverse data sources and predefined product

[139] DELOITTE DIGITAL (curated by), *From mystery to mastery: Unlocking the business value of Artificial Intelligence in the insurance industry*. 2017: 31-32
[140] *Ivi*: 30

specifications, artificial intelligence (AI) has the potential to create ideal insurance offerings for particular target groups or individual customers. This allows insurance companies to enhance product personalisation, boost market responsiveness, and meet the changing demands of their customers effectively[141].

As we have seen, AI can help address various challenges thus leading to higher customer satisfaction levels. However, compared to other sectors like retail, life sciences, and manufacturing, insurers have been slow to realize AI's potential. One reason for this lag is the industry's failure to identify the many opportunities AI offers across the insurance value chain. By exploring these entry points, insurers can tap into the potential benefits of AI. The automation of claims handling processes is one of the most advanced AI applications in the insurance industry, as well as decision-making in underwriting, pricing and marketing. With the latest AI technology, insurers can enhance content recognition, prioritize claims more intelligently, and decrease response times[142].

In conclusion, AI is more than just data analytics: its advanced algorithms enable it to analyse vast amounts of data and generate unique insights while automating repetitive tasks. This capability provides significant opportunities for businesses to optimize existing procedures and develop new ones, resulting in a competitive advantage. By harnessing the power of AI, companies can gain valuable insights into their operations and customer behaviour, enabling them to make informed decisions and stay ahead of the curve[143].

However, there are several risks associated with AI technologies about which companies are concerned about. One of the major apprehensions is the one regarding cyber risks. In fact, it has been found by researchers that certain machine-learning models face challenges in identifying adversarial input, which refers to data that is intentionally crafted to mislead the model[144]. AI systems' safety and reliability are also a common concern for executives. Moreover, a high degree of concern is associated with legal and regulatory risks. In particular, the recent implementation of the General Data Protection Regulation (GDPR) in Europe enforces privacy rules that necessitate cautious implementation. The GDPR mandates that companies utilizing personal data to make automated decisions that affect individuals must be capable of clarifying the reasoning behind the decision-making process. However, complying with these regulations can be difficult for some AI adopters due to the increased

[141] *Ibidem*
[142] *Ivi*: 29
[143] *Ivi*: 9
[144] DAVENPORT T., LOUCKS J., SCHATCKY D., *State of AI in the enterprise, 2nd edition*. Deloitte Insights; 2018

complexity of machine learning and the rising popularity of deep-learning neural networks, which can function like black boxes, providing highly accurate results without any explanation of how those results were derived[145]. Another example of potential risks associated with the use of this kind of technologies in the insurance sector, is the one offered by so-called machine bias, the effect of incorrect assumptions in the machine learning processes of algorithms. Such distortions reflect problems with the collection or analysis of data, where systems draw improper conclusions about information sets. Moreover, another concern is the historical nature of the data used to train AI algorithms. Since the digital footprint is inherently rooted in the past, relying solely on mechanical analysis of this data may not yield accurate results if future events differ significantly from past occurrences. In this respect, the assessments made by artificial intelligence tools suffer from the same limitations as human decisions, which can be flawed when based solely on experience and fail to take into account deeper logical considerations and broader evaluations of the changing context. However, the evaluations produced by artificial intelligence systems remain much more precise than human ones, because they are based on the ability to analyse an infinitely greater number of elements and to grasp their connections[146].

In light of these risks, regulators are beginning to move to define standards and controls for the use of AI, with significant impacts also on the insurance sector: this is the case, for example, with the European Regulation on Artificial Intelligence (AI Act), the first EU regulatory framework for AI, proposed by the European Commission in April 2021. It presents a process of analysing and categorizing AI systems based on the potential risks they pose to users in various applications, ranking them as unacceptable risks, high risks and limited risks. The level of risk associated with each system will determine the degree of regulation required for its use[147]. The final form of the law is still to be defined, but the aim is to reach an agreement by the end of 2023.

2.2.1 Artificial intelligence in the evaluation of works of art

In the fine art insurance sector AI technology is facilitating intelligent risk assessment and pricing decisions, expediting the claims process, and improving the overall customer

[145] *Ivi*: 12. EU regulation n. 2016/679 (GDPR)
[146] CAPONE D., *Quaderno n. 16. La governance dell'Artificial Intelligence nel settore assicurativo tra principi etici, responsabilità del board e cultura aziendale*. IVASS, Roma: Febbraio 2021: 6-7
[147] MADIEGA T., *Artificial intelligence act*. European Parliament Research Service; June 2023

experience. AI has enormous potential especially in identifying new links between characteristics of individuals and risk patterns, thus helping the insurer in personalizing the insurance premium and the product itself. Additionally, AI is optimizing document workflow management for brokers and agents, resulting in a more seamless process. In particular, AI can improve the handling of claims by offering tools that speed up their processing and allow fraud attempts to be detected[148].

Exploiting the potential of artificial intelligence can also be enormously effective in the evaluation of works of art. The necessity to build a new evaluation model for fine art based on objective and qualitative methods, steams from the need of aligning the estimate of the value of these assets more closely with the objective quantitative approach adopted for the valuation of other assets. This new evaluation model must, however, be complemented by subjective expert estimates, which are always an indispensable reference even for a validator using quantitative methods to better define the attributes of the work of art being evaluated.

The article "*La valutazione delle opere d'arte con un approccio integrato*" that can be found in The Art Finance Report 2022 by Deloitte, proposes a new evaluation method based on the combination of AI and the support of art experts[149]. In particular, the aim of this comprehensive model is to establish a transparent and empirical approach for determining the fair value of art pieces and collectibles. This approach is based on quantitative data analysis as well as on objective factors that cannot be reduced to numerical values, such as the artist's style, the auction house, and other particulars related to the artwork and its creator. These aspects are critical components of the vast array of information utilized by art critics, and thus serve as a crucial foundation to the valuation technique employed by this model. The proposed approach consists of two phases: the application of the neural approach and the use of the hedonic price method. The neural method is a quantitative approach that has the capability to comprehend the interconnections among asset features in a manner similar to that of a proficient human mind. Artificial intelligence functions as an intermediary technology between mathematics and the human brain by transforming these relationships into inference matrices that can capture both linear and non-linear dependencies, leading to the determination of the asset's price. By processing vast amounts of data at rapid speeds, this technology surmounts the limitations of human cognition and delivers precise and prompt price estimates. The databases used are mainly those related to the auction prices of individual artworks, including specifics on the object, the author and the auction house. The neural

[148] CAPONE D., *Quaderno n. 16.,* cit.: 11
[149] DELOITTE (curated by), *Il mercato dell'arte e dei beni da collezione*, cit.: 81-84

network captures the dynamic non-linear relationships that characterise this type of market, also filling the gap created by the lack of continuous time series of artwork prices as it considers the commodity within the ecosystem and contingency in which it is immersed, allowing the valuation even if any trading occurred. The research encourages to use the neural method in combination with the hedonic one which is based on a relation that links the artwork's value with some of its characteristics, following an analysis of the historical transactions registered worldwide in the art sector which are comparable with those to be evaluated. In fact, the general report is refined with a focus on fine art pieces with similar characteristics and, in order to quantify the impact of each of them on price, the estimation of the regression coefficient is required. The method in question, being based on a statistical approach, allows to transparently provide the statistical significance of the individual variables identified and in general the level of reliability of the relationship determined. In conclusion, the hedonic method is being suggested as a validation method for the neural one in the context of analysing the market value of a particular asset since the reliability and accuracy of the first one is linked to the number of transactions for similar artworks historically available, while the second method captures and identifies patterns and relationships between variables of this type of asset within the market in which it is embedded. The integrated approach proposed by this research should not be considered as an alternative to expert evaluations, but on the contrary should be seen as an aid to the evaluations carried out by experts, particularly for certain valuation applications which require a specific level of objectivity. Indeed, it does not consider artistic merit but defines the impact of the various value drivers on the price of works of art according to a purely financial and objective logic. In other words, this type of valuation tends to overcome certain criticalities present in subjective valuations but, conversely, given the specific characteristics of this type of asset, it is evident that one cannot adopt purely quantitative approaches to determine the value of an artwork.

2.2.2 "Art Recognition" system: the use of AI in the authentication of works of art

Ensuring the authenticity and attribution of a work of art is paramount when evaluating and securing a fine art insurance policy. The task of attribution involves identifying the artist who produced an artwork, while authentication aims to verify whether the artwork was indeed crafted by the presumed artist. These tasks are crucial as they directly

impact both the economic and cultural value of artworks. Art attribution involves the analysis of an artwork's style, materials and subject, to determine the responsible artist. Multiple artists and scarce information in older works can make this process challenging. Art authentication entails thorough scientific examination including pigment, canvas and paint application analysis, as well as historical context[150]. In this costly and time-consuming process, experts are commonly enlisted to verify the legitimacy of the artwork. Notably, the use of artificial intelligence, as illustrated by the example of Art Recognition[151], can also play a pivotal role in determining the authenticity of a work of art.

The AI system developed by Art Recognition, a Switzerland-based company founded in 2019, is based on the principles of deep artificial neural networks. This system is trained to comprehend the distinctive characteristics of artists by analysing photographs of all authenticated artworks associated with a particular artist. The internal database comprises millions of training images of verified authentic artworks, ranging from old masters to contemporary artists. A thorough training dataset is provided for every artist, consisting of top-quality images of all their known works. Furthermore, the dataset incorporates images of counterfeit pieces and works produced by those inspired by the artist. The primary focus of the AI is on acquiring knowledge of details such as brushstrokes, which are unique to an artist's style, as well as other features like object placement, chromatics, and high-level compositional elements. After completing its training, the artificial intelligence analyses the artwork's image to determine its authenticity. This is achieved by comparing the features it has learned with those identified in the artwork. Subsequently, the system provides a probability score that indicates the likelihood of authenticity for the examined art piece[152].

In particular, this streamlined process offers a quick and cost-effective means to authenticate any artwork, eliminating the need for transporting the pieces. The Art Recognition's AI proprietary system significantly improves the transparency and integrity of the art market. During the interview with Jean Gazançon, CEO of ARTE Generali, Carina Popovici, CEO & co-founder of Art Recognition states that: «the wealth of knowledge and expertise of art connoisseur is unquestionable, and we respect that very much. However, it is important to stress that currently there is an issue in the authentication process. Namely the

[150] POPOVICI C., POSTMA E., SCHAERF L., *Art authentication with vision transformers*. Neural computing and applications; 2023

[151] For more information visit the website https://art-recognition.com/ (last consultation: 12/11/2023)

[152] Interview by Jean Gazançon, CEO of ARTE Generali, to Dr. Carina Popovici, CEO & co-founder of Art Recognition. ARTE GENERALI (curated by), *How can Artificial Intelligence support and complement the process of Art authentication?*, 28 October 2023, available at https://www.youtube.com/watch?v=Ns31-CymvpQ (last consultation 12/11/2023)

fact that there is a huge amount of power concentrated in the hands of just a few individuals. With that in mind I also want to add that our goal is not to replace the art experts but to complement their efforts and I firmly believe that the two methods should reinforce each other, and that this collaboration is essential for enhancing the transparency and objectivity of the entire art authentication process»[153].

After submitting a photo of an artwork, clients will receive a comprehensive AI report and a digitally encrypted certificate of authenticity within seven days. The results are purely data-driven without any human intervention, thus avoiding any bias. At present, Art Recognition has successfully conducted over 500 AI authenticity evaluations for more than 100 individuals, including private collectors, auction houses, art dealers, consultancies, galleries, and legal authorities.

A notable case study exemplifying the potential of this AI system for evaluating controversial artworks can be found in the two versions of Kees van Dongen's painting, titled "*Nu en Buste*". The two almost identical versions of this painting were recently brought to auction. In particular, version A was firstly acquired at auction in 2008 with a certificate of authenticity from the Wildenstein Institute. In 2019 the artwork was withdrawn from a Paris auction when the Wildenstein Plattner Institute (WPI) questioned the initial valuation and rejected its inclusion in the Catalogue Raisonnèe, without disclosing any information about their decision. Version B, which was auctioned in Paris in May 2020, came with a WPI certificate. WPI was willing to reassess version A but required provenance records for reconsideration. Regrettably, the client lacked substantial provenance information, aside from the 2008 auction purchase and listing in a 1989 catalogue. Moreover, the auction house from 2008 failed to provide any provenance details, further complicating the authentication evaluation. In order to clarify a complex scenario, the owner of version A enlisted the assistance of Art Recognition. Upon receiving high-resolution images of the two paintings, the company initiated the process by training their AI to recognize the primary features of the artist using a set of images of authentic van Dongen paintings. The dataset was compiled from exhibition catalogues featuring works attributed to the Fauvist artist from exhibition catalogues like "Musée National d'Art Moderne, Paris" (1967), "Museum Boymans-van Beuningen, Rotterdam" (1968), and "Fondation Pierre Gianadda, Martigny" (2002). In order to improve the algorithm's discriminatory capabilities, paintings by artists with comparable styles and chronologies, like Otto Müller and Albert Marquet, were also included in the

[153] ARTE GENERALI (curated by), *How can Artificial…*, cit.

training set. After successfully learning to recognise van Dongen's features, the two disputed paintings underwent evaluation by the Art Recognition AI system. The system confirmed version A as a forgery with a 73% probability, while version B was assessed as authentic with an 81% probability. Art Recognition also conducted an in-depth analysis by subdividing the images into smaller patches and examining them individually. This examination validated the prior findings. Generally speaking, the quantity of generated patches is contingent upon the image resolution. Specifically, they create 20 patches from images with a resolution surpassing 1024×1024 pixels, 4 patches from images with a resolution less than or equal to 1024×1024 pixels but greater than 512×512 pixels. Images with a resolution smaller than 512×512 pixels are not subjected to patching.[154].

The comprehensive report that is sent to clients contains information about the AI's assessment on the authorship, the artist's style, a heat map and additional visual information such as brushstroke and activation maps. In particular, the heat map generated by the algorithm visually represents its evaluation. The interpretation is as follows: areas highlighted in red indicate the most crucial areas for the algorithm's decision, with the importance decreasing as the shade of red becomes lighter, while uncoloured regions hold minimal influence on the decision. Additionally, a brushstroke boundary extraction map is generated to showcase the brushstrokes learned by the algorithm.

In particular, the AI utilises two distinct types of artificial neural networks to discern an artist's primary features: a Convolutional Neural Network (CNN) with an embedded module for brushstroke extraction and a Vision Transformer[155]. While initially geared for natural language processing, Transformers are an innovative set of deep learning architectures that have gained widespread popularity in the real of computer vision. Notably, Vision Transformers have shown significant aptitude for image classification and Art Recognition has been a pioneer in utilizing them for authentication of art pieces. Specifically, the procedure involves feeding each artwork from the training set through the layers of the artificial neural network, where the features are identified and consolidated prior to the final layer, where the art piece is classified as "authentic" or "non-authentic". If the classification is correct, the characteristics are maintained; otherwise, the artwork receives additional processing, and alternative features are obtained. This iterative process is repeated numerous

[154] ART RECOGNITION (curated by), *Kees van Dongen: "Nu en Buste"*, available at https://art-recognition.com/case-studies/kees-van-dongen-nu-en-buste/ (last consultation 12/11/2023)

[155] The networks employed are described in detail in POPOVICI C., POSTMA E., SCHAERF L., *Art authentication with vision transformers*, cit.

times for every artwork within the training set, until the neural network efficiently grasps the unique features of the artist[156].

Upon completion of the training phase, the company proceeds to assess the robustness of the trained neural network. This evaluation involves measuring the performance on a testing set which comprises artworks that were not previously used in the training data, including high-quality forgeries. The evaluation employs two key metrics: the confusion matrix and accuracy. The process entails examining these metrics to identify the optimal model, specifically the one capable of correctly classifying the highest number of images in the testing set. This chosen model is then utilized to calculate the class probability for the artwork under consideration. Since the neural networks are designed to recognise two categories, authentic and non-authentic, a binary confusion matrix is utilised. This matrix includes four separate squares, each with distinct interpretations (see table 2.1):

- True positives: the paintings that are authentic have been correctly identified as such.
- False positives: non-authentic paintings incorrectly identified as genuine.
- True negatives: the paintings that are not authentic have been correctly identified as such.
- False negatives: genuine paintings incorrectly identified as non-authentic.

An example of the confusion matrix for the best model is presented in the table.

True Positives: 281	False Negatives: 14
False Positives: 17	True Negatives: 254

Table 2.1. Confusion matrix on a testing set. Source: ART RECOGNITION (curated by), *AI authentication report by Art Recognition*. 2023

Accuracy, defined as the proportion of correct prediction (both authentic and non-authentic) out if total predictions, serves as a pivotal metric. In the provided example, the best model exhibits an accuracy of 96.8% on the test set, indicating exemplary performance[157].

After the completion of effective training, Art Recognition proceeds to submit the painting's image through the top-performing model. The algorithm then analyses the artist's features that it learned from the training images and compares them to those present in the given image. The algorithm subsequently calculates the probability of a positive or negative

[156] ART RECOGNITION (curated by), *AI authentication report by Art Recognition*. 2023
[157] *Ibidem*

response, indicating whether the painting is authentic or not. This probability is determined as the median of the probabilities assigned to all individual patches[158].

In conclusion, the integration of AI methods into the realm of art enhances accessibility for collectors and boosts the confidence of various stakeholders, including auction houses, art dealers, galleries, private collectors, trusts, art advisors, and insurance companies on a global scale. ARTE Generali proposes Art Recognition among its services available through their app, in particular on *My Concierge* section, in order to help collectors detect fakes and forgeries. In fact, as Jean Gazançon states: «since its launch, ARTE Generali has thrived bringing innovative services to its clientele of collectors. Helping the authentication of art pieces is important in securing the insurance value of a collection. The approach proposed by Art Recognition, using AI in a very simple way for the clients is definitely helpful in starting an identification/authentication process and we are happy to propose it to our clients via our Art Concierge Platform»[159].

2.2.3 Artificial intelligence analysis of the art market: the Wondeur case

AI-technology can be also used to carry out an accurate and unbiased analysis of the art market. In particular, an excellent example of this can be found in Wondeur AI, an innovative startup founded by Olivier Berger and Sophie Perceval in Toronto, Canada. The algorithm is able to determine the development of contemporary artists, to assess the value of artworks in relation to fluctuations and influences in the art market. Moreover, by examining the last hundred years of art history, looking at the carriers of famous and forgotten artists, at museums or galleries' exhibitions and private collections in addition to publications, auction sales and to all those interconnected events that actually build up an artist's carrier, Wondeur AI can evaluate the risks regarding the evolution of the values of their artworks. To summarize, the algorithm looks at the ecosystem of art and analyses how it works and where are the drivers of change. Wondeur AI can provide a wider examination of the art market in comparison to other solutions which focus their research mostly on artists which are active in the auction market and that have had more than five transactions in the last ten years. In particular, according to Italo Carli[160], the trend analysis that this kind of searches can do is on

[158] *Ibidem*
[159] Available on the website of Art Recognition https://art-recognition.com/ (last consultation 13/11/2023)
[160] CARLI I., *L'Intelligenza Artificiale al servizio di gestione e valorizzazione di una collezione: il caso Wondeur*. In: ARTE Generali, ed. *L'ecosistema digitale dell'arte*. 2021: 38-41

less than 1% of the art market because the majority of post-war and contemporary artists have had less than three auction transactions in the past decade, indicating that the most consistent part of their sales occurs on the dealer market. Due to the highly fragmented nature of this market, relying solely on auction data can be misleading when determining the true market value of an artwork.

On the contrary, the algorithm realized by the researchers from Toronto considers the 95% of the artists born after 1900, whether they were active or not in the auction market. The AI system tracks the growth of artists, measures the evolution of their value, and assesses the global influence of museums and galleries. It achieves this by analysing patterns in the careers of numerous artists and monitoring various levels of systemic bias towards certain artist categories. This approach allows a breadth investigation of the factors of changing value in the past and the risk for value to change in the future, providing a rich study useful for insurance companies and wealth managers active in the field of risk management.

Wondeur AI made a partnership with ARTE Generali that enables insured to access to the services provided by the algorithm through the ARTE Generali App. Thanks to the specific function *My Art Market Trends* the customers can monitor and compare the performance of the artists within their collections. In order to predict the measure of value change, the algorithm analyses data at four levels: the asset level, artist level, portfolio level and market level. This is particularly important for those collectors with a large number of artworks. In fact, by inserting on the app all the information about their possessions, the system immediately understands the risk distribution in the private or public collector's portfolio, understanding the value distribution and helping the advisors to give much more awareness around buying, selling and ensuring art[161].

The section of ARTE Generali App to access Wondeur AI is very simple to use. The user just needs to type the name of the post-war or contemporary artist he/she is interested in and a series of information about last market developments will be provided. In particular, the career stage of the artist will be calculated with the related risk of erosion in terms of long-term value. The analysis follows with an explanation of the last five years changes in value, explaining if it increased, decreased or remained constant. The AI will also provide the user with an opinion on liquidity value bringing an example of an average artwork of the contemporary artist in relation to its year of creation and dimensions. It compares this result with its own opinion on the intrinsic value of the artwork, pointing out that when prices fall

[161] *Ibidem*

outside the given range, mispricing risk is high. The research follows by going in detail about the last five years career growth of the artist, comparing it with the one of other contemporaries giving a percentage measure of this growth rate. The same timeframe is taken into account to calculate the number of museums and galleries that supported the artist, providing a detailed list of significant events such solo shows and group exhibitions. The analysis is concluded by estimating the collection rank of the artist and producing future outlook about the institutional position and value creation of the person.

To provide an illustrative demonstration of Wondeur AI's application in the ARTE Generali app, the case study of the globally acclaimed artist Marlene Dumas serves as an appropriate example. After searching the name of the artist on the app, the AI provides a series of information. In particular, according to the algorithm evaluation, Marlene Dumas is positioned in the highest echelon of artists, famously known as "stars". This ranking indicates that she is among the top 0.04% of artists worldwide who have earned substantial institutional recognition. As a result, Marlene Dumas' long-term value is least susceptible to erosion, making her highly esteemed in the art world. Based on the analysis conducted by Wondeur AI, it is evident that the artist has undergone significant career development. Nonetheless, the investigation indicates that the value of her primary medium, painting, has not witnessed a noteworthy upsurge during the past five years. Moreover, the analysis indicates that her growth rate in the last two years has not exceeded the growth rate observed over the previous five years. The AI has assessed that the estimated liquidity value of a 1995 painting by Marlene Dumas, measuring 78.7x39.4 inches, is US$1.6 million. This value represents the potential selling price of her average artwork in the current market. The artificial intelligence's assessment of the intrinsic value of the same average artwork of the artist indicates a valuation between US$778,000 and US$1.2 million. This estimation has considered crucial elements such as the artist's career path and global comparisons among a pool of 250,000 artists. The Wondeur AI's analysis indicates that deviations from this price range pose a greater risk of mispricing. This suggests that prices considerably above or below the estimated range may not precisely reflect the artwork's genuine intrinsic value. Marlene Dumas is among the foremost artists worldwide, placing herself in the top 2.67% of the art industry. The artist has achieved a remarkable growth rate of 4.01% over the last five years, defining herself as an artist on the rise. Furthermore, the AI reports that over the past five years, Marlene Dumas has received significant recognition from influential institutions worldwide. More specifically, she has garnered attention and sponsorship from museums that are amongst the most prestigious 0.49% globally. Additionally, galleries that rank amongst

the top 0.73% of noteworthy establishments have recognized and supported her artistic practice. Over the past five years, Marlene Dumas has exhibited her talent at four solo exhibitions and 81 group exhibitions held at esteemed institutions, including the Museum of Contemporary Art in Chicago, the Walker Art Centre in Minneapolis, and the Stedelijk Museum in Amsterdam. The artist primarily expresses her artistic vision mainly through the medium of painting. It is worth mentioning that one of her paintings has achieved notable recognition by entering into the Tate Britain in London in 2018, one of the top museum collections worldwide. Among the top 100 museums across the globe, Marlene Dumas has established herself as one of the most highly collected artists, ranking within the top 1.36%. This achievement illustrates her widespread recognition and appeal within the art world. Therefore, it is apparent that Marlene Dumas is likely to maintain a strong presence in prestigious institutions for the foreseeable future, consolidating her status as a leading artist.

Woundeur AI does not seek to replace the expertise of art professionals, but rather to complement and amplify it. According to Italo Carli two types of AI exists: the one that aims at replacing the human expertise, which is an approach that would lead to a mistake, in particular in the art field, because of the specificity of this kind of asset; and the one that seeks to integrate and enhance human knowledge which is the objective and reason of existence of Wondeur AI[162].

2.3 Blockchain technology: possible applications to fine art insurance

In order to explain the effect of blockchain on fine art insurance, it is first necessary to clarify what blockchain is. Blockchain, a protocol for the exchange of data over the internet without a single authority, is included into the larger block of Distributed Ledger Technology (DLT), all those systems characterized by a distributed ledger that permits to manage and validate the transactions and information of the network. The governance and verification of DLT are based on the concept of trust among all the actors of the system which monitor the processes without a central authority controlling the flux. The absence of intermediary guarantees a strong democracy that makes the blockchain a revolution in terms of data management. In other words, blockchain data are distributed among many different computers and networks and are processed and stored on all of them at the same time. In this situation, the information that initially inputs the system and is subsequently processed when

[162] *Ibidem*

transactions take place, remains in the system indefinitely. Alterations to the data cannot be made unilaterally without the involvement of the other participants in the transactions and operations being made aware[163]. This participative mechanism is based on the complete transparency and security of information guaranteed by cryptography and disintermediation in order to create a shared, encrypted database of transactions that, once they are validated and recorded, the stored records are irreversible. The protocol is to establish an ever-lengthening chain of blocks of data, each of which has compact record of validated transactions by participants in the blockchain. Therefore, a feature of the blockchain system is its security. Firstly, the data cannot be unilaterally altered, and secondly, security is ensured by a special way of encoding the data. The data encoding is created by the system itself using sophisticated mathematical and logistical algorithms, which only supercomputers can recognise. This approach significantly reduces the risk of a hacker attack on the system and the possibility of unauthorised parties gaining access to it[164].

The implementation of blockchain technology in the insurance industry is gaining momentum both in terms of its application to financial transactions and in operational transactions as the conclusion of insurance contracts, settlement of claims and modification of existing contracts. The use of blockchain technology in the insurance sector yields several benefits, especially in enhancing transparency, trust and efficiency. In the first place, blockchain operates as a transparent and auditable system that records and tracks all transactions and changes. This aspect fosters a sense of trust between insurers and policyholders by providing a verifiable and tamper-proof record of activities. Moreover, the inviolability of information in blockchain technology guarantees the credibility and endurance of insurance-related documents. As soon as data is recorded on the blockchain, it becomes exceptionally resistant to modification or deletion, limiting the hazards associated with wrongful manipulation or unauthorized adjustments. During the claims process, blockchain can establish a shared and immutable ledger accessible to all relevant parties involved, including insurers, policyholders, and third-party service providers. This shared ledger promotes real-time updates and transparency, reducing the need for manual reconciliation and facilitating communication between stakeholders. Concerning underwriting, blockchain technology offers access to trusted and unalterable data, refining the precision and trustworthiness of the procedure. Insurers can securely access and verify data from various

[163] OECD (curated by), *Technology and innovation in the insurance sector*, cit.: 14
[164] BODEMER O., *Transforming the insurance industry with blockchain and smart contracts: enhancing efficiency, transparency, and trust*. 2023

sources, including policyholders, third-party databases, and internet of things devices, through a decentralised and distributed ledger. The immutability of records on the blockchain supports underwriting data integrity and reduces the risk of inaccurate or fraudulent information. This capability enables insurers to make more informed decisions about underwriting, based on reliable and transparent data sources. Furthermore, blockchain technology simplifies policy renewal procedures by automating the validation of policyholder information and guaranteeing a smooth switch from the current policy period to the renewed period. This automated process reduces administrative burdens and enhances the efficiency of policy renewal management[165].

The potential for blockchain to revolutionize the art industry is apparent, as it has the capacity to overhaul the processes of selling, payment, and storage of artwork. Specifically, blockchain technology can play a significant role in reducing fraud, establishing verifiable ownership records, and facilitating a more efficient secondary market for artworks. In the realm of fine art insurance, the implementation of a secure blockchain registry possesses the potential to increase transparency and establish an unalterable documentation of a work of art's originality and ownership history. However, it is essential to recognize that the dependability of the blockchain system is heavily reliant on the accuracy and integrity of the data entered into it. Consequently, in order for blockchain technology to gain substantial acceptance within the art field, it is imperative to expand the scope of recorded information and encourage increased participation from dealers, auction houses, and art data providers. Blockchain can have a strong impact on eliminating contradictions and constraints in the formation of the fine art insurance system. The most obvious examples of these limitations are the asymmetrical distribution of information between insurers and art market participants; the non-transparency of the circulation and conservation market in terms of determining attribution and restitution; the lack of historical information on transactions; the difficulty of determining the ownership and value of assets; and the high risk of fraud. Firstly, blockchain shall augment transparency in the circulation of value, and eradicate the pre-existing asymmetry in information dissemination among transaction participants. This can be accomplished by automatically authenticating the insured object, registering the owners, users and administrators of the art item, logging each transaction relevant to the unique object, and maintaining a record of the movement of insured items (including exhibitions and displays), their insurance and insurance incidents. Secondly, blockchain has the potential to decrease or

[165] *Ibidem*

even eliminate the threat of fraudulent activities in value assurance. This can be achieved through the technology's capability to authorize transactions and maintain timestamps that indicate the timing of transaction and operations. These recordings cannot be modified without the consent of all parties involved in the transaction or operation, and by the application of unique transaction encoding codes[166].

The immutable trail of an artwork's provenance presents a significant opportunity to enhance clarity during the claims process in instances of theft or damage. Blockchain technology has the potential to revolutionize art insurance beyond its impact on claims processing. Securing compensation for losses or damages can prove challenging due to the requirements involved. These include gathering evidence of an item's authenticity, ownership history, transfer records and market valuations over time. In the unfortunate event of a disaster, the absence or incompleteness of supporting documentation can significantly delay or even hinder the process of settling insurance claims. To address these challenges, insurance firms are progressively examining the possibility of applying blockchain technology to manage art insurance policies. It is essential to acknowledge the distinctiveness of each artwork, prompting underwriters to rely on a range of experts who aid in comprehending the multifaceted aspects that contribute to the work's value. Art underwriters bear the responsibility of ensuring the authenticity and trustworthiness of the artwork's provenance, safeguarding against fakes or stolen pieces. Once the underwriter verifies the artwork's genuineness and absence of theft, they rely on expert assessments of its value to underwrite the piece. By setting a premium, insurers essentially express their confidence in the artwork's authenticity. As a regulated industry, insurers also require assurance regarding the ownership of the artwork, ensuring it is not involved in illicit activities such as money laundering. Blockchain combines provenance and authentication, providing a linked record of ownership that depends on the validity of the starting point of the blockchain record. Crucially, the records stored on the blockchain serve as a reliable repository of original content and validation, objectively verifying information evaluated by qualified human professionals[167].

Blockchain companies involved in provenance typically aim to establish themselves as trusted authorities using a variety of methods. Verisart, which was launched in 2015 by Robert Norton, the former CEO of Saatchi Art, aims to offer a reliable database for artworks that can be created by anyone. In a noteworthy occurrence in June 2018, Terence Eden

[166] BARTOLUCCI S., GIANNONI C., and GIANNONI C., *Blockchain technologies and art: opportunities and open challenges*. 5 May 2023

[167] GLEISES S., *Can blockchain help art underwriters?*, 25 April 2019, available at https://axaxl.com/fast-fast-forward/articles/can-blockchain-help-art-underwriters (last consultation: 20/08/2023)

registered the Mona Lisa on the Verisart blockchain, assigning authorship to himself and stipulating the date of its creation as 1506. Although Verisart gains from the transparency of its database, Artory countered the associated security risk by incorporating a screening mechanism for the initial registration of works on the blockchain. In autumn 2018, Artory reached a noteworthy achievement as the first company to record a major auction sale on the blockchain. They acted as the registrar for the Ebsworth Collection, which was sold at Christie's New York for an astounding $318 million on 13 November 2018. The sale contained forty-two art pieces and set numerous records. Artory, provides collectors with a certificate of authenticity encrypted onto the blockchain and, to ensure high reliability, the company only lists works that have been thoroughly scrutinised by a reputable partner organisation, such as an auction house or gallery, that has already conducted extensive provenance research. Furthermore, Artory has made a strategic choice to maintain a double-blind registry, whereby the company does not possess information about the identities of the collectors, and solely lists the artworks. Notably, Nanne Dekking, the founder of Artory, also holds the position of Chairman at TEFAF (The European Fine Art Fair)[168].

The technology has also the possibility to accelerate and simplify contract management.

Specifically, the use of smart contracts, which are transaction protocols that execute actions based on predefined contract terms, can provide insurance companies with a significant competitive advantage. By enabling automation, smart contracts have the potential to provide time and cost savings in administrative tasks, thereby offering valuable benefits to insurers. Each validated contract within the open shared infrastructure contains data and self-executing codes specific to that contract. When a triggering event occurs, meeting the previously agreed conditions, the blockchain smart contract retrieves the predefined data sources from all participants, and then automatically executes the payout to the contract parties. A smart contract is a type of contract where a blockchain is programmed to execute specific actions after a set of conditions is met. Instead of being written in traditional legal language on a physical document, these contracts are expressed as programming code that can be executed on a computer or network of computers. A smart contract's code can specify precise rules and outcomes that mimic those of a traditional legal document, outlining each

[168] WHITAKER A., *Art and blockchain: a primer, history, and taxonomy of blockchain use cases in the arts*. Artivate: a journal of entrepreneurship in the arts, 8; October 2019: 21-47

party's responsibilities, benefits and penalties in different circumstances. Smart contracts are often designed to operate on blockchains or DLT[169].

One major benefit of using blockchain-based arrangements especially for insurance is the quick settlement of losses due to clearly outlined events through smart contracts. By integrating a smart contract into the blockchain for compensation requests, payments can be promptly released, resulting in a shorter turnround time: payments between clients and insurers can be automatically triggered when specific conditions are met. Additionally, insurers could employ smart contracts to simplify the claims process and associated financial transactions. Currently, when one company needs to compensate another for a claim, the payment is typically executed manually through methods such as writing a cheque or initiating an electronic transaction, which then undergoes a complex clearing process. Conversely, smart contracts offer the opportunity for insurers to automate this procedure by incorporating the payment terms directly into the code. Therefore, once the established conditions are fulfilled, the intelligent contract would automatically initiate the payment. For instance, a blockchain can be established to automate claims payments upon validation of coverage and quantum, thus reducing the time taken for the settlement and providing insurers with greater efficiency saving, ultimately benefiting clients[170]. However, it is essential to examine the aspect of smart contracts that concerns the prior definition of contractual clauses and the rigidity of the algorithmic codes that make up a smart contract. Such contracts necessitate a translation of terms into algorithmic language that is compatible with the protocol, thus prohibiting imprecise, general or unclear formulations. The need for a well-defined and precise semantic framework beforehand increases the level of certainty in future execution. This certainty also leads to a considerable lack of flexibility that may impose insurmountable limitations, particularly in the field of fine art insurance.

Moreover, the use of a blockchain-based insurance database could significantly improve the efficacy of measures taken to prevent fraud. Insurance fraud is commonly perpetrated by submitting multiple claims for the same loss to different insurers. A shared database for recording claims would enable the identification and prevention of such malicious activities[171].

[169] OECD (curated by), *Technology and innovation in the insurance sector*, cit.: 14
[170] BODEMER O., *Transforming the insurance industry with blockchain and smart contracts,* cit.
[171] *Ibidem*

2.4. Internet of Things

The application of Internet of Things (IoT) technology in the realm of fine art insurance can offer numerous advantages to both insurance providers and art collectors. IoT devices should be viewed as a group of technologies that allow physical objects and devices to produce data and exchange it with other objects to enable them to become "smart". The appliance becomes intelligent by integrating it with sensing technologies: it is furnished with a collection of wired and wireless sensors that enable efficient remote observation and control of objects. Such IoT applications can provide real-time data and monitoring capabilities often using the same Internet Protocol that connects the Internet, thus permitting large volumes of data to flow to computer for analysis, improving the security and risk management of valuable artworks[172]. These systems aim to supervise and control the environmental and material conditions of cultural heritage, guaranteeing their optimal preservation, and thereby decreasing the risk of damage. Consequently, insurers can utilise IoT technology to improve profitability by transforming the loss component of their income statement. By gathering and analysing IoT-generated data, insurers have the potential to move from a defensive approach of risk distribution and compensation of claims to an offensive strategy. This involves helping policyholders to prevent losses and insurers to avoid claims altogether. By preventing claims proactively, insurers can not only increase profitability but also have the chance to lower premiums and enhance customer retention rates[173].

The following discussion outlines various ways in which Internet of Things technology can be utilized in the context of fine art insurance.

The IoT paradigm can be utilised in the implementation of systems for monitoring fine art. This includes monitoring on-site as well as during transportation, and the required technologies must be customised to fit each use-case accordingly. Therefore, the selection of suitable IoT devices to monitor artwork in-situ may differ from the one employed to supervise the transport of the artwork. Environmental monitoring is a vital application of the IoT in fine art insurance. By strategically placing IoT sensors in art galleries, museums, or private collections, it is possible to continuously monitor environmental factors such as temperature, relative humidity, light levels, and other variables that significantly impact the condition and longevity of artworks. Deviations from optimum conditions may trigger immediate alerts, enabling prompt action to prevent potential damage or degradation and thus reducing future

[172] OECD (curated by), *Technology and innovation in the insurance sector*, cit.: 29
[173] CANAAN M., LUCKER J., SPECTOR B., *Opting in: using IoT connectivity to drive differentiation. The Internet of Things in insurance*. Deloitte Centre for Financial Services; 2016: 4

restoration costs. Depending on the inherent nature of each cultural heritage asset, the causes of deterioration are influenced by various physical parameters[174]. However, in order to establish a comprehensive and proactive conservation approach, it is essential not only to continuously monitor environmental variables over extended periods but also to anticipate and forecast impending fluctuations, such as frost or heatwaves, with sufficient advance notice for effective responsive actions. Consequently, preservation systems based on IoT should be equipped with data analytics capabilities to identify patterns, detect unstable fluctuations, and assist in informed decision-making[175]. Therefore, timely identification of critical thresholds for physical parameters is of utmost importance to prevent potential harm. The latest developments in IoT technologies offer the possibility of furnishing diverse areas, such as showcases and storage spaces, with bespoke environmental conditions at an affordable outlay.

Condensation, air conditioning leaks, groundwater, and pipe leaks can cause significant damage to museums, galleries and private collections. Implementing leak detection solutions enables facility managers to take corrective action promptly when leaks are identified. IoT water sensor solutions are various and are always more utilized by insurance companies to reduce the risk of water damages. The market for IoT water detection sensors is growing quickly in response to the considerable and costly issue of water damage. These systems are now widely acknowledged as vital components for preventing water losses when implemented in conjunction with thorough operational inspections, preventive maintenance and water loss mitigation plans. Water leak detection cables can be installed on wall pipes located near display areas or around particularly vulnerable spots. In order to promptly take action and prevent flooding within the gallery or exhibit, sensors for detecting leaks can be fitted to provide early notice of water leaks originating from pipes, upper floors, or the roof[176]. Water damage is the foremost cause of home insurance claims, with a combined annual cost of $17 billion in the USA and UK. Nonetheless, implementing integrated repair solutions and technology can effectively limit these claims, reducing the frequency of water damage incidents. Furthermore, such solutions can also minimize the extent of damage when incidents

[174] ASTROGA GONZALEZ E. M., MUNICIO E., NORIEGA ALEMAN M., MARQUEZ-BARJA J. M., *Cultural heritage and Internet of Things*. In: conference proceedings of GoodTechs '20, curated by ACM, ed. *ACM smart objects and technologies for social good (GoodTechs '20)*. New York; 2020

[175] *Ibidem*

[176] OLSEN E., *Preventing water damage. Trends, risks, and mitigation for water leaks, pipe bursts and plumbing issues*. CHUBB; 2020

do take place. Insurance companies globally are actively seeking concrete evidence of real reductions in losses that result from adopting these innovative technologies[177].

LeakBot is an IoT-enabled water leak detector that utilizes state-of-the-art technology. A single device suffices to monitor an entire property, effectively detecting even the slightest leaks. By swiftly notifying homeowners, LeakBot stops minor problems from escalating into major ones, also helping insurers to minimise water claims[178]. The patented Thermi-Q technology incorporated into the device ensures precise measurement of both air and water temperatures within a customer's home. When a leak takes place, it results in a continual reduction in temperature within a customer's building as cooler water enters from the outside. By detecting this regular drop in temperature, LeakBot recognises and notifies the user promptly via a dedicated app, guaranteeing timely awareness as well as response to the problem. The LeakBot device could have implications for fine art insurance. Although primarily intended for identifying and preventing water leaks in domestic properties, the adoption of this technology in the fine art insurance sector can offer increased security for valuable works of art. Within the realm of fine art insurance, the incorporation of LeakBot technology should be viewed favourably by insurance underwriters, highlighting a proactive approach to risk management and a commitment to safeguarding artworks from water-related hazards. As a consequence, it could result in more advantageous underwriting conditions, such as probable reductions in premiums or expanded insurance coverage alternatives.

IoT-based location tracking systems enhance the reliability of fine art insurance. By utilising these devices, insurance providers are able to oversee the exact whereabouts of valuable art pieces whilst in transit or on loan, minimising the potential for loss or theft. This real-time tracking capacity ensures artworks are transported safely and insurers have a complete understanding of their location at all times. An interesting illustration of the implementation of a transport monitoring solution is See Your Box™ Ltd. (SYB), a bespoke system that has a customised architecture, which has already been introduced to the market and used to monitor over 200 global logistics transports of fine art and accomplished over 10 comprehensive, long-term monitoring projects for temporary exhibitions in museums such as

[177] ONDO (curated by), *Counting the savings. How IoT leak detection is radical reducing water damage claims*. Independent research by consumer intelligence; 2022

[178] The insurance company Hiscox has successfully partnered with LeakBot since 2019. More information are available at https://insurtechdigital.com/insurtech/ondo-insurtech-plc-signs-partnership-renewal-with-hiscox (last consultation: 10/09/2023)

Guggenheim and Vatican Museums[179]. SYB is a tech-service platform that leverages IoT devices and sensors to gather, analyse, and extract information on goods that are in transit, in storage, or in use globally. A practical application of insurance companies looking for innovative solution to support their customers, even at the delicate moment of transporting insured goods, is the project launched by Aon in collaboration with the start-up SYB. Aon is a British multinational and one of the world's leading providers of risk management, brokerage and insurance services, also active in the cultural heritage sector. The collaboration took the form of the "*Trono di Grazia 4.0*" project, in which the high-tech start-up offered a comprehensive data analytics service to manage the risk associated with the movement, packaging, installation and automatic and accurate calculation of insurance profiles during the transport of Vrancke van der Stock's "*Il Trono della Grazia*" from the diocese of Caltagirone (Sicily) to Rome for full restoration by professionals. The Flemish masterpiece, a wooden painting dating back to around 1500 and valued at almost €0.5 million, required transportation over land and sea. Preserving the artwork's integrity was crucial, necessitating strict control over core parameters such as temperature, humidity, and shocks[180]. The SYB monitoring and alert service proved ideal for transport requirements. Together with the owner, all critical parameters were configured and uploaded to the system. The owner had extensive access to the artwork's recorded parameters throughout the journey. The ability of SYB to send alerts proactively to the customer, logistics firms and restoration team contributed significantly to the venture's triumph. When any parameter exceeded its designated range, a report was promptly generated and sent to those involved, enabling swift action to be taken to prevent damage to the painting. Not only did this method facilitate tracking of the masterpiece from Caltagirone to Rome by all stakeholders, but it also allowed for real-time monitoring of its condition and timely intervention when required.

The field of security and theft prevention is an area where IoT is invaluable. By utilizing IoT-enabled security systems, insurers can markedly improve the safeguarding of art collections against vandalism, theft and unauthorized access. In particular, security can be improved through the integration of motion sensors, surveillance cameras, and entry point sensors into a central monitoring system and this allows for the prompt detection and alerting of authorities or security personnel in the event of any suspicious activity, bolstering the

[179] CARCHIOLO V., LORIA M. P., MALGER M., TOJA M., *Real time risk monitoring in fine-art with IoT technology*. In: communication papers of the federal conference on computer science and information systems, 2018: 151-158

[180] SEE YOUR BOX (curated by), *Case study – See Your Box monitors "Il trono della grazia" for museums of Vatican State"*, 4 June 2018

overall security posture. Burglar alarm systems are integral to the underwriting of fine art insurance. When evaluating risks linked to fine art coverage, underwriters carefully consider the presence of a burglar alarm system as a key factor in determining premiums and coverage terms. The installation of such security measure can lead to more favourable underwriting terms, such as reduced premiums. Certain insurance policies, including ARTE Generali's policy for exhibitions, may necessitate a burglar alarm system's installation to obtain coverage[181]. The insurance provider may specify the required security measures' type and level to adequately guard the artwork insured. Non-compliance with these mandates may result in restricted coverage or claim denial. It should be noted that the impact of security systems on underwriting for fine art insurance is subjected to variation contingent upon the insurer and policy type.

In addition to mitigating losses, IoT applications have the potential to tackle a long-standing challenge faced by insurers: finding a balance between improving the customer experience, encouraging loyalty and retention, and meeting constant market pressure to lower prices. By utilizing IoT, insurers can explore original methods for providing better customer experiences while also meeting the market's need for competitive pricing[182].

However, possessing exceedingly detailed data may bring about several inadvertent outcomes. The primary one is its potential impact on the privacy of those who provide the data. Although adequate data protection is in place for the information necessary for taking out an insurance policy, the handling of data collected separately or outside of this situation might not be as clear. Tracking data through a IoT device provides abundant information that surpasses the insurer's requirements for determining policyholder behaviour or premium reductions. The ownership of data produced through the IoT, as with many digital devices, remains a topic of debate. At present, standard privacy and data protection regulations are applicable. The US Federal Trade Commission published a report in 2015[183], exploring some of the concerns around IoT and privacy. The process by which the IoT collects data creates difficulties in gaining consent each time data is collected, which is not always necessary. It is crucial that individuals are given the option to make a choice before their data is collected, except in cases where data collection aligns with the nature of transaction. In instances where

[181] ARTE GENERALI (curated by), *Condizioni di assicurazione ARTE Generali Exhibition*, January 2022 edition
[182] CANAAN M., LUCKER J., SPECTOR B., *Opting in*, cit.: 4
[183] FTC (curated by), *Internet of Things: privacy & security in a connected world*. FTC Staff Report; 2015

information use deviates from the nature of the interaction, a clear and prominent choice must be provided[184].

[184] OECD (curated by), *Technology and innovation…*, cit.: 26-28

Chapter 3. Crypto art insurance and NFTs

In an environment that is progressively distinguished by non-fungible tokens (NFTs) and virtual creativity, it is crucial to comprehend the importance of insurance for crypto art. First and foremost, it is crucial to differentiate between digital art and crypto art. The former pertains to art produced using digital means, where digital technology can be incorporated into the creative process or as a method of display in exhibitions. O the other hand, crypto art refers to digital or digitalized artworks that have been generated as non-fungible token for trading between cryptocurrency buyers and sellers[185]. In summary, non-fungible tokens can serve as an identification system for digital art. NFT technology enables digital artworks to acquire uniqueness, exclusivity and unchangeability, combating the intrinsic reproducibility of digital works. The concept is based on the idea of digital scarcity, which permits digital art to be treated and exchanged similarly to physical artworks. In fact, non-fungible tokens refer to unique digital identifiers that exist on blockchain networks and are often connected to specific digital content such as images or music. Connecting a piece of artwork to a non-fungible token, which acts as a unique digital asset, has several benefits similar to those of cryptocurrencies. These advantages include easy transferability and a reliable means of verifying the authenticity of the artwork.

Although NFTs may seem new, their development follows a trajectory that can be traced back to earlier efforts in the art market to create tradable forms of ephemeral or conceptual art. In fact, when purchasing conceptual art, the buyer is essentially obtaining acknowledgment from the art market, which recognized them as the owner of the artwork. NFTs follow this principle: the value of the digital asset comes from the willingness of the market to accept the title of ownership[186]. An illustration of this is observed in the certificates of authenticity that go along with Sol LeWitt's "*Wall Drawings*", which resemble the correlation between NFTs and unique digital images, because solely one individual or entity, the certificate owner, can acquire them. However, in contrast to digital works lacking singularity or existing in infinite identical copies, NFTs have the potential to revolutionize the

[185] TABACCHI S., *Criptoarte, arte digitale e il sistema museale*. In: ARTE Generali, ed. *L'ecosistema digitale dell'arte*. 2021: 17-19

[186] FRYE B. L., *How to sell NFTs without really trying*. Harvard Journal of Sports and Entertainment Law, 113; 2022: 127

ecosystem of digital images by endowing them with a sense of ownership and establishing digital provenance[187].

The arena of digital art is experiencing a surge in creators who seek to attain monetary gains. The standards for acknowledgment as a crypto artist are vastly liberal and versatile. A solitary pre-requisite is for an artist's piece to be minted onto an NFT and presented for sale on the blockchain. This inclusive culture allows artists from diverse backgrounds to engage and exhibit their work without any restrictions[188]. In order for conceptual artists to participate in the NFT industry, they must initially obtain cryptocurrencies and establish a cryptocurrency wallet. After completing these steps, they can proceed to establish an account on various NFT marketplaces[189]. To list an NFT on a marketplace, different expenses must be managed, including fees for minting the artwork onto the token, encrypting the token on the blockchain, and facilitating the artwork's sale. These expenses are commonly known as gas fees[190].

The NFT market has experienced a sudden and substantial increase in popularity emerging as a multi-billion-dollar industry seemingly overnight. Significant art related NFTs have been sold for millions, and even tens of millions of dollars. This phenomenon has garnered attention from diverse creators, such as acclaimed artist Damien Hirst, as well as well-known consumer brands like Coca-Cola and Nike, who are currently producing their own sets of NFTs[191]. The rise of NFTs has brought digital art to the fore, leading to a significant shift in how art is valued, owned and shared. By using blockchain technology to authenticate these tokens, digital creations have attained greater credibility, thereby resolving the longstanding issue of provenance. Suddenly, a digital artwork surpasses its file status and transforms into a tangible representation of ownership, a digital artifact adorned with the creator's unique signature and a secure documentation of its journey through the art market. The impact of NFTs reverberates throughout auction houses, galleries and online platforms, democratising access to art ownership and opening up new revenue streams for artists.

Several factors have contributed to the expansion of the NFT market. The adoption of blockchain technology has increased and has facilitated the verification of ownership and authenticity regarding digital assets. The COVID-19 pandemic has additionally expedited the

[187] WHITAKER A., *NFTs and the art market*. In: Art Basel and UBS Report, ed. *The art market 2022*. Switzerland: McAndrew; 2022: 49-55
[188] ALUMA-BAIGENT A., *Crypto: art, currency, and capital*. Canada: University of Ottawa research paper; 2021: 27
[189] FRYE B. L., *How to sell NFTs without really trying*, cit.: 129-130
[190] ALUMA-BAIGENT A., *Crypto: art, currency, and capital*, cit.: 28
[191] ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables: primer and outlook*. Working paper; May 2022: 2

demand for online activities and virtual experiences, leading to a heightened desire for exclusive digital assets. Lastly, the increase in decentralized finance (DeFi) and investments in cryptocurrency have fostered interest in NFTs as possible investment opportunities. Whilst dealers and auction houses generally welcomed the impact of NFTs in cultivating interest in art and collectibles among broader collector communities, their increasing popularity has not yet significantly affected these businesses. Moreover, it is noteworthy that platforms specifically dedicated to trading NFTs outside the art market have exhibited substantial growth and generated significant sales in recent years. This has led to the development of operative primary and secondary markets working outside the conventional structure[192].

Nevertheless, the market confronts risks and challenges, such as environmental effects[193] and the likelihood of speculative bubbles forming. New challenges in collection management emerge, notably regarding the protection and storage of NFTs. It is crucial to ensure their security and safekeeping, prompting the need for further investigation and tailored solutions. Simultaneously, the methods for exhibiting and presenting NFTs are continually developing. NFTs have also gained popularity in influential art fairs, including the showcase of NFTs at ARCO Madrid in July 2021and the Tezos NFT installation in Art Basel Miami during the same year[194]. Moreover, in early 2023, the Pompidou Centre in Paris became the first public institution in France to include NFTs in its collection. In addition, the Museum of Modern Art (MoMA) has set up a significant fund to invest in art NFTs. The Paley collection auctioned off at Sotheby's in September made this possible, earning $84 million in total. The sale of significant pieces by Pablo Picasso, Francis Bacon, and Joan Miró enabled the MoMA to reach its initial target of $70 million and a segment of this funding has been designated for the conversion of its collections to digital artwork in the shape of NFTs[195].

The emergence of NFTs have caused a fundamental shift in the perception of digital assets within the art world. Nevertheless, similar to cryptocurrencies and other digital assets, NFTs are vulnerable to risks such theft or loss. Furthermore, they show instability and lack regulatory oversight, creating doubts about ownership and valuation. Consequently, considering the significant financial values associated with NFTs, many investors are now

[192] ART BASEL & UBS REPORT (curated by), *The art market 2022*, cit.: 40
[193] Despite doubts and scepticism about the value and circulation of NFTs in the art world, the environmental impact of blockchain technology and, in particular, NFTs is a persistent concern because of the excessive amounts of computational energy consumed.
[194] WHITAKER A., *NFTs and the art market*, cit.: 49-55
[195] ART PRICE (curated by), *The art market in 2022. 26th edition report*. France: Artprice.com & ARAA; 2023: 54

considering insurance coverage to safeguard their interests in the event of such circumstances[196]. Insurance providers are faced with the task of carefully examining the terms and conditions of their policies to determine whether existing coverages extends to such situations[197]. The insurance industry will encounter several challenges when it comes to providing coverage for NFTs: the NFT market is fairly recent and marked by noteworthy unpredictability; additionally, the one-of-a-kind and irreplaceable quality of art related NFTs as non-fungible assets creates difficulties in precisely evaluating these possessions[198].

The criteria for assessing the quality and value of NFTs are very different from those applied to traditional art. As a result, the prices paid for NFTs may appear excessively high. In fact, most of the dominant art NFTs often prioritise attributes such as digital collectability and community affiliation over artistic merit[199]. There is a clash between the exuberant influence of the NFT hype and the established system of insurance companies, tax professionals, and museums that have traditionally defined artwork value. Appraisers and insurance companies are only just beginning to grapple with the challenge of assessing the true value of crypto art also because, unlike traditional art, NFT values are inextricably linked to cryptocurrencies that undergo frequent price fluctuations[200]. When dealing with traditional artworks, appraisers usually assess them once a year or less for insurance purposes by comparing them to similar works. However, crypto art lacks comparable precedents, leading to a new competition among appraisers to devise objective and rational methodologies for determining its value[201]. Moreover, museums and collectors must consider novel storage and protection methods for NFTs due to rising hacking and scamming threats. Due to the volatility of their value, unrestricted transferability across borders, perceived regulatory gaps in the digital realm, and the incentive to rapidly trade NFTs multiple times, it can be posited that NFTs pose a unique risk for money laundering.

Insurance has traditionally operated within the domains of authenticity and uniqueness, handling objects that are not reproducible or replaceable. However, the rise of conceptual art has presented new challenges for the insurance industry. Conceptual artists, as the term suggests, usually concentrate on the conceptualization phase rather than the physical

[196] EVERSHED T., *NFTs – covering the intangible*, «The Journal – Chartered Insurance Institute», 9 January 2023
[197] *Ibidem*
[198] *Ibidem*
[199] ART PRICE (curated by), *The art market in 2021. 25th edition report*. France: Artprice.com & AMMA; 2022: 43-47
[200] DUGAN K. T., *How museums are trying to figure out what NFT art is worth – determining value in the age of Bored Apes is a work in progress*, «New York Magazine - Intelligencer», 23 January 2022
[201] *Ibidem*

object, supplying documentation that gives instructions for the realization of their idea-based artworks. Consider artworks by Sol LeWitt, where the activation lies in the process of execution, or the intentional degradation of certain artworks as a creative process. Recognition of an artwork may only occur within the exhibition context, as seen in the works of Dan Flavin. These artworks find their essence in the contract, certificate, and the established relationship between the artist and the buyer. The certificate is insurable as it serves two functions: firstly, it is unique like a work of art, and secondly, it exists as a material object, typically a sheet of paper with authentic signatures. However, can a file be regarded as an object? Can it have the same attributes as a certificate in conceptual art? For instance, a token is assigned a unique number, creating a permanent record of its authenticity and ownership as generated by the platform. This numerical labelling of a token could be likened to that of a certificate, thereby rendering it potentially insurable. Nonetheless, it falls short of satisfying the criteria of irreproducibility and fails to encompass the fundamental notion of singularity. Furthermore, the application of risk analysis principles traditionally employed in fine art insurance (such as alarm systems and security personnel) proves challenging when addressing NFT marketplaces, as they presently lack the required insurance coverage standards. Over time, insurance policies for fine art have developed to also cover conceptual art. A similar transition is now taking place for crypto art, as the object of insurance becomes better defined in regard to both risks and market trends[202].

3.1 Crypto art and NFTs

3.1.1 The structure and functioning of non-fungible tokens

Non-fungible tokens serve as digital representations of unique, one-of-a-kind objects, be they physical or virtual in form. Presently, NFTs find their most common usage in the representation of digital artworks and collectibles, a realm in which they have achieved notable popularity.

Creating and recording an NFT for the first time is known as minting. The individual who mints an NFT may be either the author of the associate artwork, for example, the artist, or a person with the appropriate permissions to mint the digital asset. Minting an NFT

[202] RESTI C., *NFT: gli aspetti assicurativi*. In: ARTE Generali, ed. *L'ecosistema digitale dell'arte*. 2021: 29-31

represents the first instance of a unique, digital asset being published on a blockchain. The non-fungible token is a concise sequence of characters that adheres to specific technical standards and is stored and managed on a blockchain. This string functions as a unique identifier for a digital asset, which may be a compact digital work itself or, more commonly, a pointer to an external file containing the work. This pointer represents the location of the NFT's content and its metadata. Popular choices for storing the file include the Interplanetary File System (IPFS), a decentralised file storage system external to the blockchain, that guarantees secure and distributed access to the content referenced by the NFT[203]. An NFT is associated with an account identifier that indicates its owner. These identifiers are random numerical values rather than real names, ensuring that NFT ownership is pseudonymous by default. NFTs can be transferred by purchasing, selling or relocating them to new owners. As ownership changes hands, NFTs can be moved to different accounts[204].

NFTs are known as "non-fungible" because they are unique and have individual worth, in contrast to "fungible" possessions such as Bitcoin or Ethereum, which are identical and interchangeable. In fact, fungibility denotes an asset's aptitude for being exchanged or substituted with similar ones of equivalent value. For example, the value of one Bitcoin (BTC) is always equal to that of another, similarly, one Ether (ETH) unit is always equal to another[205]. Cryptocurrencies are an excellent option for a secure medium of exchange in the digital economy due to their fungibility, while NFTs revolutionise the crypto paradigm by ensuring the uniqueness of each token.

The features of blockchain technology enhance the distinctive attributes of NFTs. A prominent characteristic is the transparency of NFT ownership transfers. This transparency stems from the public nature of the blockchain, which enables anyone to access and view the complete history of NFT transactions. Furthermore, NFTs have an enduring nature as long as the underlying blockchain exists, and they possess an unalterable quality. This is due to the inherent properties of blockchain technology whereby messages, once posted, become fixed with no possibility of alteration or removal, and their chronological order remains unchangeable[206].

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[203] ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables*, cit.: 4-5
[204] *Ivi*: 7
[205] Bitcoin and Ether are the most commonly used cryptocurrencies. The launch of Bitcoin blockchain can be traced back in 2009 and its creation is commonly associated with the name of Satoshi Nakamoto, probably a pseudonym for a person or a group of people; while the second one is the native cryptocurrency of Ethereum. For more information see WHITAKER A., *Art and blockchain*, cit.
[206] ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables*, cit.: 7-8

According to Sasha Shilina, the main characteristics of Non-Fungible Tokens are: uniqueness, authenticity, indivisibility, rarity, ownership, transferability, transparency and trust[207]. Firstly, the unique aspects of this NFT are outlined in the metadata, which accurately describes its representation. The metadata serves as an unalterable, enduring record, comparable to a certificate of authenticity; it conveys information about the digital item associated with an NFT, often indicating its title, a brief description, and a hyperlink leading to its primary assets, such as the image file. Secondly, if the artwork was created by the artist uploading it to the platform and acknowledging it as their own, the creation of the NFT serves as the artist's signature and verification of the artwork's authenticity. Blockchain-powered NFTs provide an effective means of countering counterfeiting and giving customers peace of mind that they will receive their purchased goods. In fact, anyone can examine and access an NFT once it has been created on the blockchain to verify its metadata, ownership history, TokenID[208], blockchain address and other underlying information. In addition, as already mentioned, buyers can see the address from which the NFT was first minted, as blockchain transactions are publicly available. Indivisibility dictates that NFTs cannot be subdivided into fractional units, unlike cryptocurrencies or fungible tokens that may be divided into small units (i.e., 0.1 BTC). However, an NFT may have multiple fractional owners, mirroring the ownership structure of a work of art. Moreover, scarcity is an essential factor in the appeal of NFTs. Although some assets can be endlessly generated by developers, they can also manipulate the availability of rare and valuable items. Furthermore, blockchain simplifies ownership transfer process, making it almost instantaneous and aids in proving ownership. NFTs can be traded without restrictions and, lastly, they encourage transparency since the documentation of generating, transferring, and utilising tokens can be accessible to the public for scrutiny[209].

As previously stated, NFTs are codes that link to digital assets and are stored on a blockchain ledger. These codes represent a unique identifier for a particular object, such as a work of art, and are developed using a diversity of standards created on different blockchains. The most common today is Ethereum, a smart contract protocol that enables tokenisation, introduced in 2014 by Vitalik Buterin. Compared to the original blockchain protocol, Bitcoin, Ethereum presents a simpler interface that generalizes Bitcoin's scripting language to run

[207] SHILINA S., *A comprehensive study on non-fungible tokens (NFTs): use cases, ecosystem, benefits & challenges*. Moscow: Lomonosov Moscow State University; 2022: 1-2
[208] The unique identifier number of the NFT
[209] SHILINA S., *A comprehensive study on non-fungible tokens (NFTs)*, cit.: 1-2

many types of programs. Over time, some of these programs, or smart contracts, have become standard. ERC-20 represents the predominant Ethereum standard, referring to fungible tokens that operate like standard cryptocurrencies[210].

Early forms of non-fungible tokens have existed since the mid-2010s. However, it was not until 2018, with the debut of the ERC-721 digital standard for creating NFTs on the Ethereum blockchain, that they gained widespread acceptance within the blockchain community. At present, ERC-721 represents the token standard utilized most frequently. This standard was introduced by OpenZeppelin and it acts as an open framework that lays down the specifications and guidelines for NFTs. Before the genesis of ERC-721, projects had to build their NFTs using bespoke smart contract code. This led to limited compatibility among NFT smart contracts, resulting in marketplace friction and an unsatisfactory user experience. ERC-721 tackles these challenges by furnishing standardised interfaces for smart contracts accountable for managing NFTs. This standardisation has been fundamental in cultivating the expansion of the NFT network[211].

To interact with NFTs, individuals must use dedicated software known as a wallet that is tailored precisely for blockchain transactions. Wallets are installed on mobile phones or laptops and provide a user-friendly interface for buying, selling, creating and administering NFTs[212]. The primary function of a wallet is to securely safeguard and preserve the cryptographic private key linked to an NFT proprietor's account. Each private key has a corresponding public key that functions to verify the user's identity and authenticate their transactions. Similar to a password, the private key allows the owner to initiate tasks such as generating, selling, or transferring NFTs, and earning profits from their sales. It is worth mentioning that having access to the private key of the user's account is also equivalent to possessing the assets kept within it. To put it simply, if a user mislays or has their private key stolen, they will be deprived of access to their blockchain assets, such as cryptocurrency and/or NFTs[213].

Additionally, for a more in-depth exploration of the NFTs landscape, it is advantageous to gain a better understanding of the concepts of "protocols" and "platforms". By differentiating between protocols, which represent distinct types of blockchains like Bitcoin or Ethereum, and platforms, which serve as interfaces for interacting with and

[210] ERC signifies a set of guidelines that assist developers in simplifying the creation of a standard Ethereum-based token, while 20 denotes the specific identification number for the proposal.
[211] ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables*, cit.: 20-21
[212] *Ivi*: 8
[213] *Ibidem*

acquiring NFTs, a clearer comprehension of the ecosystem can be achieved. Platforms like SuperRare and OpenSea play a crucial role in enabling users to engage with NFTs, while the underlying protocols provide the technological framework and infrastructure for these transactions to occur securely and transparently. Today, the NFTs aggregator OpenSea is one of the most important in the ecosystem of NFT marketplaces. It is located on the Ethereum blockchain and thus NFTs prices on OpenSea are quoted in Ether. It is an all-inclusive platform that allows users to trade and create NFTs, view data, and explore wallets containing a diverse range of items, such as gaming items, digital collectibles, virtual real estate and crypto art. Essentially, marketplaces function as virtual platforms that interact with the blockchains hosting NFTs. They offer a user-friendly interface to interact with and trade NFTs and, in exchange for their services, these marketplaces sometimes charge a transaction fee on the NFT sales they facilitate. To engage with OpenSea, users commonly utilise a wallet known as MetaMask, which is available as a browser extension and is useful to virtually display tokens. After buying, the tokens get transferred to the purchaser's cold storage tool called a metal wallet (MTL) or crypto capsule, both encrypted hardware wallets that maintain digital assets offline for extra security (see figure 3.1). Established at the end of 2017, OpenSea partnered with Christie's to host a groundbreaking event in December 2021, called "*Christie's x OpenSea*". This collaboration marked Christie's first-ever on-chain NFT auction and represents a significant milestone in the integration of blockchain technology and the art market[214].

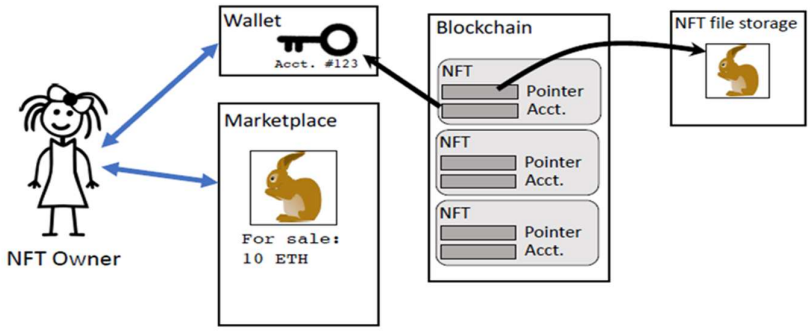

Figure 3.1. NFT ecosystem. Source: ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables: primer and outlook.* May 2022: 9

[214] *Ivi*: 19-20

3.1.2 A brief history of crypto art

The potential of emerging crypto art lies in its use of blockchain technology to bestow digital art with exclusivity, answering the question of how to maintain rarity for virtual art that can be easily replicated[215]. Although these digital creations may be infinitely replicated, the inherent worth of an NFT lies not in the associated artwork but in the certification of ownership for a specific iteration of the piece. This certification is issued uniquely or in limited multiples. To clarify, imagine a factory producing replicas of an artwork from an artist's original mould. The artist's signed replicas (i.e., those linked to an NFT) carry value, whereas any other replicas produced by the factory without the artist's approval or signature (i.e., lacking an NFT) possess no value beyond the materials' intrinsic worth[216].

The acquisition of NFT rights can significantly differ depending on the accompanying license agreement. At a rudimentary level, an NFT may only provide a certificate of authenticity, legitimising the owner. Nonetheless, NFTs can also facilitate more comprehensive rights. For example, certain NFTs confer exclusive exhibition rights for digital artwork, granting the owner complete control over its display. Other NFTs can transfer complete intellectual property rights, allowing the owner to reproduce and distribute the underlying work for commercial purposes. On the other hand, an NFT may grant limited commercial use rights without transferring complete intellectual property ownership. Apart from the rights concerning the artwork itself, NFTs can also provide access to exclusive content, events, and communities. The creator can also pledge to provide NFT owners with priority access to future releases or experiences. To summarise, NFTs establish a pathway to divide and personalize rights and access privileges in manners that surpass conventional art ownership[217].

Moreover, tokenisation of digital art through NFTs has enabled artists to gain additional profits from their sales and receive royalties each time their work is transferred to a new owner. Previously, the concept of royalties was impractical, particularly in relation to physical art, due to difficulties in tracking ownership. The integration of NFTs has facilitated fresh possibilities for artists to receive financial compensation for their works[218].

Non-fungible tokens can be compared to traditional works of art because of their uniqueness. However, they can also be incorporated into larger collections of works as is the

[215] DONATI A., *NFT: gli aspetti legali*. In: ARTE Generali, ed. *L'ecosistema digitale dell'arte*. 2021: 20-24
[216] MIONE M., GUZZONI E., CIRICA F., *Fuori dall'hype: evoluzione e nuove prospettive del mercato NFT*. In: Deloitte creative team - Italia, ed. *Il mercato dell'arte e dei beni da collezione, report 2023*. 2023: 70-75
[217] *Ibidem*
[218] SHILINA S., *A comprehensive study on non-fungible tokens (NFTs)*, cit.: 6

case for Larva Labs' *CryptoPunks* or Yuga Labs' *Bored Ape Yacht Club*[219]. These NFTs and others can be discovered in an online museum dedicated entirely to NFTs, known as the Museum of Crypto Art (MOCA). It curates NFT artwork projects dating from the early 2010s onwards, showcasing artworks both in the metaverse and in physical locations around the world. To date, the museum has organised twenty virtual exhibitions in six virtual worlds and displayed artworks in real-life exhibitions in fifteen different cities[220].

Although NFTs gained popularity on the Ethereum blockchain, the earliest record of an image embedded in a blockchain dates back to Bitcoin block 138725 in 2011. This image was in the form of ASCII art, an image constructed using letters and punctuation marks[221]. Following this, the initial versions of NFTs were "coloured coins", experimental assets created in 2012 on the Bitcoin network. A coloured coin is a unit of Bitcoin that contains descriptive data indicating its purpose outside of cryptocurrency. Coloured coins were proposed as a method of representing vouchers, tangible assets, corporate stocks, among others. No association was made at that time with works of digital art.

An experiment carried out during the "*Seven on Seven*" conference at the New Museum in New York City in 2014 resulted in the development of the first NFT in the current artistic sense of the term. This asset was a five-second animated work of digital art named "*Quantum*", sold by its creator, Kevin McCoy, to the Glitch CEO Anil Dash for £4 during a live demonstration, and registered on the Namecoin network. The crypto artwork showcases dynamic and colourful octagonal forms that constantly transform through animation.

Numerous initial NFTs were minted on Bitcoin utilizing a platform known as Counterparty, allowing for data to be inserted into Bitcoin script, a primitive smart-contract language inherent to Bitcoin. One notable NFT project that originated on Counterparty is *Rare Pepes*, which was minted in 2016. Nevertheless, at the end of the 2010s, Counterparty forfeited its exclusive capability to house NFTs as other competing platforms emerged[222].

In 2017, several historically significant NFT projects were launched, with many being the pioneers in their respective categories. One standout project is *Decentraland*, which emerged as the first metaverse venture built on the Ethereum blockchain, realized in virtual reality, and powered by NFTs. The metaverse-style game experience permits players to purchase land parcels in a shared virtual environment that are catalogued as NFT assets. After

[219] WHITAKER A., *NFTs and the art market*, cit.: 49-55
[220] For more information see https://museumofcryptoart.com/
[221] ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables*, cit.: 16
[222] *Ivi*: 17-18

acquiring these assets, they have the liberty to construct on them and develop interactive experiences, such as NFT art galleries. Another noteworthy project from that era is *CryptoKitties*, the first blockchain game to successfully rely on NFTs. Developed by Dapper Labs, *CryptoKitties* enabled players to purchase, collect, breed, and trade virtual cats. *CryptoPunks*, on the other hand, can be credited with introducing the concept of a collection of NFT. They consist in 10,000 collectable, 24x24 pixel images of characters randomly generated, with no two exactly alike. They were created by Matt Hall and John Watkinson, the founders of Larva Labs, a New York-based software company. Crypto collectables are a noteworthy entry into the realm of NFT applications. These collectibles are each associated with specific identifiers, which imbues them with rarity and enhances the appeal of purchasing and exchanging them. They are truly unique, or at least produced in a limited quantity[223].

Renowned auction houses including Sotheby's, Christie's, and Phillips, among others, have adopted NFTs due to the rising popularity among influential artists. Particularly, the art world's acceptance of NFTs was marked by Christie's sale of Beeple's NFT artwork "*Everydays: The First 5000 Days*" in March 2021. The work by the digital artist, whose real name is Mike Winkelmann, was sold for an astounding $69 million from an opening bid of $100, making it the sixth-highest price ever paid for a piece created by a living artist. The digital artwork is a composition of 5,000 digital images posted online by the artist every day for 13 and a half years[224]. This revolutionary trade introduced NFTs to the mainstream leading to the emergence of crypto art in the auction market: during 2021 numerous crypto artists were included into the distinguished global Top 500 list of successful artists made by Art Price[225]. Of particular note was Beeple, who took the 19th position, surpassing the famed artist René Magritte. Shortly behind were Larva Labs (51st), Yuga Labs (66th), Pak (113th, surpassing Henri Matisse), Mad Dog Jones (381st), and Rare Pepe (436th). These artists and creators were previously unknown to conventional collectors, but they already had received recognition within the cryptographic community[226].

Several prominent contemporary artists have, in turn, chosen to invest the NFT ecosystem and adopt its codes. In particular, during summer of 2021, Damien Hirst revealed

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[223] *Ivi*: 19

[224] CHRISTIE'S (curated by), *Beeple first 5000 days*, 2021, available at https://onlineonly.christies.com/s/beeple-first-5000-days/beeple-b-1981-1/112924 (last consultation: 8/10/2023)

[225] ART PRICE (curated by), *Top 500 artists by auction turnover*, 2021, available at https://it.artprice.com/artprice-reports/the-art-market-in-2021/top-500-artists-by-auction-turnover/ (last consultation 8/10/2023)

[226] ART PRICE (curated by), *The art market in 2021*, cit.: 43-47

his inaugural NFT project, "*The Currency*", comprising 10,000 dotted paper pieces linked to their virtual "twins". Buyers were given a unique option: they either opt to obtain the physical artwork or have it purposefully destroyed and altered into a non-fungible token[227].

In May 2021, Christie's conducted an auction of five digital artworks produced by Andy Warhol in 1985 through ProPaint software but converted into NFTs with the consent of the Andy Warhol Foundation. The combined earnings from the five pieces sharply rose to $3.37 million, far beyond the original high estimate of $100,000. Therefore, the auction results for these first-ever Warhol NFTs, which include his famous flower, Campbell's soup can, banana motifs and two self-portraits, significantly exceeded the initial predictions[228].

The most popular NFTs are not always traditional artworks, but rather digital collectibles such as *CryptoPunks* and *Bored Apes*. These creations respectively by Larva Labs and Yuga Labs have generated over $75 million in sales in 2021, equating to approximately one third of the NFT auction market. In 2022, Yuga Labs acquired the intellectual property of *CryptoPunks* in a major transaction, gaining widespread attention. They then introduced the Punks Legacy Project in an effort to donate significant NFTs to esteemed institutions globally. Notably, they gifted "*CryptoPunk 305*" to the Institute of Contemporary Art, Miami, an influential player in the world of NFTs. A major aim of this project is to foster responsible ownership of NFTs through highlighting the importance of appropriate storage, insurance, and precise valuation reporting as best practices[229].

3.2 NFTs art market

The emergence of NFTs has given rise to a novel global market centred around digital art and collectibles. Artists and creators can now monetise their digital works directly without intermediaries, whilst collectors can obtain exclusive digital items and display their collections in digital spaces. This allows for a more direct and autonomous approach to buying and selling crypto art. In fact, the majority of NFT-related activities in the art market take place beyond the traditional auction and gallery channels. Digital art marketplaces operate much like conventional primary and secondary art markets. However, the primary distinction is that artists sell their own works directly on the marketplace, rather than hiring an

[227] ALLEN S., JULES A., KHAIRE M., KELL T., SHRIVASTAVA S., *NFTs for art and collectables*, cit.: 23
[228] ART PRICE (curated by), *The art market in 2021*, cit.: 43-47
[229] TAYLOR C., *Embracing technical innovation in the artworld*. In: Art Basel and UBS Report, ed. *The art market 2023*. Switzerland: McAndrew; 2023: 41-45

auctioneer, broker or auction house for representation and commission assistance. Additionally, buyers are able to autonomously list artworks on the market for sale or resale, without the need for an intermediary to take a share.

Nonetheless, NFT marketplaces, which are distinguished by their high liquidity, ease of access, and continuous trading, are characterized by considerable speculation. Unlike the traditional art market, the transactions of NFTs are pseudonymous and have low barriers to entry. Buyers are not required to disclose their identities or backgrounds. Additionally, the relatively low starting prices of many NFTs have opened up accessibility compared to high-priced fine art. The liquidity, accessibility, and anonymity factors have made NFTs as attractive vehicles for short-term financial speculation, instead of longer-term art collecting and the quick trading of NFTs appeals to many buyers as they take advantage of price fluctuations. Although financial speculation may create interest, it can also contribute to price volatility. This occurs when speculators hurry to buy and sell NFTs depending on predicted market shifts, rather than intrinsic artistic value[230]. Moreover, most of the total value generated in the art related NFT business originates from resales. In comparison to the art market, where the average resale period spans between 25 and 30 years, crypto art commonly undergo purchase and resale within a significantly shorter timeframe of approximately one month. According to data from NonFungible.com, a significant number of these resales have been profitable to date, with the total profits exceeding the losses incurred. For instance, 91% of transactions yielded a profit in 2021[231].

The sale of Beeple's NFT at Christie's New York in March 2021 marked a pivotal moment for the traditional art market, propelling it into the realm of technology. The auction not only broadened art horizons but also attracted the attention of multiple buyers, sellers, and artists who ventured into the NFT market, creating tokenizable digital art. Whilst NFTs are appreciated by dealers and auction houses for their ability to attract a wider range of collectors to the art and collectibles market, their influence on sales value has been somewhat restrained. In 2021, both Sotheby's and Christie's sold NFTs with a value of $230 million. However, this figure is dwarfed when compared to their total gross revenues exceeding $14 billion[232].

[230] ART BASEL & UBS REPORT (curated by), *The art market 2023*. Switzerland: McAndrew; 2023: 34

[231] *Ivi*: 35. NonFungible.com solely concentrates on monitoring transactions that occur on the Ethereum blockchain, particularly the ERC-721 standard, as well as the Ronin and Flow blockchains. These three blockchains are believed to comprise over 90% of the total value of NFT sales. Nevertheless, the platform does not oversee off-chain or side chain activities, nor does it encompass sales backed by alternative technological standards that may have arisen on the Ethereum blockchain.

[232] ART BASEL & UBS REPORT (curated by), *The art market 2022*, cit.: 40

In 2021, NFT sales were mainly driven by art and collectibles, which accounted for 63% of the total sales value. However, art alone accounted for a smaller portion, contributing only 14% to the overall sales. In particular, the sales of NFTs for art and collectibles experienced significant growth, skyrocketing from $4.6 million in 2019 to an impressive $11.1 billion in 2021. The value of crypto art sales expanded over a hundredfold in 2021, reaching $2.9 billion, while collectibles experienced even greater growth, reaching $8.6 billion.

In 2022, the collectibles market continued to expand, becoming the dominant segment in terms of value. On the other hand, after reaching its peak in August 2021, sales of crypto art witnessed a market decline in 2022, with its share dropping to 8%. This downturn can be traced back to the drop in the value of Ether, which had a negative impact on the overall market sentiment[233]. Furthermore, the trading volume slowed due to the higher number of offerings and participants saturating the NFT market[234] (see figure 3.2).

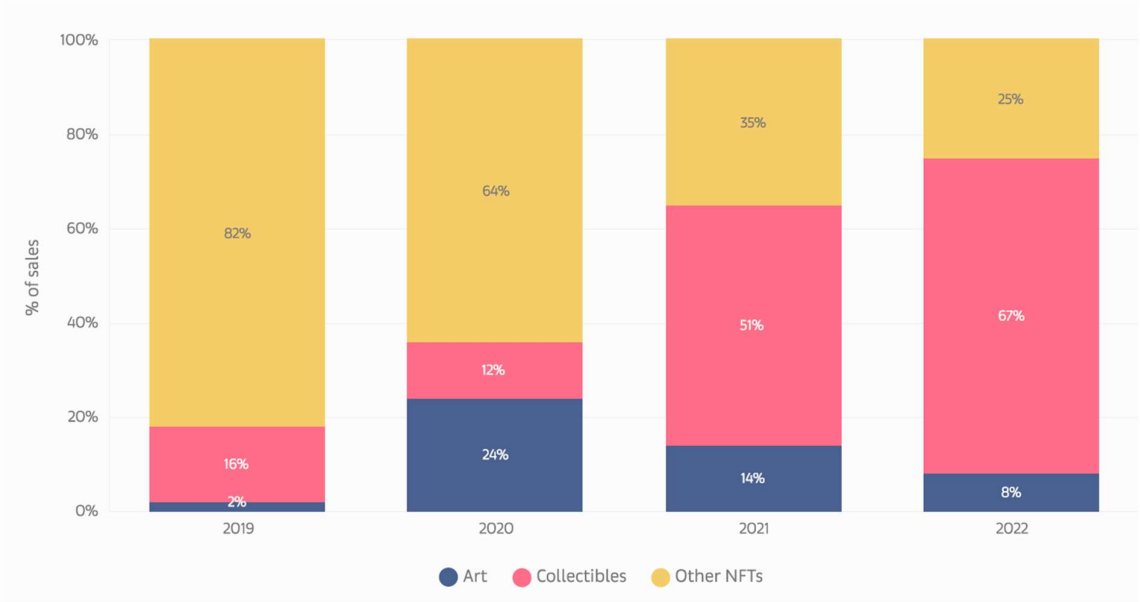

Figure 3.2. Share of value of art and collectibles in all NFT sales 2019-2022. Source: ART BASEL & UBS REPORT (curated by), *The art market 2023.* Switzerland: McAndrew; 2023: 34, with data from nonfungible.com

[233] According to data from Coinbase.com, the value of Ethereum (ETH) experienced a significant surge against the dollar throughout 2021. From January 2020 to its peak in November 2021, the price of ethereum increased 34-fold, from around $135 to over $4,630. This significant growth led to an increase in purchasing power and a rise in speculative trading. However, in the following months, the price of Ethereum fell significantly, reaching a low of $880 in June 2022. By the end of 2022, there was a modest recovery, with the price reaching just over $1,200 in December. However, this was still only around a third of its 2021 peak. More detailed information can be found at www.coinbase.com/price/Ethereum.

[234] ART BASEL & UBS REPORT (curated by), *The art market 2023*, cit.: 33-34

This significant decline in both trade value and volume served to quell the media hype surrounding NFTs and rid the market of its most speculative traders. Figure 3.3 displays the steep rise in prices that also enticed speculative trading.

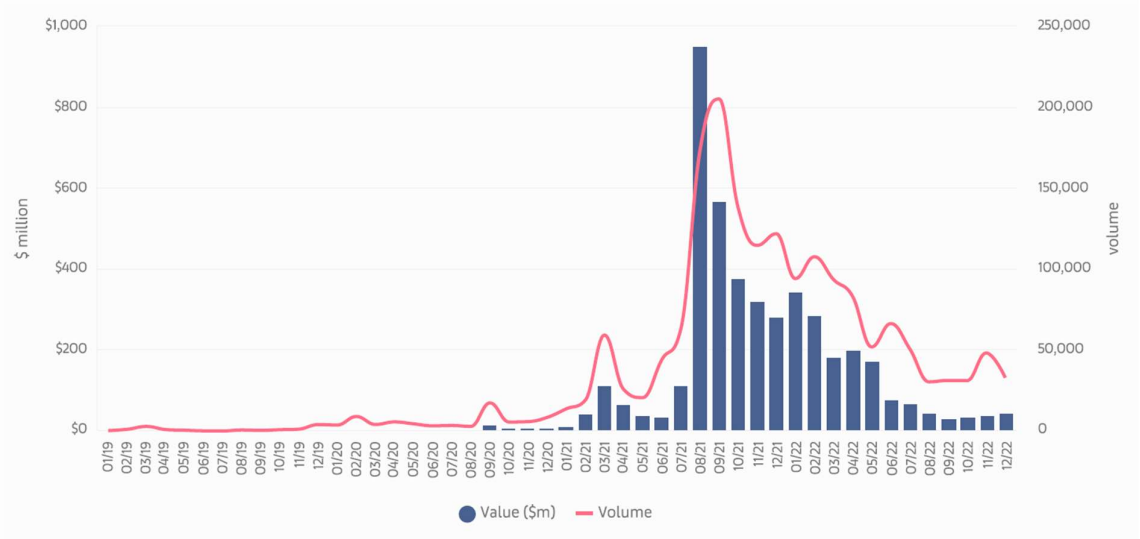

Figure 3.3. Value and volume of sales of art related NFTs 2019-2022. Source: ART BASEL & UBS REPORT (curated by), *The art market 2023.* Switzerland: McAndrew; 2023: 36

In recent years, there has been a significant increase in transactions volume, with figures rising from just over 755,760 in 2019 to 5.5 million in 2021. Moreover, there has been a considerable surge in the number of buyers and seller participating on these platforms, with the figures escalating from less than 45,000 and 25,000 respectively in 2019, to 2.3 million buyers and 1.2 million sellers in 2021. In particular, the numbers of individual buyers and sellers engaging in art related NFT transactions increased rapidly between 2019 and 2021, with unique buyers rising by over 67 times from 2,287 to 153,382 and unique sellers growing by almost 50 times from 1,891 to 92,252 over this period. One factor contributing to the increase in buyers on these platforms is the attraction of significantly escalating prices. The mean price of crypto art for primary sales was $200 in 2020, rocketing to $1,462 in 2021. Similarly, the average price for secondary resales was $265 in 2020 which hiked up to $5,485 in 2021. Although averaging lower prices than art NFTs in 2021 – at $586 for primary sales and $3,108 for resales – collectibles NFTs have experienced a more pronounced year-on-year price increase, jumping form just $9 for primary sales and $72 for resales in 2020. These extremely fast-rising values sparked a rise in buyer participation, with many trying to capitalise on the price surges[235].

[235] ART BASEL & UBS REPORT (curated by), *The art market 2022*, cit.: 42

Although the market contracted in 2022, activity on these platforms continued to expand, as evidenced by a 55% increase in unique sellers to 180,416 and a 14% growth in unique buyers to 174,764. This growth was solely driven by increased participation in the secondary market, as the primary market saw a decline in participation from both buyers and sellers of 12%[236]. Several factors have combined to drive the burgeoning resale market for NFTs. Reasonably priced initial offerings and steeply increasing secondary values, together with the immediacy of trading NFTs afforded by smart contracts, have generated a level of liquidity that far surpasses what has been achievable in the traditional secondary art market. The convergence of these circumstances spurred a surge in speculative trading, with investors swiftly buying and selling NFTs at an unprecedented rate, fluidly entering and exiting positions. Consequently, the burgeoning resale market was predominantly fuelled by short-term tactics rather than prolonged investments.

Traditionally, the secondary market dominated collectibles sales, whereas art NFTs initially saw greater involvement in the primary market. Notably, in 2019-2020, primary transactions accounted for the majority of both sales volume and value for art NFTs. However, as the sector matured, this balance shifted rapidly. As already mentioned, the unprecedented surge in prices and instant liquidity in 2021 fuelled an explosion in secondary trading. That year, secondary sales increased to 73% of the overall art NFT value, while primary sales decreased to 27%. Moreover, the percentage of transaction count for secondary deals more than doubled. This trend continued to accelerate in 2022, where secondary sales solidified their dominance. They constituted 80% of art NFT revenues and the majority (61%) of trades, indicating that reselling has overtaken new releases and commissions as the principal marketplace function[237].

Despite experiencing significant price declines from late 2021, art related NFT sales in 2022 approached $1.5 billion, which still represents a large drop of 49% year-over-year but signifies values that are over 70 times greater than the $20 million market in 2020. Nevertheless, this decline in the art segment was considerably worse than that of NFTs overall, which saw only a 12% value decline across all categories. The markedly larger collectables segment outperformed expectations, with valuations increasing by 15%, from $10.3 billion in 2021 to $11.8 billion in 2022 (see figure 3.4)[238].

[236] ART BASEL & UBS REPORT (curated by), *The art market 2023*, cit.: 35
[237] *Ivi*: 38
[238] *Ivi*: 37

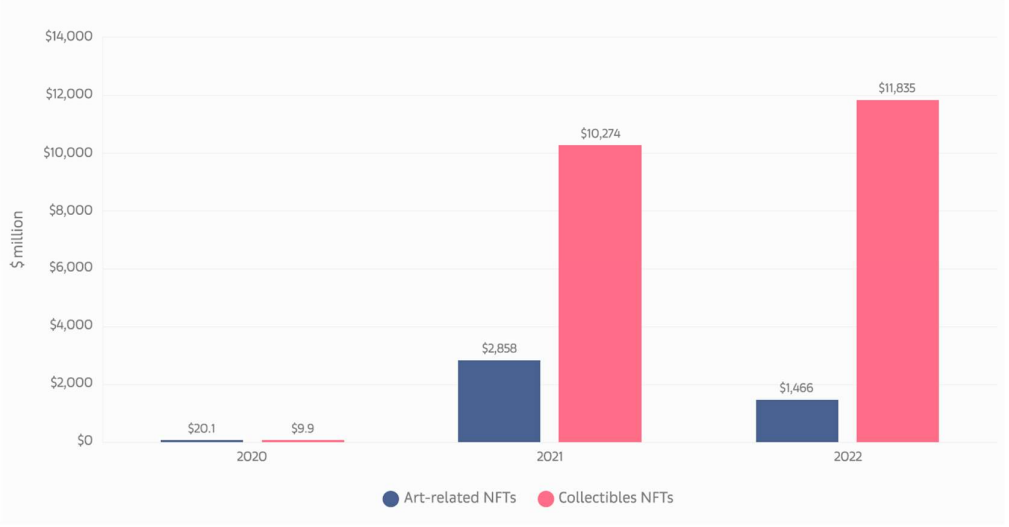

Figure 3.4. Annual sales of art and collectibles NFTs 2020-2022. Source: ART BASEL & UBS REPORT (curated by), *The art market 2023.* Switzerland: McAndrew; 2023: 37

The rise of NFTs has led to the creation of the "creator economy", a thriving network where artists and creators earn continual royalties and maintain direct contact with their audience[239]. Prominent auction houses, namely Sotheby's and Christie's, have formed specialized teams to address their digital asset divisions[240]. The rise in popularity of NFTs has transformed the relationship between artists and conventional art dealers, leading digitally native creators to increasingly consign their works directly to these auction houses. While brick-and-mortar auctions tend to display the highest-quality artworks, bidding at such auctions may result in higher fees for buyers compared to purchasing NFTs on online platforms like OpenSea. The data previously analysed indicates a decline in sales volumes from previous peaks, but it also underlines sustained interest in NFTs and their growing appeal amongst novice collectors[241]. In the world of NFT auctions held by prestigious auction houses, record-breaking sales are often driven by an increase in new buyers. For example, during the sale of Beeple's Everydays at Christie's, an incredible 91% of bidders were previously unfamiliar with the auction house. This highlights the appeal of NFTs to a new audience[242].

[239] *Ivi*: 41
[240] For instance, Christie's launched Christie's 3.0, a completely on-chain NFT platform that facilitated blockchain auctions. In 2022 the platform held two auctions and sold a total of 87 NFT lots for just under $6 million. Sotheby's launched their exclusive platform for NFT sales, Sotheby's Metaverse, in October 2021. They also organize Natively Digital, a highly esteemed set of auctions dedicated solely to digital art and NFTs, thrice a year, along with the virtual gallery in Decentraland. ART BASEL & UBS REPORT (curated by), *The art market 2023*, cit.: 158-159
[241] TAYLOR C., *Embracing technical innovation in the artworld*, cit.: 41-45
[242] WHITAKER A., *NFTs and the art market*, cit.: 49-55

Italians are also showing increasing familiarity with NFTs. According to a 2022 study by Ipsos and Politecnico di Milano, 9% of Italian collectors own or have owned NFTs, while 14% express an interest in purchasing them in the future, implying a potential rise in NFT adoption. Among the NFTs owned by Italian consumers, artistic NFTs are the prevailing category, possessed by 27% of NFT owners, followed by profile pictures and collectibles[243] (see figure 3.5).

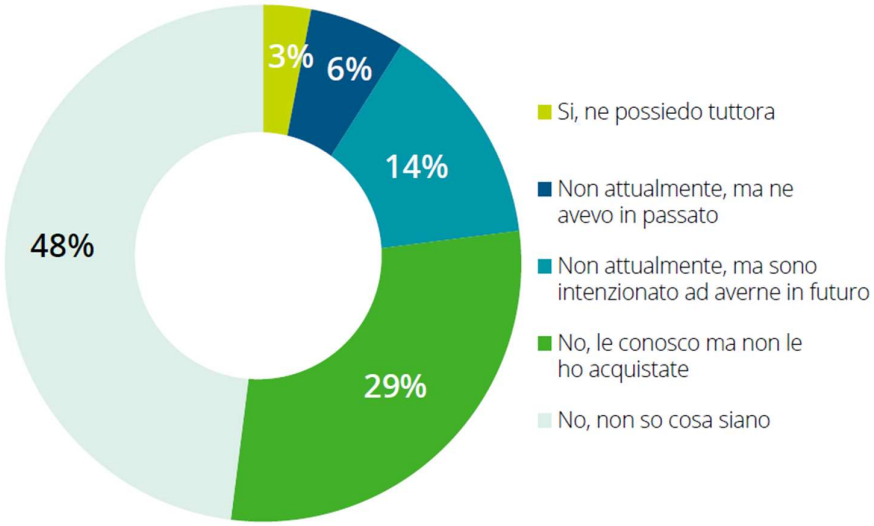

Figure 3.5. Italian collectors that currently possess or have formerly possessed NFTs. Source: MIONE M., GUZZONI E., CIRICA F., *Fuori dall'hype: evoluzione e nuove prospettive del mercato NFT*. In: Deloitte creative team - Italia, ed. *Il mercato dell'arte e dei beni da collezione, report 2023*. 2023: 70-75

Generally speaking, according to the online art trade report by Hiscox, traditional art collectors are hesitant to fully embrace NFTs and remain cautious about their immediate future. Only 12% of art buyers surveyed at the beginning of 2023 expressed interest in purchasing an NFT in the next twelve months, a decline from the 27% recorded in January 2022[244]. The majority (66%) of NFT buyers stated that their primary motivation for purchasing NFTs was the potential return on investment, despite a decrease from 83% in 2022. Nevertheless, there has been an increase in the percentage of buyers who consider social impact and patronage as crucial factors, rising to 54% from 39% in 2022. Furthermore, an increasing number of individuals acknowledged the advantages of community spirit, with 44% of respondents agreeing that joining a network and engaging with people with similar interests is an important factor in buying NFTs, up from 38% in 2022[245].

[243] MIONE M., GUZZONI E., CIRICA F., *Fuori dall'hype*, cit.: 70-75
[244] HISCOX & ART TACTIC (curated by), *Hiscox online art trade report 2023*. London; 2023: 30
[245] *Ibidem*

In particular, according to the research published by Statista on 27 September 2023, the trade of non-fungible tokens within the art sector has experienced considerable variation from April 2021 up until September 2023. The statistic provides insights into the recent market activity and highlights the fluctuations in NFT sales within the art segment during the specified 30-days timeframe. As of April 15th, 2021, art related NFTs sales for the preceding 30 days amounted to approximately 28.4 thousand, generating and aggregated value of around US$78 million. However, the highest point of this statistic was attained on 15th August 2021, with an approximate total of 117.4 thousand NFT sales recorded in the art segment within the same duration. Following this peak, the sales trend displayed a general decline in the subsequent months. As if 15th September 2023, about 4.3 thousand NFT sales were recorded over a 30-day period, with a total value amounting to roughly US$11.1 million. These sales transactions were carried out through the Ethereum, Ronin, and Flow blockchains[246].

The research carried out by The Block provides insights about art and collectibles NFT trade volume on the Ethereum blockchain. The graph displays how the volume of transactions is generally decreasing during 2023, with the *Bored Ape Yacht Club* NFTs always gaining more attention in comparison to the other NFTs (see figure 3.6) [247].

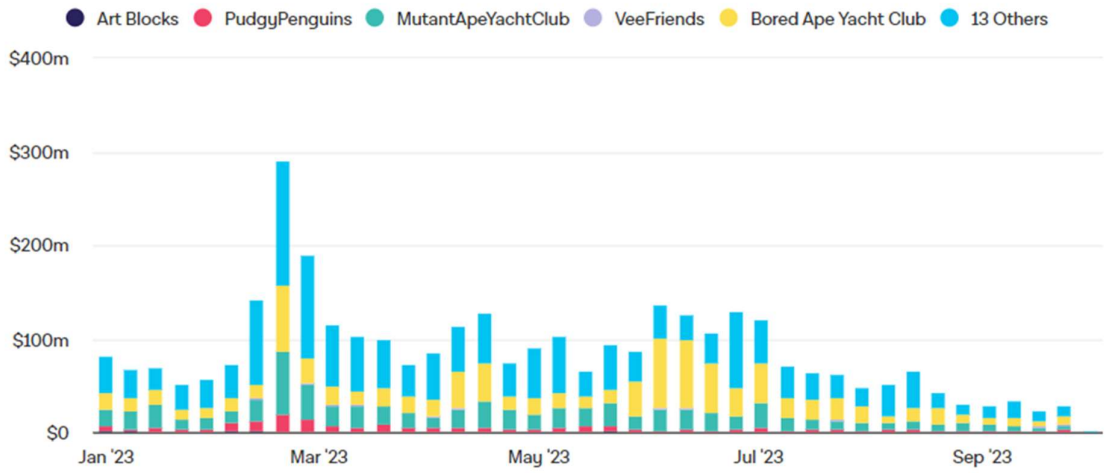

Figure 3.6. Ethereum art and collectibles NFT trade volume updated to October 2, 2023. Source: THE BLOCK (curated by), *NFTs. Art and collectibles*, 2023, available at https://www.theblock.co/data/nft-non-fungible-tokens/art-collectibles (last consultation 2/10/2023)

[246] STATISTA (curated by), *Total number of sales involving a non-fungible token (NFT) in the art segment worldwide over the previous 30 days from April 15, 2021 to October 15, 2023, by type*, 2023, available at https://www.statista.com/statistics/1235228/nft-art-monthly-sales-volume/#statisticContainer (last consultation 27/10/2023) and STATISTA (curated by), *Total value of sales involving a non-fungible token (NFT) in the art segment worldwide over the previous 30 days from April 15, 2021 to October 15, 2023, by type*, 2023, available at https://www.statista.com/statistics/1235263/nft-art-monthly-sales-value/ (last consultation 27/10/2023)

[247] THE BLOCK (curated by), *NFTs. Art and collectibles*, 2023, available at https://www.theblock.co/data/nft-non-fungible-tokens/art-collectibles (last consultation 2/10/2023)

Moreover, following the research by The Block, also the average sale price of well-known Ethereum NFT collections is constantly decreasing over 2023, with a particularly significant fluctuation for *CryptoPunks* (see figure 3.7)[248].

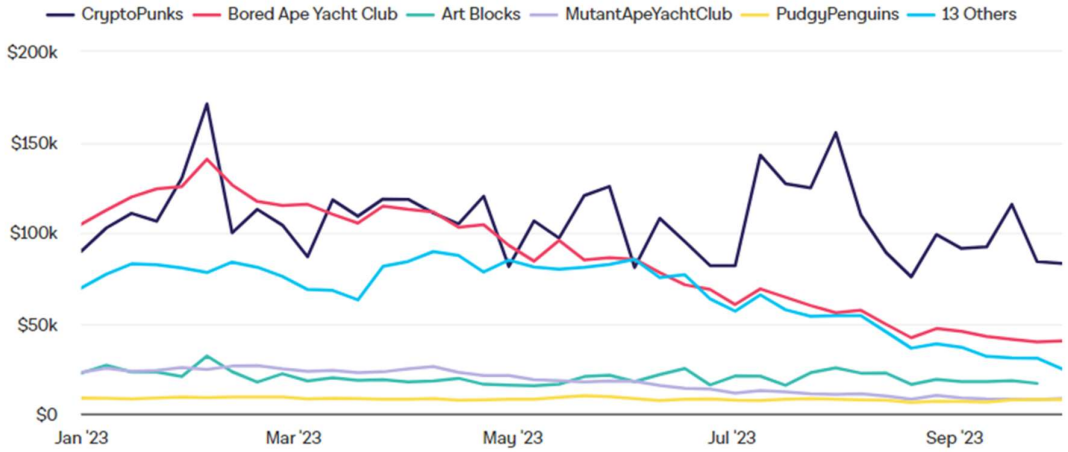

Figure 3.7. Ethereum art and collectibles NFT average sale price updated at October 2, 2023. Source: THE BLOCK (curated by), *NFTs. Art and collectibles*, 2023, available at https://www.theblock.co/data/nft-non-fungible-tokens/art-collectibles (last consultation 2/10/2023)

At present, the market of NFTs is undergoing significant growth and offering substantial profit-making potential. These data, which are valid at the time of writing, underscore the immense growth and global trends within the NFT market. The market's robust revenue projections, average revenue per user, and expanding user base depict the opportunities available and the market's evolving landscape. The NFT market is set to grow substantially, with estimated annual revenue projected to increase at a CAGR of 18.55% between 2023 and 2027. This trajectory suggests that the total revenue in the NFT market is estimated to reach an impressive sum of US$3,162.00 million by 2027. In terms of the average revenue per user, it is calculated to be roughly US$114.80 in 2023. From a worldwide perspective, it is evident that the United States earned the highest revenue amounting to US$781,900.00 thousand in 2023, demonstrating its dominant position in the NFT market analysed. Furthermore, the market is expected to observe significant growth in user numbers. By 2027, it is expected that the number of users will reach approximately 19.31 million individuals, indicating the growing interest and engagement within the market[249].

[248] *Ibidem*
[249] STATISTA (curated by), *NFT – worldwide*, 2023, available at https://www.statista.com/outlook/dmo/fintech/digital-assets/nft/worldwide (last consultation 28/10/2023)

3.3 Emerging risks and coverage proposals

Art related NFTs have gained immense significant popularity and investment potential; however, they also pose certain risks that require consideration. To reduce these risks, insurance policies tailored to NFTs are emerging to offer safeguarding for collectors, artists, and investors. It is imperative that those participating in the crypto art market comprehend the risks and insurance solutions available to protect their valuable assets. The thriving NFT market presents exciting possibilities for novel utilizations and income streams and, as interest grows, so does the importance of anticipating the risks associated with NFTs and their transactions.

Traditional art collectors should be knowledgeable about the potential dangers when acquiring artwork. To ensure a seamless transaction, thorough research into the provenance of a piece and the implementation of additional security measures are crucial steps. In contrast, the trade of non-fungible tokens presents an enhanced level of security and transparency. NFTs act as immutable digital signatures, instilling unparalleled confidence amongst collectors and this newly found confidence extends to the preservation and legacy of art. Digital art pieces held on the blockchain are protected against physical decay, although proper storage remains crucial. Furthermore, blockchain technology enables the secure and widely available movement of high-value assets, all while remaining transparent to the public eye. Just as blockchain technology established a trusted protocol for digital currency, NFTs now ensure the authenticity, uniqueness and ownership of unique assets[250].

Although NFTs offer numerous advantages, there remain challenges and risks, such as identifying the authentic owner of an NFT and ascertaining its uniqueness. With the growth of the digital world and an increasing number of NFT transactions, there has been a surge in fraudulent activities including the possibility for malicious actors to counterfeit NFT artwork created by well-known artists and distribute them for sale, the theft and duplication of sought-after NFT designs, and fake NFT giveaways. While technological progress has facilitated the efficient trading of digital assets, it has also ushered in novel cyber dangers[251].

Copyright protection issues have become increasingly prevalent, especially on open non-curated NFT platforms. It is essential to exercise caution when uploading content to such platforms, as any file has the potential to be sold without permission. The digital domain poses challenges for artists with respect to ownership and attribution due to the ease of

[250] SHILINA S., *A comprehensive study on non-fungible tokens (NFTs)*, cit.: 29
[251] *Ivi*: 34

unauthorized replication and distribution of their creations. Consequently, there is a demand for a renewed approach to safeguarding intellectual property in the digital era. Numerous artists have reported cases where their works were sold as NFTs on digital marketplaces without their consent or awareness. An exemplary instance is the incident involving a Jean-Michel Basquiat NFT drawing, which was listed for auction but later removed after it was discovered that the sellers did not possess the rights to it. This clearly goes against the primary aim of NFTs, which is to facilitate the lawful sale of art: the inherent value proposition of an NFT lies in its ability to authenticate a physical work of art using a unique token, ensuring that the token holder is the rightful owner of the original artwork. However, a significant problem arises when someone creates an electronic depiction of the actual work, affixes a token, and sells it on a virtual commercial platform. Under this circumstance, there is no affinity with the primary artwork, and the token is associated with a fraudulent reproduction. The importance of conducting thorough research and deploying comprehensive authentication measures within the NFT industry cannot be understated, as these measures can mitigate deceptive or unauthorised NFT transactions and protect the interests of artists, copyright holders, and collectors.[252].

The decentralised nature of NFT platforms removes the need for sellers to undertake "know your customer" or similar audits, unlike conventional online platforms. Several marketplaces permit the creation of fresh NFTs free of charge, with a simple process and no limitations on quantity. This implies that anyone, including automated programs, could generate an NFT without the content's authorisation and sell it without demonstrating ownership of the initial image. Although copyright regulations, like the 1996 WIPO Copyright Treaty and the 1998 Digital Millennium Copyright Act in the United States, are applicable to such channels, application relies generally on copyright holders or their delegates detecting violations and issuing takedown notices to the service provider. However, detecting and addressing intellectual property infringements can be a difficult and time-consuming task. Some platforms have considered limiting and banning known infringers, but the anonymity provided by these assets enables them to potentially continue operating under a different wallet and pseudonym[253].

To counteract instances of art infringement on NFT platforms and safeguard the rights of artists and collectors, DeviantArt, a well-known international content platform for artists founded in 2000, launched DeviantArt Protect in 2021. This innovative image recognition

[252] *Ivi*: 31
[253] ART BASEL & UBS REPORT (curated by), *The art market 2022*, cit.: 47

software scrutinizes public blockchains and third-party marketplaces to pinpoint any potential instances of art infringement relating to minted NFTs. This undertaking broadened their pre-existing image review measures, previously concentrating exclusively on breaches within their own platform, which serves about 70 million registered users. From its launch in September 2021, until January 2022, DeviantArt Protect dispatched 120,000 alerts regarding infringements to their users. The software surveys more than five million NFTs every week, and the volume of infringement notifications is substantially increasing. Between September and October 2022, alerts rose by 30%, and the monthly growth rate increased by over 300% from November to December, suggesting a rapid expansion of the reported activities. Furthermore, bots designed to scrape the internet, reproduce artist's work, and automatically list these copies for sale on NFT platforms have been identified through DeviantArt's audit research. Such practices have been made effortless by the ease of minting new NFTs with no limitations. The widespread use of these practices in NFT platforms presents substantial challenges to the market's long-term stability and the absence of comprehensive regulatory oversight has resulted in instability and aversion to risk, which have undermined both current and prospective users' confidence in the NFT ecosystem, hindering its potential for future advancements[254].

These platforms operate without a proper regulation, allowing transactions which would be deemed unacceptable in other financial markets. The technique of "wash-trading", whereby the worth of an NFT is artificially enhanced by trading between accounts owned by the same person, is noticeably one of them. Although it is prohibited in various jurisdictions for traditional financial instruments, NFTs are currently unregulated, with no regulatory oversight or enforcement mechanisms in place[255]. Through the use of blockchain analysis, instances of NFT wash-trading can be tracked by scrutinising transactions that relate to NFT sales that are funded by self-financed addresses. In other words, these addresses are either funded by the selling address itself or by the address that initially delivered funds to the selling address. An analysis of NFT sales to self-financed addresses indicates that particular NFT vendors conducted a substantial quantity of wash trades, equating to hundreds of transactions. Cryptocurrency auditing firm Chainanalysis has published data presenting numerous instances of wash-trading in the NFT market during 2021, resulting in significant profits for a select few traders. The analysis identified 262 users who performed over 25 transactions, selling NFTs to their own funded addresses. Although not all of these trades

[254] *Ivi*: 47-48
[255] *Ivi*: 46

resulted in profits, the 110 successful wash traders generated almost $9 million in profit, in contrast to the $416,984 in losses incurred by the 152 unsuccessful traders[256].

Another growing concern is the occurrence of "rug-pulls", whereby NFT collections sell out at high profits initially, under the promise of free NFTs, or additional benefits in future drops. Unfortunately, this is just a façade, as the creators often disappear, leaving original buyers with worthless NFTs[257].

Money laundering is a long-standing issue within the realm of fine art, and its underlying causes can be easily comprehended. In fact, criminals can use illegally acquired funds to buy artwork, sell it later and by doing so they attain money that appears legitimate, with no traces leading back to the original unlawful activities. Taking this into account, along with the anonymous nature of cryptocurrencies, concerns have emerged about the vulnerability of NFTs to comparable criminal practices. However, in contrast to the challenge of determining the extent of money laundering in physical art, the transparency inherent in blockchain technology facilitates more trustworthy estimations of NFT-related money laundering[258].

The emergence of non-fungible tokens has transformed the art industry, offering artists and art collectors novel prospects for possession, authentication, and revenue generation. Nevertheless, along with the potential benefits, there are also inherent risks associated with the use of art NFTs which are very different from the ones faced by traditional art. Insurance policies have historically mitigated risks in various domains; however, it is crucial to acknowledge that traditional insurance may not comprehensively cover all the risks associated with crypto art.

As the art world undergoes significant changes, where the value of digital creations is comparable to traditional artworks, insurance practices are also evolving to accommodate the protection of this new kind of art. Upon examining art history, it becomes apparent that insurance options for digital art were limited, indicating the initial suspicion around the authenticity and worth of this emerging medium. Traditional insurance policies, designed for physical assets, faced challenges when it came to accounting for the distinct traits of

[256] ART BASEL & UBS REPORT (curated by), *The art market 2022*, cit.: 46 and CHINANALYSIS (curated by), *The 2022 crypto crime report. Original data and research into cryptocurrency-based crime*. February 2022: 33

[257] ART BASEL & UBS REPORT (curated by), *The art market 2022*, cit.: 46

[258] CHINANALYSIS (curated by), *The 2022 crypto crime report*, cit.: 11

intangible digital creations. This left artists and collectors exposed to a range of risks without sufficient coverage.

The various risks associated with art NFTs have been observed, but the capabilities of insurance coverage to address these challenges are restricted. While insurers provide coverage for certain digital assets, their existing product mainly concentrate on fungible tokens such as cryptocurrency, rather than non-fungible tokens. Similar to other digital assets such as cryptocurrencies, NFTs are vulnerable to loss or theft. For example, there have been reports of NFT theft through scams totalling over $100 million between July 2021 and July 2022. On average, these scams netted perpetrators $300,000 each[259]. Scams can take many forms, but typically entail duping victims through fraudulent methods to obtain and steal their assets[260].

Due to the substantial value linked to NFTs, numerous investors are considering insurance coverage as a means of securing their financial interests in case of such circumstances[261]. Clyde & Co. senior associate David Ktshozyan states that «Insurers whose policies may potentially respond to such claims will need to determine whether their individual wordings potentially trigger coverage. On the other hand, current trends seem to indicate that NFTs are largely popular among the younger generation, who may not recognise the role that insurance plays with respect to risk of loss. Given the unique nature of NFTs – and their associated risks – coupled with a market of new potential customers, there will almost certainly be a need for new, bespoke insurance products providing unique solutions for digital assets, including NFTs»[262].

The insurance sector faces multiple difficulties when evaluating insurance coverage for NFTs. Firstly, the NFT market remains reasonably fresh and fraught with considerable unpredictability and volatility, creating uncertainties regarding valuation[263]. Furthermore, there are apprehensions about the preservation of NFTs, where “hot” storage pertains to online connectivity, which heightens susceptibilities to theft or loss, whereas “cold” storage delivers offline security measures[264]. In particular, when an NFT is bought, the token is transferred to the buyer’s digital wallet for cryptocurrency. NFTs are usually kept in cold storage wallets, which are disconnected form the internet to enhance security. Two typical cold wallets that are used for NFTs are metal wallets (MTL) and crypto capsules. These are

[259] ELLIPTIC (curated by), *NFTs and financial crime. Money laundering, market manipulation, scams & sanctions risks in non-fungible tokens*. Elliptic NFT report 2022 edition; 2023: 4
[260] *Ivi*: 13
[261] EVERSHED T., *NFTs – covering the intangible*, cit.
[262] *Ibidem*. Global law firm Clyde & Co provides extensive services to clients across its core sectors, comprising commodities, trade, transport, energy and insurance.
[263] The problem of crypto art appraisal is discussed in more detail in the next paragraph.
[264] EVERSHED T., *NFTs – covering the intangible*, cit.

encrypted physical devices, similar to USB drives, providing offline storage for digital assets. By storing the NFT in cold storage, rather than in a hot wallet connected to the internet (the MetaMask wallet displays their tokens virtually), the buyer can reduce the risk of digital hacking or theft of the token. This approach to cold storage illustrates how NFTs bridge the virtual and physical storage is necessary for optimal ownership security[265].

Jennifer Schipf, global chief underwriting officer for fine art and specie at AXA XL, during an interview with Business Insurance Magazine stated that she has received several inquiries from customers interested in insuring digital assets, such as NFTs. Schipf clarified that AXA XL's specie segment covers cryptocurrencies and some Bitcoin cold storage, which are valuable commodities and not art-related items. Insuring NFTs demands a mixture of cyber insurance and fine art insurance: insurance policies covering fine art generally safeguard against physical loss or damage, which is not applicable to NFTs since they do not have a physical form. According to Schipf, policyholder should ensure that their current policies have sufficiently broad language and do not exclude coverage for advising on the sale of digital assets, either explicitly or implicitly[266].

Despite the digital risks often associated with cryptocurrency, insurance companies are starting to offer insurance protection for its physical aspects through the employment of cold storage. Non-fungible tokens, as cutting-edge technology, they have substantial implications for underwriters. Presently, the NFT market is relatively undeveloped: unlike the traditional market for fine arts, which has evolved for centuries and boasts established infrastructure, the NFT market is still in its nascency. In the conventional art market, specialists can confirm the provenance of artworks, appraisers can evaluate prices based on historical data, solicitors can manage legal matters, and skilled artisans can restore damaged works. The insurance sector has also accumulated significant knowledge about insuring art in the traditional market. In contrast, the crypto art market presently lacks the same level of established structure. It is relatively underdeveloped, which creates challenges when assessing the value of NFT-linked artworks during policy renewals. Furthermore, there is uncertainty concerning the repairability of damaged digital art and whether it would be deemed a total loss-only market. Additionally, determining the value of a total loss in a volatile market poses

[265] ALUMA-BAIGENT A., *Crypto: art, currency, and capital*, cit.: 6
[266] LERNER M., *Digital artwork creates new risks*, «Business Insurance», 1 June 2021

difficulties. Another problem arises due to the shortage of insurers with claim teams that possess the necessary experience to handle crypto art claims in an efficient manner[267].

To address these enquiries regarding digital and crypto assets, Mary Pontillo, senior vice president and national fine arts practice leader for Risk Strategies, teamed up with Rob Rosenzweig, the senior vice president and national leader in cyber risk practice at Risk Strategies[268]. Rosenzweig clarifies that when galleries and auction houses sell and insure digital or other forms of fine art, there are two types of potential risks: first-party and third-party exposures. Third-party exposure pertains to the prospect of loss, theft, or damage to an NFT whilst it is under the care, custody, or control of the art dealer. In such scenarios, it is imperative to devise a solution to ensure the gallery is compensated and the consignor is reimbursed. There is also the risk that involves the potential for a liability claim against the gallery if they are found to be negligent in securing the NFT. Rosenzweig maintains that the liability risk can be addressed with relative ease in the current commercial insurance marketplace. He points out that well-structured cyber policies, which galleries or auction houses typically maintain, usually do not include exclusionary language that restricts coverage for unauthorised access, cybercrime, or any activities that involve exfiltrating, damaging, or altering an NFT. However, Rosenzweig identifies two challenges concerning the first-party insurance of artwork. Firstly, in the context of commercial crime policies and cyber policies that cover digital crime, assessing the value of a digital collectible, as already said, differs markedly from the methods used for money, securities, or tangible property. Secondly, the industry is facing the challenge of determining how to ensure the risk that comes with holding digital currencies, including NFTs. The issue is not only limited to the fine art sector but also applies to businesses and exchanges functioning as digital banks that hold other digital currencies. There are efforts to comprehend how to assess the risk based on various factors, such as cold storage or hot storage methods. While certain specialised insurance markets have introduced products designed to address the loss or theft of digital currencies, such as NFTs, Rosenzweig highlights the need for insurers to develop a greater understanding of the storage locations used by collectors, galleries, and auction houses[269]. Pontillo recommends that individuals engaged in selling, purchasing, or exchanging NFTs should utilize a trustworthy and well-established storage. It would be advantageous to inquire whether the custodian possesses its own insurance policy, as this suggests that they have been

[267] DRABBLE R., *Why Nike's virtual shoes are a step towards the future of fine art insurance*, «Liberty Specialty Markets», 17 November 2021
[268] MOORCRAFT B., *How can we insure NFTs?*, «Insurance Business Magazine», 13 July 2021
[269] *Ibidem*

assessed by crypto-focused underwriters and satisfy specific criteria. In conclusion, the possibilities for insuring art NFTs are currently restricted. According to Rosenzweig, the coverage currently available in the cyber market concentrates largely on third-party liability, while first-party coverage is currently undermined. Rosenzweig proposes that coverage for NFTs is more suited to a fine art policy due to their distinctive valuation factor. Despite being a digital currency at its core, NFTs differ in value from traditional currency. Therefore, assessing losses based on their value would be better served by fine art adjusters, who have an in-depth understanding of the marketplace and the valuation of such works[270].

To summarize, conventional insurance policies for fine art and cyber risks fail to provide coverage against potential damage or loss of cryptographic keys and related works. The insurance sector faces challenges regarding NFT coverage, which potentially necessitates a combination of features from cyber insurance, fine art insurance, and other relevant areas to create a hybrid product. Fine art insurance policies usually cater to physical damage or loss and thus, it may be hard to imagine how they can appropriately handle claims involving non-physical assets like crypto art. In situations where the owner has exclusively misplaced the cryptographic key or the hard disk that contains the NFT, the digital document persists, and the misfortune is mainly pecuniary rather than corporal. Nevertheless, Rob Rosenzweig clarifies that there is a physical aspect to NFT artworks. As NFTs are typically stored on URLs, anyone can retrieve and scrutinise them over the internet. This presents the potential for unauthorised modification, which may decrease the value attributed to the NFT as an artwork or as part of a collection. In such instances, vandalism or unapproved modifications may conceivably be protected under traditional fine art insurance policies[271].

Art insurers, who were initially hesitant to venture into unknown territory, are now recognising the potential of digital art and NFTs. However, the lack of available data due to the early stages of the NFT market is a considerable hurdle in insuring NFTs. Furthermore, the volatile nature of this market constitutes another challenge. Determining the payout for a loss of something as abstract as an NFT in a rapidly changing market is a complex issue. Due to the nascent stage of the digital assets industry, insurance providers that specialise in valuable possessions are not yet prepared to furnish their usual “all risks” coverage for such assets. This is mainly due to the fact that unknown or unforeseeable loss scenarios are a major concern, making it arduous to limit coverage merely through exclusionary conditions.

[270] *Ibidem*
[271] *Ibidem*

Additionally, insurers are confronted with a deficiency of data on the types, frequency, and severity of conceivable risks.

Because of these reasons, insurance policies for crypto art are usually structured upon a "named perils" approach. Consequently, coverage is only available for specific perils that are mentioned in the insurance contract. If a claim is made, the insured party must prove to insurers that the claimed loss pertains to one of the specified perils and elucidate how the loss was caused by that particular peril[272].

When discussing the risks covered by a digital asset insurance policy, it is important to note that the policy does not primarily focus on insuring the digital assets themselves. Rather, the policy is centred around the private keys or key shares required for conducting transactions involving digital assets on a blockchain. As already said in the first paragraph of this chapter, private keys serve as the digital equivalent of a physical key or password, providing the owner with exclusive control over their digital assets. Possessing the private key associated with a particular public address on a blockchain allows the owner to sign and authorize transactions involving their assets. In particular, a private key is a randomly generated, unique, and cryptographically secure string of characters generated using advanced mathematical algorithms. These private keys, which are of utmost importance, are normally protected against three particular perils. Firstly, the policy provides coverage for the permanent loss or destruction of private keys, including any backups or copies associated with them. The second peril involves theft or unauthorized reproduction of the private keys, resulting from collusion or dishonesty on the part of employees or agents entrusted with their safekeeping. The third peril protects against theft or copying of private keys by third parties not affiliated with the insured or their agents. Simply put, insurance products designed for NFTs will consider it an insured loss if an NFT owner is unable to access their token. In order for the insured to be eligible for coverage under the last two perils, the theft or copying of digital assets must lead to the permanent loss of those assets after they have been transferred to a public blockchain address outside of the insured's control. It is worth noting that, in the case of the third peril, the act of theft cannot be conducted remotely. The perpetrator must have physical access either to the hardware storing the private keys, key shares, or backups, or to the insured's designated premises where their business operations take place. This

[272] APPRAISAL BUREAU (curated by), *Interview: James Croome, head of Fine Art & Specie Arch Insurance Company*, 17 August 2022

proximity requirement ensures that coverage is limited to situations where the assailant has direct access to the necessary components to carry out the nefarious act[273].

For NFTs that represent digital artwork, obtaining insurance coverage that protects against the loss or theft of the NFT's private keys is possible. It is noteworthy that this coverage exclusively concerns the NFT as proof of ownership, and it does not insure the underlying digital artwork. In fact, it is yet unknown whether intellectual property insurance or cyber insurance would be able to cover a loss event with regard to the digital artwork component that is referenced by the token but is stored independently[274]. As the value of NFTs connected with digital artworks can be highly unstable, self-custody of these assets usually cannot be insured. Consequently, to obtain coverage, the insured must retain the services of a trustworthy professional custodian. This reduces the moral hazard for insurers as the custodian, distinct from the person who owns the NFT, can offer a more secure storage solution. A prevalent method for achieving this is through a hard wallet, a physical device that securely stores the NFT private keys. The insured can then give this hard wallet to the custodian, who will keep it in a secure safe or vault[275].

In the context of NFT insurance, there are standard exclusions that typically apply. One such exclusion concerns "systematic" risks, which refer to risks associated with the failure of the underlying blockchain or smart contract. Insurers may be unable to provide coverage for these risks, as they are considered inherent to the technology itself. In addition, insurers may also exclude risks that are deemed too unlikely or remote to occur. If a policyholder's customer is forced to send transaction instructions under duress, and the policyholder complies, leading to the token being diverted to a bad actor's digital wallet, the underwriter is unlikely to cover any resulting losses. This exclusion is based on the understanding that these circumstances are unforeseeable and beyond the control of the insured[276].

YAS Digital Ltd, a Hong Kong-based regional InsurTech company, and the Hong Kong branch of Assicurazioni Generali S.p.A., were the pioneers in embracing the challenges presented by NFTs in the insurance industry. On April 6th, 2021, they launched NFTY, an innovative insurance product that leverages the growing popularity of advanced blockchain

[273] *Ibidem*
[274] NOH M. E., *Brave new media – collector risks in relation to the insurability and valuation of NFTs*. In: Deloitte, ed. *Art & finance report 2021*. Luxembourg: Deloitte private; 2021: 304-306
[275] *Ibidem*
[276] *Ibidem*

technology to authenticate digital assets, including media, music tracks, artworks, and collectibles. The first artwork insured under this policy was the music track "Nobody Gets Me" by Hanjin Tan, a Chinese-Singaporean singer. The policy specifically provides coverage for the theft and loss of the NFT, safeguarding the interests of the policyholder[277]. On May 24, 2021, YAS announced that it was expanding NFTY's coverage into the realm of fine arts by partnering with The Spectacle Group, a contemporary art gallery located in Kowloon Tong which showcases artists from across the globe and serves as a pioneer in the Hong Kong art scene by introducing NFT art for the first time. As a result, YAS has insured the first group of five NFTs from Antoine Gaussin's series of airport runway photographs, "The Uncharted Project", which Gaussin presented at Art Central 2021 in Hong Kong[278]. Currently, the coverage is temporarily unavailable, but YAS assures customers that NFTY will be relaunched soon.

A few pioneering insurance firms are venturing into the nascent market of crypto art insurance, with Coincover and selected Lloyds syndicates leading the way. Some providers furnish policies that safeguard the safekeeping of private keys for digital assets. Specifically, in 2019, Arch Insurance (UK) Limited collaborated with Marsh, a prominent global broker, to unveil Blue Vault, a revolutionary product that is globally accessible. Blue Vault offers coverage up to US$150 million per client through the Lloyd's market for the loss or theft of private keys due to external or internal incidents, including employee theft or physical damage. The policy guarantees that the private keys remain properly secured in conventional vault facilities[279].

Malca-Amit, a company founded in 1963 in Israel and now operating worldwide, is specialized in the provision of secure and seamless logistics services for the movement and storage of high-value, precious items. Since 2021 it provides a service of securely safeguarding digital assets in a physical Ballet wallet within their highly protected vaults[280]. As an established storage provider for valuable items such as diamonds and bullion, they possess extensive experience and have equipped their premises with robust security systems, comprising physical surveillance and alarm systems. Access control mechanisms and identity checks ensure that only customers have authorized access to their own Ballet wallets. Furthermore, Malca-Amit provides complete liability coverage for customers'

[277] More information available at https://www.yas.io/en/NFTY/
[278] NOH M. E., *Brave new media*, cit.
[279] MARSH JLT SPECIALTY (curated by), *Blue Vault: an innovative cold storage solution for digital assets*, 2021, available at https://www.marsh.com/us/services/financial-professional-liability/products/cold-storage-for-digital-assets-blue-vault.html (last consultation: 28/09/2023)
[280] Ballet wallet is a multi-currency physical cryptographic wallet.

cryptocurrencies and NFTs, protecting both the Ballet wallet and the assets stored on it from any physical loss or damage while under their custody. The company undertakes this liability through an insurance policy underwritten by a reputable provider within the Lloyd's of London market, guaranteeing total liability protection for customers' cryptocurrencies and NFTs stored. Malca-Amit's insurance policy for NFT storage requires valuation reports that meet USPAP standards and use their proprietary methodology for appraisal[281].

In March 2022, IMA Financial Group launched IMA Web3Labs, a cutting-edge research and development centre dedicated to insurance and risk management in the metaverse. This pioneering facility is located within Decentraland, a virtual world constructed on blockchain technology. The primary aim of IMA Web3Labs is to create a designated area where different transactions can be conducted effortlessly within the metaverse, including negotiating insurance coverage for potential non-fungible token purchases[282].

Coincover provides insurance for NFTs to both corporate and consumer clients. The company's solutions preserve partner wallets and their contained NFTs from threats such as hacking, phishing, and other harmful acts. Coincover also offers an insured guarantee to its clients, in case such risks occur. The company aims to protect both businesses and their customers from the risks posed by malicious hacking and theft through its proactive screening and transaction protection measures. Leveraging technology, Coincover monitors activities for any suspicious behaviour to shield digital assets from compromise. Furthermore, Coincover's solutions are secured by Lloyds of London, a prominent provider of cyber insurance, which offers insurance coverage if a protected digital asset is successfully targeted despite the company's security measures. This two-pronged strategy of proactive prevention and retrospective compensation through Lloyd's underwriting aims to provide comprehensive protection for digital assets against cybercrime risks. The organization endeavours to impede hackers from obtaining access to private keys and transferring funds to unauthorised wallets. Moreover, it strives to detect and prevent instances of human errors, such as inadvertently transferring currency to an incorrect address. Detection of anomalous transactions allows for prompt securing of funds before losses transpire. Protection further targets common scams ubiquitous in the crypto sphere. Coincover's system continuously monitors all activities and

[281] MALCA-AMIT (curated by), *Cryptocurrencies, NFTs, and inheritance – passing on your assets securely,* 30 March 2022, available at https://www.malca-amit.com/blog-post/cryptocurrencies-nfts-and-inheritance-passing-on-your-assets-securely (last consultation 28/09/2023)

[282] IMA FINANCIAL GROUP (curated by), *IMA Financial Group unveils the metaverse first insurance research & development facility*, 2 March 2022, available at https://imacorp.com/imafg-unveils-first-metaverse-insurance-research-development-facility/ (last consultation 28/09/2023)

transactions in real-time to secure assets from loss or theft threats originating from both illicit and accidental causes. Compensation is available in case risks are not fully prevented[283].

3.4 How to value art related NFTs

The emergence of crypto art is causing a transformation in how value is perceived, surpassing aesthetic consideration and extending into the domains of scarcity, uniqueness, and provenance. As part of this paradigm shift, the factors that contribute to the value of digital artworks come to the fore, introducing a new set of considerations for collectors and professional figures involved in the art related NFTs market. The concept of scarcity, historically linked with the exclusiveness of limited editions, undergoes a transformation in the digital era. NFTs utilize blockchain technology to validate scarcity because each token denotes a unique piece. Uniqueness, closely intertwined with scarcity, reinforces the value of digital art. The amalgamation of creative expression and technological advancement guarantees that no two digital artworks are indistinguishable from each other. Provenance, formerly a signature feature of the tangible art universe, takes on new significance in the digital realm. The transparency and immutability of blockchain transactions address the long-standing challenge of determining an artwork's history. The evolution and acquisition of a digital creation can be traced by collectors from its earliest stages, revealing the narrative behind its creation. This digital paper trail lends credibility and authenticity to artworks, bestowing them with a tangible history despite their intangible nature.

Assessing the value of crypto art is imperative in determining their eligibility for insurance coverage for multiple reasons. Firstly, the value of an art NFT determines the necessary amount of coverage for safeguarding potential losses or damages. Insurance policies usually demand an accurate appraisal of the insured asset to set the coverage limit and premium. Secondly, comprehending the value of crypto artworks enables insurance providers to evaluate the level of risk involved. Higher-value NFTs can draw the attention of potential thieves, hackers or fraudsters, rendering them more vulnerable to theft, cyberattacks or market manipulation. By assessing the value, insurers can customize coverage options and premiums to sufficiently mitigate these specific risks. Furthermore, precise valuation of art NFTs enables insurance companies to ascertain the apt coverage terms and conditions. Specialist policies might be necessary for distinctive or high-value NFTs, specifically those

[283] More information available at https://www.coincover.com/asset-protection

linked to celebrated artists or extraordinary digital collectibles. A thorough comprehension of the value allows insurers to design policies that acter to the particular risks associated with art NFTs. Valuation is additionally indispensable in the settlement of claims. When a loss occurs, the insurance company depends on the assessed value to decide the amount of compensation that the policyholder is owed, and thus failure to obtain a proper valuation can lead to disputes and complications during the claims process. Moreover, an accurate assessment of crypto art enhances transparency and trust in the insurance industry. This facilitates the establishment of a standardized framework for insuring these digital assets, which, in turn, instils confidence among artists, collectors, and insurers alike. Assessing the worth of art NFTs enables customization of insurance coverage to mitigate the distinct hazards and difficulties linked with this nascent asset category, affording monetary safeguard and tranquillity of mind to participants in the NFT network.

However, assessing the value of non-fungible tokens can be a challenging task[284]. A prominent case in point is Eduardo Burillo, a museum trustee and NFT collector who endeavoured to give CryptoPunk #5293 to the Institute of Contemporary Art in Miami in July 2021. Nonetheless, the assessment of the artwork proved difficult for the museum, and they could not accept the donation. The donor requested an Internal Revenue Service (IRS) valuation for the charitable contribution, but museum regulations prevented uninsured works from being accepted. To tackle this problem, Caroline Taylor, Burillo's art advisor and founder of Appraisal Bureau, has disclosed intentions of creating a unique NFT valuation platform that has received recognition from insurance companies like Lloyds of London[285]. Appraisal Bureau is a prominent data and analytics company that specializes in the valuation of fine art and digital assets. The firm's distinguished expertise is demonstrated through their use of a proprietary NFT valuation methodology which is trusted and employed by major international insurance markets. For the purpose of this research, an interview with Caroline Taylor was conducted via e-mail. In the questionnaire, she explains that institutional clients are the primary demanders for assessment reports for art-related NFTs for insurance purposes. This trend is exemplified by the acquisition of CryptoPunk #5293 by the Institute of Contemporary Art in Miami because, as mentioned before, government regulations often

[284] For an in-depth study of the various art-related NFTs' attributes and their impact on sale price and likelihood of sale see: FRIDGEN G., KRAUSSL R., ORESTIS P., and TUGNETTI A., *The fundamental value of art NFTs. Working paper*. Goethe Unievrsity Frankfurt, Center for Financial Studies. 2023

[285] WHITAKER A., *NFTs and the art market*, cit.: 49-55

require insurance coverage for all artworks within museum holdings[286]. In order to meet this growing demand, Appraisal Bureau is committed to pushing the boundaries of innovation through the development of solutions that harness the potential of distributed ledger technology. This extends their work beyond valuation and is evidenced by their collaboration with Arweave, a decentralized storage network, to create a tokenized appraisal system[287]. Appraisal Bureau stands out for its unwavering dedication to professional standards and ethics. The reports adhere to the rigorous guidelines outlined by both the Uniform Standards of Professional Appraisal Practice and the IRS, guaranteeing accuracy and reliability. The company's appraisers are highly qualified members of the Appraisers Association of America, ensuring that Appraisal Bureau continues to function as an impartial and unbiased third-party entity. The company also collaborates with specialists worldwide, seeking expert opinions on personal property to guarantee comprehensive and informed valuations[288].

As emerged from the interview conducted for this thesis, the development of the NFT valuation methodology of the Appraisal Bureau was informed by Caroline Taylor's decade of experience as a contemporary art appraiser, specifically with intangible conceptual art. It was created out of necessity due to increasing demands for insurance policy subscriptions from both private and institutional clients. To address this issue a methodology was developed to establish a systematic and recognized approach to assess the retail-replacement value of crypto art[289]. Since its creation, this valuation methodology has been extensively adopted by key worldwide insurance markets. For example, Caroline Taylor's company has collaborated with Malca Amit[290]. Usually required on a monthly or quarterly basis, these insurance underwriters demand periodic valuation reports. Thanks to Appraisal Bureau's proprietary technology, they are now able to carry out retroactive appraisals, which satisfy the claims criteria of security providers and custodians. The company provides comprehensive assistance to clients throughout the claims process, ensuring a seamless and efficient experience. Furthermore, their team possesses the requisite expertise to act as expert witnesses when

[286] Author's interview with Caroline Taylor, Co-Founder and Chief Executive Officer at Appraisal Bureau, 13 December 2024. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.
[287] By tokenising appraisals, the Appraisal Bureau and Arwave utilise blockchain technology to produce a digital representation of the appraisal report. These tokens, which operate on a decentralised storage network, function as unalterable records, upholding the integrity of the appraisal and adverting unauthorised adjustments or manipulation.
[288] More information available at https://appraisalbureau.com/company/
[289] Author's interview with Caroline Taylor, Co-Founder and Chief Executive Officer at Appraisal Bureau, 13 December 2024. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.
[290] DUGAN K. T., *How museums are trying to figure out what NFT art is worth*, cit.

required. This supplementary service is indicative of their dedication to delivering proficient and dependable support to clients during legal proceedings or disputes pertaining to valuations[291].

The proprietary methodology for pricing NFTs developed by Caroline Taylor takes into account multiple critical factors. Firstly, the innovative approach considers the average blockchain price of equivalent works. The use of this methodology by insurance companies is motivated by the necessity to precisely ascertain the potential payout in the event of the loss or destruction of a volatile digital currency. In order to tackle this issue, Taylor's approach provides a dynamic solution by automatically computing the worth of NFTs on a daily basis. This guarantees that insurance policies accurately mirror the fluctuating value of digital currencies, thereby providing a just and current evaluation of the potential payout. By considering the average blockchain price, the value of comparable pieces, and the practical use of NFTs, Taylor's methodology presents a comprehensive and trustworthy pricing approach for these exceptional digital assets. In particular, when an NFT related to art belongs to a collection, the appraisal process is more straightforward. This is because experts have an ecosystem to work with and more data points to compare[292]. Nevertheless, a major obstacle emerges as some of these sales may not be considered legitimate, and the difference between a genuine and a fraudulent price can be significant. Cryptocurrency markets have been the subject of accusation of deceitful trading with the intent to artificially elevate prices. Taylor acknowledges the existence of these concerns in the market and states that undisclosed precautionary measures are being taken to address them. In fact, the Appraisal Bureau has developed a technology to detect and remove whitewashes, which are cases of wash trading where the buyer and seller collude or are the same person, as well as outliers, which are data points that deviate significantly from other values[293]. Its application by Lloyd's of London emphasises the sector's acceptance of the methodology's efficiency and highlights its significance for NFT-related policies in the insurance industry[294].

While traditional artworks are usually judged on their aesthetic value, collectability, rarity, and provenance, assessing the worth of an NFT involves a range of distinct measures. For example, some NFTs offer intrinsic utility by providing access to exclusive virtual

[291] More information available at https://appraisalbureau.com/services/insurance/
[292] Author's interview with Caroline Taylor, Co-Founder and Chief Executive Officer at Appraisal Bureau, 13 December 2024. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.
[293] Author's interview with Caroline Taylor, Co-Founder and Chief Executive Officer at Appraisal Bureau, 13 December 2024. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.
[294] DUGAN K. T., *How museums are trying to figure out what NFT art is worth*, cit.

content or real-world advantages such as membership to exclusive clubs. In addition, particular NFTs confer ownership of underlying assets, such as copyrights to artworks. Furthermore, non-fungible tokens are exchanged on blockchain networks, which can undergo substantial price fluctuations. Moreover, appraisers carefully examine multiple data points on a daily basis, owing to the fact that these NFTs reside on blockchains associated with an unstable currency. A comprehensive appraisal report, usually spanning twenty or more pages according to Taylor, is subsequently generated. This report analyses the prices that buyers have paid for comparable artworks in recent years, both at galleries and through auctions[295].

During an interview with Megan Noh, co-chain of Pryor Cashman LLP's Art Law Group, Ankur Kacker, senior vice president of specie and digital assets at Marsh, stressed the importance of valuing NFTs in the insurance process. Insurers have two options when it comes to providing insurance for NFTs. They can rely on the purchase price of the NFT and provide insurance based on that value, similar to how newly purchased traditional artworks are insured. Alternatively, they can agree on a different valuation basis and calculate the premium accordingly. It is worth noting that the value of an NFT is not guaranteed to remain stable over time and therefore, choosing and agreed-value policy presents both advantages and disadvantages, whereas insuring an NFT according to its purchase price is a simpler option[296].

In her interview with Megan Noh, Claudia Hess, the CEO of Hess Art Advisory and certified member of the Appraisers Association of America, outlines the process of conducting a fair market value appraisal for NFTs. Hess asserts that a thorough appraisal must establish the proper market level for the NFT and take into account unique value characteristics connected to this form of artwork. By combining these elements, it is possible to generate an appraisal report that conforms to the Uniform Standards of Professional Appraisal Practice. Hess observes that, aside from the commonly used quality criteria applied in assessing art, NFTs possess distinct worth characteristics. Potential factors influencing the value of NFTs include the artist's involvement in shaping the NFT market (although this does not necessarily ensure higher value), their recognition and presence on social media, and their exhibition history. Additionally, environmental sustainability issues stemming from the energy consumption of creating NFTs and maintaining their blockchain-based storage and

[295] RUMMER A., *A professional art appraiser explains why valuing an NFT is 'totally different' than judging a painting*, «The Block», 29 March 2022
[296] NOH M. E., *Brave new media*, cit.: 304-306

trade infrastructures could have an impact on their value. Furthermore, the value of individual NFTs can be impacted by restrictions or permissions established through smart contracts. Hess highlights that her team analyses a large and complex dataset to determine the fair market value as of a specific date. Although the value attributes of NFTs may vary and be more intricate, the essential process of collecting data and making comparisons to determine value remains the same[297].

Whilst the 2020-21 edition of the Uniform Standards of Professional Appraisal Practice included the addition of "digital tokens", it failed to comprehensively address the unique aspects of crypto art. The guidelines list among personal property: «any tangible or intangible article that is subject to ownership and not classified as real property, including identifiable tangible objects that are considered by the general public as being "personal," such as furnishings, artwork, antiques, gems and jewellery, collectibles, machinery and equipment; and intangible property that is created and stored electronically such as plans for installation art, choreography, emails, or designs for digital tokens»[298].

The existing systems used by appraisers, such as the Getty's Object ID standard, encounter difficulties in accurately describing and categorising crypto artworks. Due to the unique nature of digital assets, conventional criteria like measurements and markings are often irrelevant or hard to translate. To comprehensively evaluate an NFT, it is imperative to provide an elaborate account of the artwork's economic, financial, and technological features[299]. The expertise of time-based media art (TBMA) conservators has established a foundation for comprehending the technological aspects of digital artworks. While conservation is traditionally considered independent from the market, conservators' ability to reverse-engineer the artistic process could prove valuable to appraisers. In the NFT market, it is crucial to verify digital provenance, which necessitates an in-depth comprehension of the artwork's technological structure and an objective viewpoint, free from any inclination to sell the piece. To tackle the "audit problem", appraisers may utilize systems established for media art conservation and cooperate with technological experts. This issue refers to the need to forensically trace the minting process, confirm the artist's technological decision-making process, as well as verify the digital provenance, all performed by an independent party akin to auditors in financial contexts. It is crucial to have objective expertise in examining an

[297] *Ibidem*
[298] THE APPRAISAL FOUNDATION (curated by), *2020-2021 Uniform standards of professional appraisal practice (USPAP). Extended through 31 December 2023*. Appraisal Standards Board; 2021
[299] QUANCARD M., WHITAKER A., *Economic provenance and the audit problem. How can expertise from time-based media art conservation help appraisers vet NFTs?*, «Outland», 8 July 2022

NFT's provenance, especially during the transfer of an NFT between various blockchains. For instance, the DADA Collective needed to remint their innovative collection of crypto collectibles, the Creeps & Weirdos, as ERC-721 in 2019. This was because the collectibles were initially created in 2017, when only ERC-20 existed. This resulted in two distinct sets of collectibles, and appraisers must understand how the disparity between the ERC-20 and ERC-721 versions affects the determination of the appraised value[300]. Moreover, the wallet in which an NFT is first minted establishes its ownership history. Although a shared wallet may seem harmless or even collaborative, it obscures the true origin of the artwork. Essentially, an NFT acts as a certificate of authenticity, providing verifiable digital provenance. In a broader sense, the blockchain offers a timestamped record of ownership, tracing back to the artist. However, if this record does not originate from the artwork's inception, the NFT will only serve as a record of past transfers, and not as a genuine certificate of authenticity. Using a shared wallet is comparable to adding a collective signature to a painting created by a single artist, thus hampering the comprehension of the artwork's origin. The development of effective best practices for NFT appraisal necessitates co-operation among numerous stakeholders, comprising appraises, art market entrepreneurs, artists, curators and time-based media art conservators. Whilst dealing with a varied spectrum of artworks, conservators have established individual methodologies. Groups focused on establishing NFT appraisal standards should accept the complex, varied, and continually changing nature of artworks in the NFT realm. Conservators consider each artwork separately and include the work methods and intentions of various parties, such as artists, curators, collectors and viewers, in their approach. Their expertise can bring valuable insights to the development of comprehensive NFT appraisal standards. By incorporating the extensive methods used in TBMA with the timestamping functionalities innate in blockchain technology, the authentication and assessment of NFTs can be effectively ensured. This is particularly crucial for artworks that need to be transferred from inactive blockchains and reissued, a situation that is anticipated to become more common. TBMA has developed procedures similar to surgical operations or autopsies for artworks, which can offer valuable insights for appraisals by creating a clear link between the artwork and the blockchain[301]. Some artists use multiple wallets or transfer their artworks to temporary wallets before selling them. These practices cans serve different purposes, including maintaining privacy, organizing different bodies of work, challenging platform-enforced structures, or safeguarding their secure wallets by using alternative

[300] *Ibidem*
[301] QUANCARD M., WHITAKER A., *Digital provenance and the wallet problem*, «Outland», 17 June 2022

accounts. For instance, in April 2021, artist Nicolas Sassoon created a distinct wallet under the alias YMMSH, to produce artwork anonymously on the Tezos blockchain. In the view of appraisers, an artist's wallet acts as a digital version of their studio and verified proof of the artwork's origin. Appraisers necessitate a protocol to authenticate the wallets of artists and collectors for establishing standards of digital provenance. Achieving this requires a joint effort encompassing technologists and blockchain specialists to ensure its feasibility[302].

In addition, NFTs present a challenge in separating artistic and financial elements as their impact on the market cannot be ignored. Significant factors such as exhibition and sale platform, artist royalties and the evolving role of royalties in the market must be considered. Therefore, an interdisciplinary approach is necessary to appraise the artwork, examining both intrinsic and extrinsic factors. Traditional art history often overlooks an artwork's economic dimensions, but NFTs draw attention to elements like ownership, commercial licenses, and resale royalties. Consequently, assessing crypto art demands a broader perspective which factors in both economic and artistic aspects[303].

NFT buyers have the potential to acquire a variety of rights based on the asset, which can include exhibition, financial, and governance/voting privileges. It is worth noting that these specific rights may be limited by the platform on which the NFT was acquired. When assessing value, if the NFT in question includes commercial exploitation rights, an income-based approach is recommended. For example, *Bored Apes Yacht Club* by Yuga Labs granted Ape owners complete business usage rights, whereas *CryptoPunks* were initially limited by Larva Labs to annual profits of $100,000 per owner. In March 2022, Yuga Labs acquired the intellectual property of *CryptoPunks* and proclaimed that the holders would have unrestricted commercial rights in the future. The appraisal complexity of these digital assets is elevated by the fluctuating nature of their rights.

Moreover, the NFT market's diversity encompasses hybrid forms that surpass conventional appraisal norms. The combination of art, design, and gaming affects the categorisation of NFT market data. For instance, Nonfungible.com categorizes *Cryptokitties*, an early project that experimented with ERC-721 tokens as gamified collectables, under the art label. This affects the understanding of purely artistic NFTs when industry or academic analysts aim to comprehend the size and details of that market segment, thus a comprehensive view of the overall market is necessary for evaluating NFTs.

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[302] *Ibidem*
[303] QUANCARD M., WHITAKER A., *Economic provenance and the audit problem*, cit.

Determining the value of NFTs commonly demands meticulous case-specific analysis and assessment. In fact, even if NFT's price histories can be tracked in real-time and are publicly accessible, appraisers must individually interpret these market metrics. As private start-ups, for example Appraisal Bureau, are developing their own valuation models for NFTs, it is crucial to establish transparent standardized procedures. These standards should be accessible to appraisers and other experts worldwide, in accordance with the decentralized nature of blockchain technology[304].

[304] *Ibidem*

Chapter 4. New approach to fine art insurance due to climate change

The rapid rise in global temperatures during the 20th and 21st centuries is an unprecedented event. As affirmed by the Intergovernmental Panel on Climate Change (IPCC), human activities are substantially responsible for a significant proportion of this surge[305]. The increase in the Earth's average atmospheric surface temperature is a direct result of the heightened emission of greenhouse gases, leading to the greenhouse effect. The rise in global temperatures is just one aspect of the consequences of human-induced disruption to the planet's climate balance. These disruptions result in changed rainfall patterns, more frequent droughts, increased storm intensity, changes in ocean acidity and temperature, sea level rise, and other impacts. These changes affect World Heritage sites, and if the trajectory remains the same, the threats posed by these consequences are expected to increase.

This chapter investigates the role of insurance in safeguarding cultural heritage against natural disasters given the significant threat that climate-related events present. The Intergovernmental Panel on Climate Change characterizes climate change as «a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer»[306]. Aligned with the conceptual framework of the IPCC, climate change can arise from both natural processes and human activities. On the other hand, the United Nations Framework Convention on Climate Change (UNFCCC) differentiates between climate variability resulting from natural processes and climate change construed as a human-induced phenomenon. The UNFCCC specifically addresses human-induced climate change, defining it as «a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods»[307].

The 2018 findings of the "*Special report on global warming of 1.5°C*" by the IPCC highlight the significance and urgency of the issue[308]. According to the IPCC, human

[305] IPCC (curated by), *Climate change 2023: synthesis report. Contribution of working groups I, II and III to the sixth assessment report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: Core Writing Team, H. Lee and J. Romero; 2023: 4
[306] *Ivi*: 122
[307] Article 1 of the United Nations Framework Convention on Climate Change; 1992
[308] IPCC (curated by), *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. Cambridge and New York: Cambridge University Press; 2018

activities have increased the global temperature by 1 degree Celsius (C) since the pre-industrial era. If emissions continue unchecked, the temperature is anticipated to surpass 1.5°C by around 2040, and 2°C by 2065. The report highlights several climate change impacts that could be alleviated or considerably reduced by restricting global warming to 1.5°C instead of 2°C or above. For instance, by the year 2100, a rise in global sea levels associated with a 1.5°C increase in global warming would be 10 cm less than the sea level rise observed with a 2°C increase in global warming. The possibility of an ice-free Artic Ocean in summer would arise approximately once per century with a 1.5°C increase as opposed to at least once per decade with a 2°C hike. Coral reefs, which are projected to decline by 70-90% with a 15°C temperature rise, would face virtually complete extinction (>99%) with a 2°C increase in temperature. To achieve the objective of limiting global warming to 1.5°C, prompt and comprehensive changes in the use of land, energy, industry, buildings, transport, and urban infrastructure are critical based on the IPCC report. In particular, global net anthropogenic CO_2 emissions should be cut by around 45 percent from 2010 levels by 2030, finally reaching a state of zero emissions approximately by 2050.

Climate change has caused an escalation in the hazards connected to such events in the last few decades. These risks have resulted in various impacts on infrastructures, buildings, and particularly historical sites and monuments. In fact, the field of cultural heritage is exceptionally susceptible to these risks. According to UNESCO (2006), «the impacts of climate change are affecting many and are likely to affect many more cultural goods in the years to come»[309]. Different countries have experienced the adverse effects of extreme weather events, floods, and other catastrophes on the condition of numerous cultural assets. Therefore, it is essential to prioritize improving resilience to natural disasters and implementing efficient climate change adaptation strategies. These strategies are crucial for minimizing damages and implementing proactive management approaches to safeguard cultural heritage[310].

Climate risk insurance is a specific type of insurance designed to mitigate losses and damages caused by climate-related events and their financial implications. This insurance mainly concentrates on risks associated with extreme weather conditions and climatic phenomena. Although there are similarities and differences between two other types of

[309] UNESCO (curated by), *Climate Change and the World Heritage. Report on predicting and managing the impacts of climate change on World Heritage and Strategy to assist States Parties to implement appropriate management responses*. UNESCO World Heritage Centre; 2006: 46

[310] DE MASI F., PORRINI D., *Managing climate change risk: the case of the Italian Churches*. Natural hazards, 105; 2021: 2619-2637

insurance, namely "catastrophe insurance" and "natural hazard insurance", climate risk insurance includes certain aspects of both. Natural hazard insurance typically covers damage to property resulting from natural phenomena, such as floods, earthquakes, and hurricanes. Conversely, catastrophe insurance protects individuals and enterprises from all types of natural disasters, as well as from societal crises, including terrorism, riots, and civil unrest, along with natural hazards. Therefore, climate risk insurance may be employed interchangeably with natural hazard insurance or catastrophe insurance for calamities brought about by natural elements beside earthquakes and sinkholes, which stem predominantly from geological processes instead of climate change[311].

The frequency, intensity and impact of extreme climate events are increasing due to rising global temperatures. In 2022, natural disasters caused approximately US$270 billion worth of damages, with roughly 55% of this cost being uninsured[312]. It is crucial to have insurance coverage against climate risks to mitigate the harmful effects of climate-related disasters. The IPCC in 2012 has emphasized the importance of risk-sharing and risk transfer to successfully mitigate the negative impacts of climate change[313]. Similarly, reports from the UNFCCC highlight the need for insurance to both cope with the impacts of climate change and manage resultant losses and damages[314]. According to the Swiss Re Institute, an organization under the Swiss Re insurance company with the role of producing data driven research, it is projected that climate change will cause a 33% to 41% increase in the number of properties at risk by 2040, leading to a surge in insurance premiums, estimated to be between US$149 to 183 billion[315].

Mitigating the adverse effects of climate change necessitates the availability of insurance coverage against climate risks. Notwithstanding, there is presently an absence of unanimity on climate risk insurance, and the implementation of climate insurance policies diverges substantially across nations due to diverse challenges. Based on global climate change assessments, specifically the Fourth and Fifth Assessment Reports of the IPCC,

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311 LIN Y., WANG L., SHI X., CHEN M., *Evolution of research on climate risk insurance: a bibliometric analysis from 1975 to 2022*. Advances in climate change research, 14; 2023

312 MUNICH RE (curated by), *Natural disaster risks. Rising trend in losses*, 2022, available at https://www.munichre.com/en/risks/natural-disasters.html (last consultation 17/11/2023)

313 IPCC (curated by), *Managing the risks of extreme events and disasters to advance climate change adaptation: special report of the Intergovernmental Panel on Climate Change*. Cambridge and New York: Cambridge University Press; 2012

314 UNFCCC (curated by), *Approaches to address loss and damage associated with climate change impacts in developing countries that are particularly vulnerable to the adverse effects of climate change*. 2013

315 SWISS RE (curated by), *More risk: the changing nature of P&C insurance opportunities to 2040*. Swiss Re Institute; 2021

research into climate insurance can be divided into three discernible phases[316]. The first phase (1975-2007) focused on evaluating the feasibility and potential of the United States' National Flood Insurance Program, as well as investigating the socioeconomic implications of transferring climate risk through reinsurance. Due to limited data availability, the methodologies employed in these studies were relatively simplistic. The development stage (2008-2014) saw a swift rise in flood insurance inquiry. Research during this stage employed catastrophe modelling and probabilistic techniques to estimate losses caused by natural disasters and their financial impacts. During the boom period (2015-2022), there was a rising focus on climate risk insurance affordability, while considering income inequality.

Francesco de Masi, researcher at the Department of Economics at the University of Salento in Italy, emphasises the vital role of insurance in addressing climate change. In an interview conducted for this thesis, he states that «Insurance policies are useful tools for proper management. They are important strategies for protecting against the risks of financial losses resulting from highly significant natural phenomena. Additionally, they are part of a broader awareness of the need to intervene directly to safeguard assets of significant cultural, historical, artistic and religious value. In fact, thanks to an adequate risk culture and a consequent awareness of the exposure of our territory and the assets present on it, an effective intervention strategy must be defined that takes into account all possibilities, among which insurance plays a primary role»[317].

The topic of climate insurance and its far-reaching implications is gaining global and interdisciplinary importance, and in the future an emerging trend may involve combining big data with artificial intelligence and machine learning to devise and execute index or parametric insurance. Parametric insurance is a unique risk management approach that guarantees a predetermined financial indemnity when a specified triggering event occurs. Specifically, indemnity payments are triggered when an external index, such as the average temperatures of a specific area, exceeds or falls below a critical threshold called the strike-point. Moreover, the lack of on-site inspections to determine the eligibility of payouts results in a significant reduction in transaction costs. However, despite these advantages, a major

[316] IPCC (curated by), *Climate change 2007: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on climate Change*. Cambridge and New York: Cambridge University Press; 2007 and IPCC (curated by), *Climate change 2014: impacts, adaptation and vulnerability. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on climate Change*. Cambridge and New York: Cambridge University Press; 2014

[317] Author's interview with Francesco de Masi, researcher at the Department of Economics at the University of Salento in Italy, 19 December 2023. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.

challenge arises in the form of 'basis risk', which refers to the risk that a collector or public institution may suffer a loss without receiving an insurance payout. This innovative insurance model differs from traditional indemnity-based policies by avoiding the need for exhaustive claims assessment. Instead, it relies on quantifiable parameters to trigger compensation[318]. According to Donatella Porrini, associate professor at the science of economy department at the University of Salento, Italy, parametric insurance can be identified as a solution to simplify underwriting and reduce costs for catastrophe insurance, particularly in the context of climate change[319]. In particular, using more precise and detailed risk models for various climate hazards, machine learning can be utilised to create more customised and accurate pricing models.

4.1 Climate change-related risks on cultural heritage

Climate change is manifesting itself with increased intensity and frequency of extreme weather events, deviations from seasonal temperature patterns, heavy precipitation, wildfires and rising sea levels. These phenomena not only impact our daily lives directly, but also present a serious threat to our planet's future and cultural legacy.

In fact, cultural heritage assets, comprising historic buildings, archaeological sites and monuments, along with their associated contents and collections, are subject to continuous interactions with their environment, commonly referred to as weathering processes, resulting in ongoing transformation. The acceleration of decay rates and the emergence of new deterioration phenomena pose significant challenges to cultural heritage, particularly in the context of climate change. Climate-related shifts have the potential to intensify the physical, chemical and biological mechanisms responsible for material degradation by affecting the structure and composition of the materials involved leading to a greater need for conservation and restoration. Biological degradation, caused by microorganisms like mould and algae, as

[318] Parametric or index insurance, unlike traditional insurance, compensates policyholders based on the development of an index (or confluence of parameters) correlated with the losses incurred. This type of insurance offers several advantages over indemnity-based insurance, including reduced operational costs, decreased moral hazard and adverse selection, and faster disbursement of funds to policyholders following disasters. Additionally, machine learning algorithms can be employed to objectively identify extreme events, thereby mitigating the basis risk associated with this particular insurance mechanism. For more information see CESARINI L., FIGUEIREDO R., MONTELEONE B., et al., *The potential of machine learning for weather index insurance*. Natural Hazards Earth System Sciences, 21; 2021: 2379-2405

[319] Author's interview with Donatella Porrini, associate professor at the science of economy department at the University of Salento, Italy, 19 December 2023. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.

well as infestations of insects, is more likely to occur, particularly impacting the physical structure of buildings and the collections found in galleries, libraries, archives, and museums. In addition, climate change introduces increased risk by affecting the occurrence and severity of hazardous events such as droughts, floods and landslides, with profound consequences for cultural heritage preservation. In addition to these challenges, cultural heritage faces immediate threats from rising sea levels, variations in storm surge intensity leading to coastal erosion, flooding and potential inundation, as well as changes in inland fluvial dynamics. The collective impact of these environmental factors underscores the critical importance of developing comprehensive strategies to protect cultural heritage in the face of evolving climatic conditions[320].

Major international organizations, such as the Unites Nations (UN) and UNESCO, have been engaging with these concerns for several years[321].

In 1972, UNESCO ratified the "*Convention concerning the protection of the World Cultural and Natural Heritage*". Its primary aim is to recognise and safeguard sites of extraordinary cultural or natural significance by establishing and maintaining a list. This endeavour strives to encourage international collaboration in preserving all 690 sites listed as World Heritage sites. Moreover, a "*Danger list*" has been set up to identify sites at risk due to factors such as pollution, earthquakes, and floods[322]. As far back as 1972, UNESCO acknowledged the potential hazard posed by environmental risks to cultural heritage. However, in 2006, the UNESCO World Heritage Committee made a significant move by adopting the report titled "*Predicting and managing the impacts of climate change on world heritage*"[323]. This report offers a strategy to support member countries in implementing effective management responses and a policy document on the effects of climate change on world heritage sites. In 2007, as a result of this process, the General Assembly of States Parties to the World Heritage Convention adopted a "*Policy Document*" addressing the

[320] SESANA E., GAGNON A. S., CIANTELLI C., CASSAR J. A., HUGHES J. J., *Climate change impacts on cultural heritage: a literature review*. WIREs Climate Change, 12; 2021: 2
[321] GHILARDI R., *Gli impatti del climate change sul patrimono culturale*. In: Deloitte creative team - Italia, ed. *Il mercato dell'arte e dei beni da collezione, report 2023*. 2023: 92-94
[322] To access the "*List of World Heritage in danger*" in accordance to Article 11(4) of the "*Convention concerning the protection of the World Cultural and Natural Heritage*" see https://whc.unesco.org/en/danger/ (last consultation 17/11/2023)
[323] UNESCO (curated by), *Climate Change and the World Heritage. Report on predicting and managing the impacts of climate change on World Heritage and Strategy to assist States Parties to implement appropriate management responses*. UNESCO World Heritage Centre; 2006

impacts of climate change on world heritage properties[324]. A work for updating this policy document was launched in 2019[325].

Since the policy document's approval, the World Heritage Committee has received several reports concerning the conservation status of World Heritage sites affected by climate change. Meanwhile, numerous significant global agreements and reports have influenced national commitments, such as the UN 2030 Agenda for Sustainable Development signed in 2015 by all 193 UN member states[326], and the Paris Agreement of the UNFCCC.

In 2019, ICOMOS published "*The future of our pasts: engaging cultural heritage in climate action*", a report detailing the effects of climate change on cultural heritage and proposing initiatives to combat it[327]. The proposed measures include risk management, adaptation, and resilience strategies in the heritage sector with the potential to aid climate action.

The year after, ICOMOS has officially recognised a climate emergency and called for a prompt and cooperative effort to safeguard heritage from the consequences of climate change. The organisation has recommended taking decisive measures and emphasised the need to pursue pathways that would limit global warming to 1.5°C[328].

The latest international report on this subject, published in 2022, is a collaborative effort involving ICOMOS, UNESCO, and IPCC. It underscores that climate change is presently exerting its influence on various forms of heritage across the globe[329].

In Italy, the protection of cultural heritage has been integrated into the "*National plan for adaptation to climate change*" due to the significant importance of cultural heritage in our country and the vulnerability of certain key locations, including Venice. In the December 2022 version of the plan, water stands out as a major contributing factor to the degradation of cultural assets' materials, both directly and indirectly[330]. More frequent extreme events, such

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[324] UNESCO (curated by), *Policy document on the impacts of climate change on World Heritage properties*. UNESCO World Heritage Centre; 2008

[325] UNESCO (curated by), *Updated policy document on climate action for World Heritage*. UNESCO World Heritage Convention; 2023

[326] In particular, target 11.4, aimed to strengthen efforts to safeguard the world's cultural and natural heritage, was included as a specific objective.

[327] ICOMOS (curated by), *The future of our pasts: engaging cultural heritage in climate action*. Technical Report. International Council on Monuments and Sites – ICOMOS: ICOMOS Paris; 2019

[328] ICOMOS Resolution 20GA/15 – Cultural Heritage and the Climate Emergency

[329] SHEPHERD N., COHEN J.B., CARMEN W., et al., *ICSM CHC White Paper III: The Role of Cultural and Natural Heritage for Climate Action: Contribution of Solutions Group III to the International Co-Sponsored Meeting on Culture, Heritage and Climate Change*. Charenton-le-Pont & Paris, France: ICOMOS & ICSM CHC; 2022

[330] MASE (curated by), *Piano nazionale di adattamento ai cambiamenti climatici*, available at https://www.mase.gov.it/pagina/piano-nazionale-di-adattamento-ai-cambiamenti-climatici (last consultation 18/11/2023)

as intense precipitation leading to floods and storms, result in damages, including structural harm to historic buildings. Moreover, the plan conforms that thermal overheating plays a role in ecosystem modification and gradual desertification of particular regions, increasing the risks of damage and irreversible loss of landscapes and historic structures[331].

The European Green Deal, introduced in December 2019, is Europe's strategic answer to the challenges presented by climate change, with the primary goal of positioning Europe as the first climate-neutral continent by 2050. Currently, the cultural heritage sector is only directly impacted by two strategies within the European Green Deal. The recently implemented *EU adaptation strategy*, part of the European Green Deal, acknowledges the effects of climate change on cultural heritage, particularly emphasizing the significance of the *EU Directive on the assessment and management of flood risks* 2007/60/EC (*The Floods Directive*) in mitigating risks for cultural heritage linked to floods. The *Renovation Wave strategy* is the second document within the European Green Deal that references cultural heritage. It highlights the significance of adhering to cultural heritage as a fundamental principle during the renovation process[332].

At the same time, in line with the Work Plan for Culture 2019-2022[333], which involves a dedicated initiative centred on identifying and exchanging best practices for adapting historic areas to climate change, a joint initiative was launched in the form of an Open Method of Coordination (OMC) group composed of experts from member states. This group started its work in January 2021 and it's the first structured group of experts nominated by EU member states specifically tasked with enhancing the resilience of cultural heritage in the face of climate change. Their mandate encompasses investigating effective practices and inventive approaches to safeguard cultural heritage in the context of climate change, scrutinizing existing and emerging threats, as well as the effects of climate change on tangible heritage, discussing the suitable measures for adaptation and mitigation, while also identifying potential risks[334]. However, ensuring the adaptability of cultural heritage to climate change

[331] GHILARDI R., *Gli impatti del climate change sul patrimono culturale*, cit.
[332] COMMISSIONE EUROPEA (curated by), Il *Green Deal europeo. Per diventare il primo continente a impatto climatico zero*, available at https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_it (last consultation 18/11/2023)
[333] EUR-LEX (curated by), *Council conclusions on the Work Plan for Culture 2019-2022*, available at https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52018XG1221(01) (last consultation 18/11/2023)
[334] EU COMMISSION, DIRECTORATE-GENERAL FOR EDUCATION, YOUTH, SPORT AND CULTURE (curated by), *Strengthening cultural heritage resilience for climate change: where the European Green Deal meets cultural heritage*. Publications Office of the European Union; 2022. This document provides an overview of the activities undertaken by the European Union Open Method of Coordination (OMC) group, comprising experts from Member States, focusing on the theme of 'Strengthening cultural heritage resilience for climate

while avoiding any unintended harm or loss resulting from adaptation measures, known as maladaptation, is a significant issue. This challenge applies to diverse forms of cultural heritage, including archaeological sites, built structures and movable artifacts. Notably, there is a significant gap in economic assessments that comprehensively encompass the entire range of costs associated with climate change impacts on cultural heritage in Europe. The OMC expert group strongly believes that the expenses incurred in taking proactive measures outweigh the potential costs of inaction[335].

4.1.1 Analysis of the impacts of climate change on cultural heritage

The effects of climate change on cultural heritage can be divided into direct and indirect impacts. Direct effects refer to changes in building material due to climate-related factors, including biodegradation, corrosion, haloclasty, and cryoclasty. On the other hand, indirect effects occur when shifts in the climate affect the surrounding environment and, as a result, the structures themselves. An example of this can be seen in the changes to soil moisture levels, which cause shrinkage and swelling in expansive clay soils, ultimately affecting the stability of buildings[336].

Sesana et al., examine the impact of gradual climate change on tangible cultural heritage in their 2021 study[337]. The study presents, by means of an in-depth analysis of the scientific literature, the relationship between climatic stressors and changes in the rate of deterioration of cultural heritage materials and structures. The first section delineates the effects of gradual changes in temperature, precipitation, and wind on outdoor heritage that is directly exposed. On the other hand, the next one illustrates the consequences of gradual variations in temperature and humidity on indoor cultural heritage, including collections. The third section presents and extensive analysis of the effects of alterations in the natural physical environment on heritage, encompassing phenomena such as fluvial floods and gradual changes in fluvial dynamics, sea level rise, storm surges and their coastal impacts, landslides,

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change'. The content is derived from the deliberations and information shared and endorsed by the OMC expert group members during meetings held between 2021 and 2022. Additionally, insights from presentations delivered by external experts who were invited to contribute are included.

[335] *Ivi*: 7

[336] BLAVIER C. L. S., HUERTO-CARDENAS H. E., et al., *Adaptive measures for preserving heritage buildings in the face of climate change: a review*. Building Environment, 10; 2023: 2

[337] SESANA E., GAGNON A. S., CIANTELLI C., CASSAR J., and HUGHES J. J., *Climate change impacts on cultural heritage*, cit.

extreme heat, and shifts in ocean properties (based on Sesana et al.'s study, table 4.1. summarizes the impacts of climate change on outdoor and indoor cultural heritage).

Firstly, the impacts of gradual changes in climate on the outdoor cultural heritage are divided among changes in temperature, precipitation, and change in wind.

Specifically, temperature variations are categorized into freeze-thaw cycles and thermoclastism. The former denotes the structural damage and disintegration of stone, brick, and ceramic materials resulting from temperature oscillations that induce fluctuations in the volume of water held within porous materials. Due to climate change, the frequency of freeze-thaw cycles has increased, resulting in further harm to historical structures and archaeological sites. Conversely, thermoclastism ensues from the expansion and contraction of surface mineral grains triggered by thermal fluctuations arising from seasonal changes and diurnal shifts in air temperature, as well as direct solar exposure. This phenomenon can lead to microcracking, exfoliation of stones, and erosion of building material surfaces. Projections indicate an augmented risk of thermoclastism in the Mediterranean region as a result of climate change[338], with a particular impact on widely employed materials such as Carrara marble. Some proactive measures have been implemented in the region, exemplified by the installation of open-sided shelters over archaeological World Heritage Sites in Malta.

Moreover, the study continues by considering changes in precipitation and the resulting implications of increased rainfall within the context of climate change. This heightened precipitation can lead to soil saturation and overwhelm drainage systems, potentially increasing the likelihood of dampness penetrating historical materials. Water infiltration into porous substances can occur not only through precipitation but also from condensation and capillary action in the presence of soil moisture. Such water ingress leads to material degradation, chich includes corrosion, biological activity, and sub florescence due to salt crystallization.

In particular, corrosion is a chemical process resulting in the gradual degradation of materials, mainly caused by exposure to water and often accompanied by the deposition of salts, usually chlorides. This phenomenon is more pronounced in environments with acid rain[339] and elevated atmospheric levels of carbon dioxide (CO_2), which is attributed to human

[338] Temperature fluctuations, especially in areas exposed to intense solar radiation, can influence the occurrence of thermoclastism on the surfaces of heritage materials. Additionally, extreme temperatures pose a threat of thermoclastic deterioration, stemming from the repeated expansion and contraction of earthen materials.

[339] Acid rain is formed by the reaction of water with air pollution comprised of sulphur dioxide (SO_2) and nitrogen oxides (NO_x), leading to the production of nitric and sulfuric acids.

activities. Additionally, air pollution is frequently associated with the surface soiling of stone on historical buildings, which adds another corrosive factor. Increased precipitation, particularly in warmer climates, worsens the corrosion of metals and glass materials and causes surface erosion in carbonate rocks, including limestone and marble.

An increase in relative humidity in a warmer climate worsens the biological degradation of cultural heritage. Specifically, changes in humidity levels have a notable influence on the proliferation of microorganisms on both stone and wooden heritage materials. Extended periods of moisture contribute to heightened relative humidity and internal dampness within materials and, when coupled with increasing temperatures, such conditions create a favourable environment for diverse biological activities, leading to the deterioration of historical structures. This degradation is observable through the accumulation of biomass and the decay brought about by numerous agents, such as fungi, algae, mould, lichens and insects.

The last consequence on cultural heritage arising from the augmented precipitation associated with climate change, as examined by the authors, is salt crystallization. Fluctuations in temperature and humidity cause soluble salts to dissolve and recrystallize, thus initiating cycles of salt crystallization. Structural transformations triggered by hydration and dehydration cycles of certain salts induce stress on materials in which they are embedded. The combination of variable precipitation and temperature, alongside the existence of soluble salts within stone materials, leads to a higher frequency of salt crystallization cycles, ultimately leading to increased material damage.

The final climatic factor affecting outdoor cultural heritage is the alteration in wind characteristics, encompassing changes in speed, direction, and gusts, particularly during storms. Heritage buildings and archaeological sites bear significant consequences due to this factor, often resulting in severe damage and potential structural collapse from excessive wind impact. In addition to this, wind acts as a carrier for pollutants, salts, and sand, posing threats to heritage materials. The abrasive action of wind can cause erosion through the transport of particles, thereby heightening the risk of water infiltration into porous materials.

Climate change poses challenges also for indoor cultural heritage, particularly for the interiors of building that lack controlled environments, a common trait among numerous historical edifices. External climate conditions directly affect unregulated indoor setups, causing alterations in thermos-hygrometric conditions. These variations, in turn, stimulate mechanical, chemical, and biological decay within the interiors, affecting the objects and

collections housed therein. In fact, museums, which act as repositories of diverse collections, including both organic and inorganic materials, are frequently located in historical buildings lacking modern climate control systems. Consequently, it becomes imperative to assess the possible impacts of climate change on the internal environments of these spaces.

The impacts of gradual climate changes on indoor cultural heritage and collections are categorized by the authors into three main domains: mechanical, chemical, and biological degradation.

Mechanical degradation is further subdivided into freeze-thaw cycles, salt crystallization cycles, and mechanical damage to historic masonry buildings and wooden materials. Freeze-thaw cycles, although infrequent, can occur in uncontrolled indoor environments, resulting in the mechanical deterioration of stone, mortar and ceramic artifacts located within. Sal crystallization cycles, leading to similar damage mechanisms both indoors and outdoors, occur when indoor relative humidity reaches levels conductive to salt crystallization. The presence of specific soluble salts can result in efflorescence and sub florescence effects, which can compromise wall paintings, frescoes and other decorated surfaces. Furthermore, fluctuations in indoor temperature and relative humidity, driven by climate change, can lead to physical damage to hygroscopic wooden materials and historic masonry buildings. During periods of increased relative humidity, woods absorb moisture, causing mechanical stress during cycles of swelling and shrinkage. This phenomenon extends to associated materials such as coatings on wooden panels or furniture, resulting in detachment from substrates and damage to painted surfaces or gilded components.

The acceleration of chemical reactions becomes a relevant concern in areas expected to undergo increased warmth and humidity as projected by climate change scenarios. Such conditions may have an impact on heritage materials made from paper and silk. In humid and warm environments, paper that is acidic or exposed to air pollution can deteriorate, resulting in the breakdown of cellulose fibres, thus contributing to the degradation of books and manuscripts. Consequently, heritage objects such as wall decorations, furniture fabrics, and costumes made from silk have a lifespan dependent on the levels of humidity and temperature. Internal conditions characterized by increased warmth and humidity can also induce alterations in the coloration of photographs, particularly when subjected to acidic pollutants.

Finally, climate change is affecting the preservation of indoor cultural heritage by causing biological decay, which presents an increasing risk in changing environmental conditions. As a result of the interplay between higher relative humidity and the expected

warmer climate, indoor environments are more susceptible to degradation caused by mould and insects. Fluctuations in indoor temperature and humidity levels can lead to potential biological deterioration of collections and archives, highlighting the diverse implications of climatic shifts on preserving cultural heritage in enclosed areas. It is crucial to maintain stable environmental conditions to prevent such damages.

The Eindhoven University of Technology, located in the Netherlands, conducted a study that investigates the impact of climate change on valuable museum collections located within historical buildings[340]. The study also developed an assessment method to evaluate the risk. This methodology is specifically applied to evaluate two historical museum buildings, one in the Netherlands and the other in Belgium. The evaluation focuses on two museum rooms showcasing collections of historic paintings and wooden furniture.

Furthermore, a round-table discussion was held at the National Gallery of London on 17 September 2008 to explore the implications of climate change on cultural heritage, specifically in museums and house collections[341]. The aim of the event, organized by the International Institute for Conservation of Historic and Artistic Works (IIC), was to raise awareness among conservation and museum professionals regarding potential climate change impacts on indoor cultural artifacts. Many individuals in these fields assume that their collections housed in museums are safe from climate-related risks. A constructive approach to assess the risk of climate-induced damage on indoor collections involves leveraging conservators' insights gained through comprehensive condition surveys of collections. Collaborative efforts among conservators, scientists and curators are crucial for formulating damage functions that are suitable for various materials in the collections.

The last section of the research by Sesana, et al., concentrates on the impact from catastrophic changes in the natural physical environment on cultural heritage, both indoor and outdoor. In particular, profound alterations in the natural physical environment caused by climate change, such as flooding, rising sea level and its associated coastal impacts, and landslides can exert significant repercussions on cultural heritage, both outdoor and indoor.

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[340] HUIJBREGTS Z., KRAMER R. P., MARTENS M. H. J., VAN SCHIJNDEL A. W. M., and SCHELLEN H. L., A *proposed method to assess the damage risk of future climate change to museum objects in historic buildings*. Building and Environment, 55; 2012: 43-56

[341] This was the inaugural round-table of the "*Dialogues for a New Century*" series, held during the IIC Congress in London in 2008. The initiative is intended to increase awareness of and encourage conversations about the issues and challenges of our time that impact and are impacted by heritage conservation. Particularly, the event of 17 September was titled "*Climate change and museum collection*". IIC (curated by), *Climate change and museum collections*, transcribed by S. Hughes. London; 2008.

Flooding is a crucial consequence of climate change that greatly affects cultural heritage. Flood events significantly increase moisture levels in historical structures and materials leading to physical, chemical, and biological degradation. The prolonged presence of moisture within flooded buildings can raise interior humidity levels, contributing to the degradation of collections. Inefficient drainage systems, designed for lower water volumes, worsen the effects of flood events and exacerbate degradation. Additionally, urban development practices, including the use of impermeable ground surfaces in historical cities, have the potential to compromise drainage systems by impeding the infiltration of rainwater, resulting in increased runoff and damage. Anticipated changes in fluvial patterns are expected to heighten the effects on archaeological sites located in river floodplains. Historical evidence reveals that past fluctuations in climate have affected the erosion of catchment areas and downstream deposition, consequently affecting archaeological sites either through erosion or preservation by means of burial. Fluctuations in groundwater levels, impacted by climate change, have an impact on the discharge of rivers in both rural and urban areas, altering runoff characteristics and posing potential stress on archaeological resources. Furthermore, the melting of glaciers may contribute to flooding, demonstrating the diverse climatic factors that can lead to the inundation of cultural heritage sites.

More intense rainfall due to climate change will heighten the risk of ground instability and landslides. This may result in loss of cultural heritage sites or historical buildings situated on or near slopes, or damage and burial of structures due to debris, mud, and rocks.

The rising sea levels have emerged as a significant hazard to the preservation of cultural legacy in coastal areas. Underwater cultural assets, such as sunken coastal cities, shipwrecks and arachnological artifacts are at risk from the effects of sea level rise. This vulnerability steams from shallow-water erosion and the retreat of benthic species, such as seagrass, which serves as a stabilizing element for submerged sites. This retreat worsens erosion, impacting the stability of underwater heritage. Additionally, sea level rise is expected to amplify occurrences of extreme events such as storm surges, generating larger waves that affect sediment equilibrium in coastal areas and the stability of underwater archaeological sites and monuments. The alteration of the shoreline, resulting from these processes, holds implications for various heritage typologies. Some heritage structures may face the risk of disappearance due to erosion and coastal retreat, while others may be impacted by sediment accumulation in the coastal environment. The research carried out by Sitzia F., Peters M. J. H., and Lisci C. on the case study of Tharros, an archaeological site situated in Sardinia, Italy,

demonstrates the impact of climate change on archaeological areas[342]. Although Tharros, the ruins of a city founded by Phoenicians in VII century BC, is now musealized and safeguarded, it is subject to risks due to climate change and in particular to sea level rise and costal line modification.

Elevated sea surface temperatures have the potential to induce alterations in water currents, oxygen concentrations, and salinity levels. Furthermore, the absorption of atmospheric carbon dioxide (CO_2) by the oceans results in acidification, which can impact underwater heritage, particularly shipwrecks and submerged archaeological sites. Ocean acidification accelerates the corrosion rate, and the expected alterations in salinity due to climate change, resulting from an intensified hydrological cycle with increased precipitation and evaporation, as well as warmer sea surface temperatures, may lead to heightened presence of organisms like shipworms. This increased presence poses a risk of damage to underwater structures.

In a warmer climate, cultural assets anchored in permanently frozen ground face annual cycles of freezing and thawing, leading to gradual deterioration. Moreover, archaeological heritage, such as burial sites found in mountainous areas, high latitudes, and polar regions, is expected to deteriorate due to microbial decay caused by climate change. Another concern arises from the heat generated by microbes, which intensifies in warmer soils, potentially causing softening and subsidence of building foundations. Additionally, permafrost thawing exposes frozen archaeological assets to erosion, further jeopardizing their preservation.

Lastly, the combination of droughts and extreme heat increases the likelihood of fire ignition and propagation, which poses a threat to cultural heritage. Fires result in both material loss and deformation of heritage assets and elevate the probability of cracking or splitting of structures. Elevated temperatures can cause both visible macroscopic effects, including stone cracking, soot accumulation, and colour alteration in iron-containing stones, and microscopic degradation processes, such as mineralogical and textural changes in stones, which could weaken their structure over time. Furthermore, drought conditions result in soil desiccation and impact unfired construction materials, which poses structural implications for the foundations of historical buildings and archaeological sites.

[342] SITZIA F., PETERS M. J. H., LISCI C., *Climate change and its outcome in the archaeological areas and their building materials. The case study of Tharros (Italy)*. Digital application in archaeology and cultural heritage, 25; 2022

Table 4.1. Impacts of climate change on cultural heritage

Impacts of climate change on outdoor cultural heritage	Variations in temperature	Freeze-thaw cycles
		Thermoclastism
	Changes in precipitation	Corrosion
		Biological degradation
		Salt crystallization cycles
	Alteration in wind characteristics	
Impacts of climate change on indoor cultural heritage and collections	Mechanical degradation	Freeze-thaw cycles
		Salt crystallization cycles
		Mechanical damage on wooden materials and historic masonry buildings
	Chemical degradation	
	Biological degradation	
Impact from catastrophic changes in the natural physical environment on cultural heritage, both indoor and outdoor	Flooding	
	Slope instability and landslides	
	Sea level rise and associated costal impacts	
	Changes in ocean properties: temperature, salinity, and acidity	
	Permafrost thawing	
	Droughts and extreme heat	

4.1.2 An in-depth understanding of cultural heritage sites at risk in Italy

According to the UNESCO State of Conservation Report, 62 Cultural Heritage Sites across 46 countries currently confront the hazards of climate change[343].

Among these sites also Venice and its Lagoon is listed. Inscribed in 1987 on the World Heritage List, the city is constructed on 118 small islands, and its vast array of masterpieces and monuments is one of the most concentrated in the world. Archaeological evidence and historical data demonstrate Venice to have experienced subsidence at a rate of approximately 10cm per century due to natural causes such as delta propagation and sediment compaction, resulting in a rise in water levels. During the twentieth century. Nearby industries extracted groundwater from deep aquifers, resulting in a further subsidence of between 10 and 13cm. While this practice ceased in the 1970s, irreversible harm had already occurred[344]. These factors significantly contribute to the rise in sea levels in local areas, a phenomenon that warrants consideration within the broader context of global climate change-induced sea level rise. The increase in the average volume of the ocean stems from the melting of icecaps and glaciers, as well as the expansion of warmer seawater, which is also known as "eustatic sea-level rise". This distinction is crucial from the concept of relative sea-level rise, which encompasses the cumulative impact of both global and local alterations[345]. To summarise, the interplay between local and global sea level dynamics ultimately leads to a net sea level increase in the city of Venice. In recent times, there has been a significant increase in the frequency of floods and consequential damage to the UNESCO site. Regarding future projections, moderate climate change scenarios indicate that Venice is anticipated to undergo a net loss in elevation of 54 cm by the year 2100.

On 30th November 2022, Italy presented a detailed report on the conservation status of Italian cultural heritage[346], outlining actions taken in response to the suggestions provided by the collaborative 2020 Advisory mission of World Heritage Centre, ICOMOS, and RAMSAR[347]. The report details the proposed initiatives in relation to Venice, comprising the creation of a dedicated high-water barrier to safeguard San Marco's Basilica and plans for the

[343] UNESCO WORLD HERITAGE CONVENTION (curated by), *State of conservation reports*, available at https://whc.unesco.org/en/soc/?action=list&pattern=&sitescategory=1&soc_start=&soc_end=&id_threats=244%2C130%2C129%2C128%2C127%2C126%2C131&fullsearch=&otherthreats= (last consultation 18/11/2023)
[344] UNESCO (curated by), *Case studies on climate change and world heritage*. UNESCO World Heritage Centre; 2009: 70-71
[345] *Ibidem*
[346] UNESCO (curated by), *Venice and its Lagoon (Italy). State of conservation report in compliance with the Decision 44 COM 7B.50 of the World Heritage Committee*. World Heritage Convention; 1 December 2022
[347] WHC, ICOMOS, RAMSAR (curated by), *Report of the joint WHC/ICOMOS/RAMSAR advisory mission to Venice and its Lagoon (Italy)*. 27-31 January 2020

entire elevation of San Marco insula. On the other hand, the MoSE system (Modulo Sperimentale Elettromeccanico), already used twenty times during 2021-2022, still awaits completion because continued modernisation and maintenance efforts are crucial for achieving full functionality. Moreover, recovery efforts persist from the extraordinary high-tide incident in November 2019. Despite improvements to the risk prevention system, there has been an increase observed in the frequency and magnitude of high tide events, culminating in the highest recorded level of the Adriatic Sea in history on 22 November 2022.

In general, the effects of human activities and natural changes, such as the increase in sea level, sever weather occurrences, and other outcomes of climate change, lead to the degradation and damage of the city. Given these challenges, the World Heritage Centre and Advisory Bodies hold that the property is facing existing and potential threats, as specified in paragraph 179 of the Operational Guidelines[348]. Therefore, they suggest adding the property to the "*List of World Heritage in Danger*". This recommendation aims to inspire greater commitment and engagement from local, national, and international stakeholders. Its objective is to facilitate the design of efficient and viable corrective measures to tackle these long-standing issues.

While the threat of rising tides poses a noteworthy challenge, climate change also affects Heritage Properties that are not immediately faced with this imminent danger. Elevated temperatures, increased precipitation, droughts, and the more frequent occurrence of extreme weather events all threaten several Heritage Sites.

To understand the extent of the problem, we can consider the Italian peninsula as an illustrative case. In October 2022, CHARISMA Academy, an Erasmus+ project co-funded by the European Union with a focus on risk management of cultural heritage, conducted research shedding light on the assessment and management of cultural heritage risks across Europe[349]. The primary objective of this study is to establish a comprehensive framework for addressing the risks posed by climate change. To support this goal, the project includes a detailed mapping of at-risk cultural heritage in specific countries, namely Italy, Germany, Austria, and the Czech Republic. This mapping initiative serves to facilitate the evaluation of impending risks to tangible cultural heritage, particularly those associated with climate change and

[348] UNESCO WORLD HERITAGE CONVENTION (curated by), *Venice and its lagoon*, 2023, available at https://whc.unesco.org/en/soc/4446 (last consultation 19/11/2023)
[349] CHARISMA (curated by), *Project result n. 1. Study on risk assessment and management of cultural heritage across Europe*. October 2022. For the official website of the project consult https://www.charisma-academy.eu/ (last consultation 22/11/2023)

human activities. The resulting "heritage at risk" maps are a cartographic representation derived from partner-provided lists identifying endangered or vulnerable cultural heritage due to the impacts of climate change, natural hazards, and human actions. These lists are further enriched by incorporating data from internationally recognized sources such as the UNESCO World Heritage List, the ICOMOS World Reports on Monuments and Sites in Danger, and the World Monuments Fund.

The maps identify the different cultural heritage sites at risk, categorizing them based on specific perils such as air pollution, anthropic risk, biological threats, flood risk, geological hazards, and seismic risk. As already underlined, the concept of climate change is broad and affects, in various measures, all the risk types listed here. Examining the pending risks within Italy's cultural heritage framework reveals a diverse range of challenges. Among the categorized risks, the most frequently encountered entry is "other", indicating that the primary threats to cultural heritage are related to the passage of time. These include issues such as water infiltration, moisture, dust accumulation, residue buildup, and the growth of spontaneous vegetation. Although these issues occur in many regions, in Italy they are particularly connected to human factors such as neglect, mismanagement, pollution resulting from intense urbanization, and other human activities. Within the anthropogenic risks category, vandalism and the impacts of mass tourism are more pronounced. Moreover, the cultural heritage of Italy is highly exposed to geological risks, particularly in the historic centres located in central Italy. These centres, constructed in tuff and subject to soil erosion exacerbated by human activities and atmospheric agents, are particularly vulnerable. Additionally, recent earthquakes in L'Aquila (2009), Emilia Romagna (2012), and the events in Amatrice and Central Italy (2016-2017) highlight the significant threat of seismic risk to Italian cultural heritage. (see figures 4.1 and 4.2)

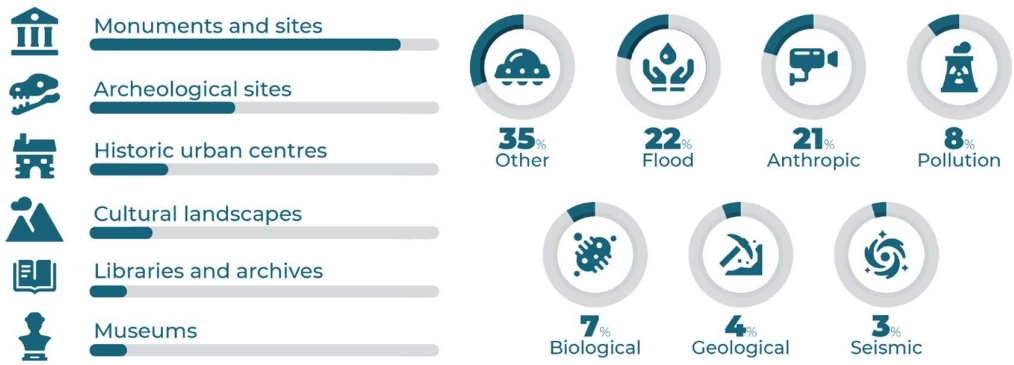

Figure 4.1. Cultural heritage in Italy sort by typologies and risks. CHARISMA (curated by), *Project result n. 1. Study on risk assessment and management of cultural heritage across Europe*. October 2022: 60

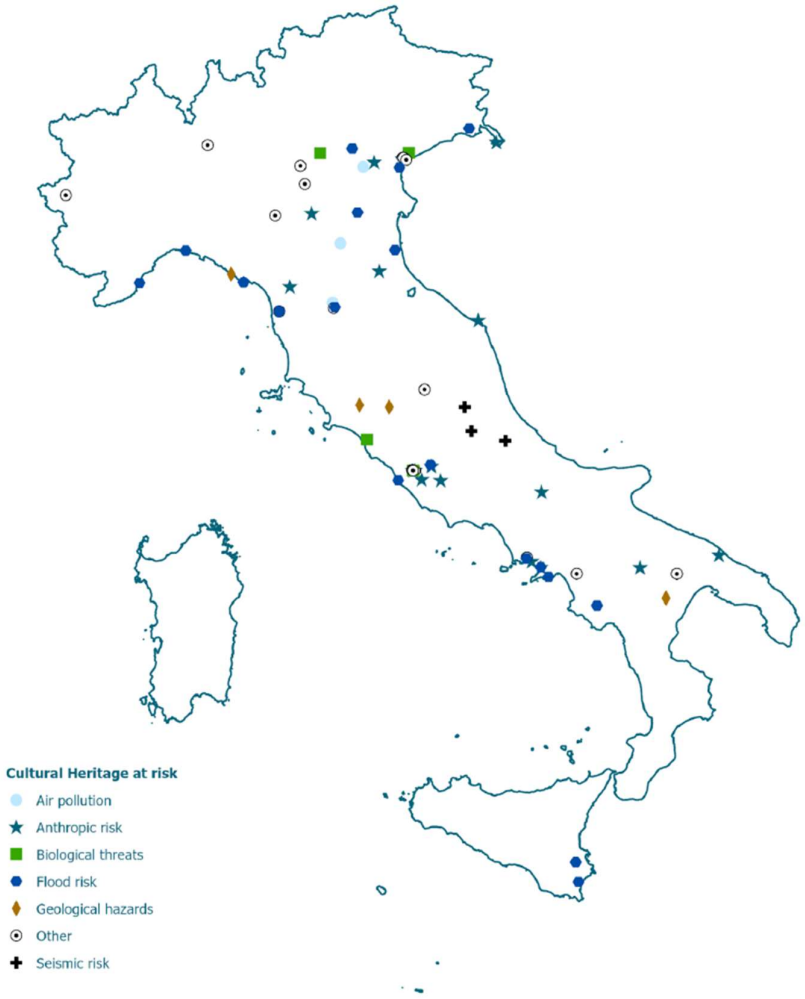

Figure 4.2. Cartographic representation of cultural heritage sites at risk in Italy. Source: CHARISMA (curated by), *Project result n. 1. Study on risk assessment and management of cultural heritage across Europe*. October 2022: 58

4.2 Insurers as partners in risk mitigation and prevention in the face of climate change

The alteration of water cycle and temperature, combined with the increasing frequency of severe phenomena such as floods, droughts, and wildfires are gradually affecting our cultural legacy. To successfully manage future challenges, it is crucial to establish preventative and protective measures, starting with the identification of potential risk scenarios. Risk analysis encompasses various factors, with geographical location being a crucial one. It involves an analysis of scientific data to identify potential natural environmental hazards, such as earthquakes and floods[350]. The quantification of territorial

[350] RESTI C., *Taking security seriously*. In: AXA XL, ed. *Insights from our experts*. 2020: 26-28

vulnerability may be realised through nationwide classifications and risk maps published by government authorities. These assessments take into account landform structures, such as mountain ranges, and integrated historical data and dynamic trends in an effort to predict future behaviour with reasonable accuracy, enabling an impartial risk evaluation at the site-specific level[351].

Once the environmental and natural risks within a specific geographic region are identified, including historical data, it is necessary to assess their likelihood and the potential consequences for both the location and its contents. In such scenarios, insurers can offer valuable information and guidance as they possess the necessary expertise to contribute extensively to this risk assessment process by utilising their knowledge of historical claims data, actuarial models, and risk management strategies. Their role can extend beyond solely providing insurance coverage, as they can also act as partners in risk mitigation and prevention. By fostering a collaborative approach with policyholders, insurers can stimulate proactive measures to mitigate vulnerability and enhance resilience against environmental and natural hazards.

In particular, some insurance companies are involved in the development of specialised risk mapping programmes that assist not only in forecasting and mitigating future losses, but also in the avoidance of claims, thus ensuring the protection of customers' properties. Insurers make a substantial contribution to the development of discourse on risk mitigation strategies and the promotion of a culture of preparedness in light of the constantly evolving global challenges, by utilising their expertise and insights. For example, the AXA Future Risk Report 2023 underscores the severity of hazards related to climate change[352]. In fact, in the 10th edition of the report, a comprehensive evaluation of potential global hazards based on in-depth surveys carried out by the company's specialists, climate change has been identified as the primary emerging risk on a worldwide level. This AXA annual survey highlights the importance of risks for their business, with proactive risk anticipation serving as a strategic method to reduce their effects and improve preparedness. Over the last ten years, this report has carefully tracked the changing perceptions of both experts and the public regarding the vulnerabilities faced by our societies[353]. It is noteworthy that climate change has

[351] *Ibidem*
[352] AXA (curated by), *Future risks report. 10th edition*. 2023
[353] In 2020, AXA initiated a collaboration with Ipsos Group S.A. to conduct a study on the general public. The purpose is to compare the opinion of AXA specialists with the wider population's attitudes towards emerging risks, highlighting the risks that individuals perceive as their highest vulnerabilities and identifying the stakeholders they trust to manage and mitigate these risks. Ipsos Group S.A. is a multinational market research and consulting company based in Paris. The company was founded in 1975.

consistently taken the top spot in expert rankings since 2015 and, for the first time in 2023, has become the primary concern for the public across all geographic regions surveyed, including America, Africa, Europe, Asia Pacific, and the Middle East.

The interview with Frédéric de Courtois, AXA Group Deputy CEO, as featured in the AXA Future Risk Report 2023, emphasizes the pivotal role of insurance in tackling emerging risks[354]. Firstly, insurers demonstrate their proficiency in risk evaluation and mitigation by using advanced models and data analytics to comprehend and calculate emerging risks. De Courtois elucidates this by stating, «we have developed sophisticated models and data analytics that help us understand and quantify new risks. For example, in the case of climate change, we are able to assess the potential impact of extreme weather events on our policyholders». This profound understanding empowers insurers to accurately price policies and incentivize policyholders to undertake precautionary measures against these risks. Secondly, insurance companies can act as influential drivers of risk reduction efforts. By offering discounts or alternative incentives for the proactive adoption of risk management measures, they encourage policyholders to adopt safer practices. Therefore, prevention becomes a primary area of focus. By employing data strategically, insurers can assist their clients in decreasing the risk associated with climate change. Through the reduction of such risks, insurers can ensure their capability to offer insurance coverage at reasonable rates[355].

Generally speaking, in the context of climate change, six distinct insurance mechanisms emerge as effective tools to encourage policyholders to adopt more proactive risk management practices[356]. Firstly, insurance companies can offer premium discounts as a reward for policyholders who undertake risk-reduction measures for their insured properties. Secondly, flexibility of deductibles can be applied to adjust the policyholder's excess based on the implementation of risk-reduction measures. This innovative approach enables insurance firms to increase the excess when policyholders fail to take adequate risk reduction measures, while decreasing it to encourage and facilitate the adoption of such measures. Moreover, the introduction of a deductible requires the policyholder to allocate financial resources, thereby promoting long-term dedication to risk reduction efforts. A third viable option for enhancing risk reduction involves implementing risk-based premiums. This has potential to increase risk awareness, leading to indirect risk mitigation efforts. However, this

[354] DE COURTOIS F., *Prevention should be a priority focus*. In: AXA, ed. *Future risks report. 10th edition*. 2023: 40
[355] *Ibidem*
[356] EUROPEAN COMMISSION (curated by), *Insurance of weather and climate-related disaster risk: inventory and analysis of mechanisms to support damage prevention in the EU. Final report*. Brussels; August 2017: 60-62

is contingent upon the transparency of premiums regarding the origin of the risk. In this scenario, the premium cost is intricately tied to the predicted annual losses from the various extreme weather events covered by the insurance. Nonetheless, a critical challenge arises in regions characterized by elevated risk levels, as the application of risk-based premiums may result in significantly high costs. This may subsequently limit financial resources available for reducing risk, unless there is a mechanism to decrease premiums when undertaking risk-mitigating measures. Fourthly, terms and conditions requirements within insurance policies can also prove useful. This implies that a policyholder can access coverage or more favourable coverage conditions exclusively upon fulfilment of specific risk-reduction criteria, mandating the implementation of risk-mitigation measures as stipulated by the insurance provider. Moreover, informational initiatives and awareness campaigns, such as the dissemination of hazard maps and local risk data, can significantly enhance risk awareness and the perceived benefits of insurance or preparatory measures. Finally, insurance firms can employ bonus-malus systems as a further mechanism to strengthen risk management practices among policyholders. This entails the rewarding of policyholders with reduced premiums during periods of consistently low losses, while sustained high losses result in premium escalation. However, the main challenge within this mechanism is establishing a direct correlation between the policyholder's implemented risk management measures and subsequent changes in losses, rather than attributing fluctuations to fortuitous periods of favourable outcomes.

Different cultural heritage asset categories, such as historic structures, archaeological sites and artistic collections, have different disaster risk management requirements. These needs are intricately linked to the inherent features of each heritage category, including scale and the nature of the assets, whether they are movable or immovable[357].

An efficient risk management plan to mitigate the effects of climate change on cultural heritage comprises three stages: pre-disaster, during the event, and post-disaster. Anticipatory measures before a disaster entails activities such as risk assessment, the implementation of preventive and mitigative strategies tailored to specific hazards, including maintenance and monitoring initiatives. Additionally, emergency readiness preceding a disaster entails the establishment of an emergency team, devising evacuation plans and procedures, implementing warning systems, and organizing temporary storage facilities. During a disaster,

[357] UNESCO, ICCROM, COMOS, IUCN (curated by), *Managing disaster risks for world heritage. World Heritage resource manual*. UNESCO World Heritage Centre; 2010: 13

typically referred to as the first 72 hours after an incident, it is vital to have in place and practice various emergency plans for the protection of the artistic heritage. Finally, the period following a disaster involves a systematic evaluation of the destruction caused, executing corrective measures to restore compromised items[358].

In the comprehensive risk management plan for mitigating the impacts of climate change on cultural heritage, insurance assumes a pivotal role across all these phases. Particularly, in the pre-disaster phase, insurance is important in supporting and encouraging the implementation of preventative measures and the formulation of emergency plans. The role of insurance goes beyond the provision of financial cover. It acts as an incentive for institutions and stakeholders to invest in and implement preventive measures, motivating cultural heritage managers to participate in activities such as risk assessments, structural reinforcement and the formulation of contingency strategies. Furthermore, during the emergency situation, insurance can serve as a crucial resource since the company can facilitate links with experts and specialists, thereby providing invaluable support in effectively addressing the unfolding event. This collaboration guarantees that the emergency response is well-informed, prompt, and benefits from professionals' expertise who can help to reduce the impact on cultural heritage. Post-disaster, the role of insurance extends to the financial realm. It helps to ease the economic burden caused by damages and enables the execution of corrective measures for restoring and recovering cultural items. The financial support provided by insurance is vital for the ongoing preservation and rehabilitation of cultural heritage assets in the aftermath of a disaster.

In summary, insurance has a multifaceted role spanning the entire risk management continuum. It encompasses proactive measures before a disaster, expert collaboration during the event, and essential financial support in the aftermath. This significantly strengthens the resilience and conservation of cultural heritage against climate change-related risks. This approach, motivated by incentives, aligns the interests of insurance providers and custodians of cultural heritage, fostering a collaborative framework that ultimately benefits the protection and preservation of cultural heritage.

[358] *Ivi*: 13-14

4.2.1 Risk assessment methodologies and adaptive measures in the face of climate change

Cultural heritage is becoming increasingly vulnerable to the adverse impacts of climate change, including floods, mudslides, and fires, resulting in a notable loss of these important properties. The insufficient reaction to these difficulties is evident in the meagre number of world heritage assets that have implemented comprehensive disaster risk reduction plans. This deficiency can partially be ascribed to common misconceptions. Firstly, there is a commonly held belief that climate change-related disasters are uncontrollable events beyond human influence, leading to a perceived futility of preventive measures. Furthermore, heritage managers and policymakers frequently prioritize addressing perceived immediate threats, such as developmental pressures and obvious, gradual deterioration, allocating their attention and resources accordingly. Finally, the susceptibility of heritage properties to disasters tends to be acknowledged only post-catastrophe, when it is frequently too late to avert substantial damage[359].

Recognising these challenges, the Resource Manual entitled "*Managing Disaster Risks for World Heritage*" has been created as a part of the developing World Heritage Resource Manual Series[360]. The manual has been developed through collaboration between ICCROM, the UNESCO World Heritage Centre, ICOMOS and IUCN with the aim of increasing the awareness of World Heritage managers and administrators about the actual extent of risks associated with disasters. The manual presents a comprehensive methodology to facilitate the identification, assessment, and mitigation of associated risks.

A comprehensive management approach for cultural heritage assets necessitates a meticulous evaluation of the associated risks, particularly in the context of the escalating threat posed by climate change. In essence, this entails the identification of precise and potential hazards, clarifying their frequency, magnitude, and the anticipated consequences. It is imperative to acknowledge that despite these efforts, the elimination of risks is an unattainable objective. Rather, the primary goal is to reduce exposure by pragmatic methods. By undertaking a comprehensive risk analysis, one can identify the potential risks that pose a threat to cultural heritage and determine whether they can be eradicated, mitigated, accepted, or transferred. When managing the financial risk of potential loss or depreciation of cultural assets, third-party interventions such as insurance are crucial[361]. The financial impacts of disasters highlight the necessity of investing proactively in preventative risk management

[359] UNESCO, ICCROM, COMOS, IUCN (curated by), *Managing disaster risks for world heritage*, cit.: 2
[360] *Ibidem*
[361] RESTI C., *Taking security seriously*, cit.: 26

planning. In fact, investing in pre-emptive measures prior to a disaster is markedly more cost-effective than addressing the consequential costs of post-disaster recovery and rehabilitation. As such, prioritising risk reduction arises as the most viable and efficacious method for cultural heritage management in the face of climate-induced adversities[362].

Predicting climate change and its effects can only be done with a level of uncertainty. The gravity of this impending challenge depends on the interplay of two distinct components: hazard and vulnerability (this relationship is showed in figure 4.3)[363].

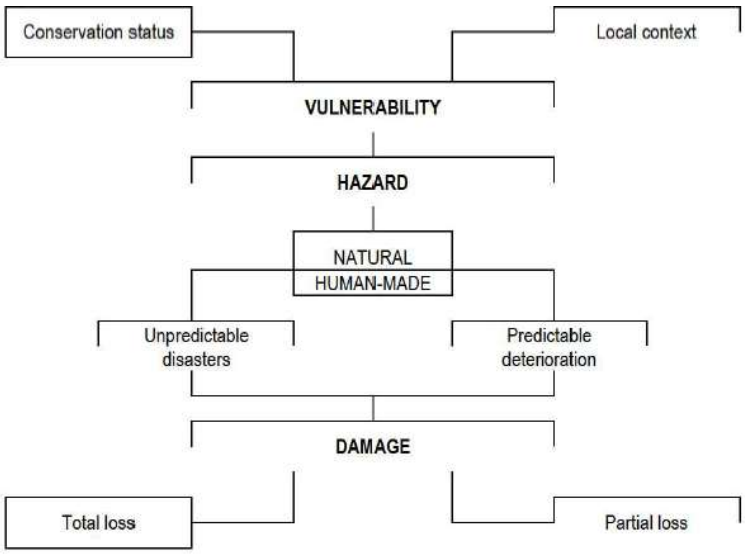

Figure 4.3. Vulnerability-hazard-damage relationship. Source: ADAMO S., IMPERIALE F., LUPERTO I., *Cultural heritage and challenges for catastrophic risk management in Italy*. Journal of Multidisciplinary Research, 9; 2017: 33-51

A hazard constitutes an event, such as a storm or inundation, that has the potential to cause damage to cultural assets. Conversely, vulnerability refers to the susceptibility or exposure of cultural assets to the identified hazard. While a hazard serves as the external source of a potential calamity, vulnerability represents the innate fragility of heritage assets, arising from factors such as their geographical location or distinctive features[364]. In order to formulate proficient protection and conservation strategies for cultural sites, it is imperative to execute apt monitoring and vulnerability evaluation procedures. The vulnerability of cultural heritage can increase awareness among both individuals and governments, hence inducing them to enact appropriate measures for mitigating the impacts of climate change with the implementation of appropriate policies and tools[365].

[362] UNESCO, ICCROM, COMOS, IUCN (curated by), *Managing disaster risks for world heritage*, cit.: 8
[363] ADAMO S., IMPERIALE F., *Cultural heritage and challenges for catastrophic risk management in Italy*. Journal of Multidisciplinary Research, 9; 2017: 33-51
[364] UNESCO, ICCROM, COMOS, IUCN (curated by), *Managing disaster risks for world heritage*, cit.: 8
[365] DE MASI F., PORRINI D., *Managing climate change risk*, cit.: 2619-2637

In the context of cultural heritage, the use of risk assessment methodology and tools is advantageous for priority setting. Assessment involves the synthesis of current observations and past experiences to facilitate the prediction of future events or guide subsequent actions. Here, Forino G. et al.'s research in 2016 aims to illustrate and examine an operational procedure for calculating the Cultural Heritage Risk Index (CHRI)[366]. This pioneering index evaluates climate change-induced risks to cultural heritage. The paper formulates the CHRI by quantifying risk as a function of hazard, exposure, and vulnerability. This methodology is applied to the Burwood Beach Wastewater Treatment Works, a cultural heritage asset in Newcastle, Australia, which is currently deteriorating. Within the context of the paper, risk assessment involves a comprehensive evaluation of evidence, culminating in an informed prediction regarding the likelihood or probability of undesired events occurring within a specified timeframe. The construction of the CHRI involves a set of four analytical stages: hazard analysis, exposure analysis, susceptibility analysis and, lastly, risk analysis which synthesises the findings of the previous stages. The CHRI is calculated by transforming the fourth step into an index, where each attribute is assigned a weight based on its potential impact on a cultural heritage asset. To ensure clarity and precision, the attributes linked to each analytical step in the CHRI are elaborated with regards to source data, interpretation, and measurement (see figure 4.4). This thesis will focus on examining the approaches and techniques employed in Fiorino G. et al.'s research, rather than conducting an extensive evaluation of the data. The aim is to provide a concrete illustration of how to construct an effective climate change-related risk assessment index.

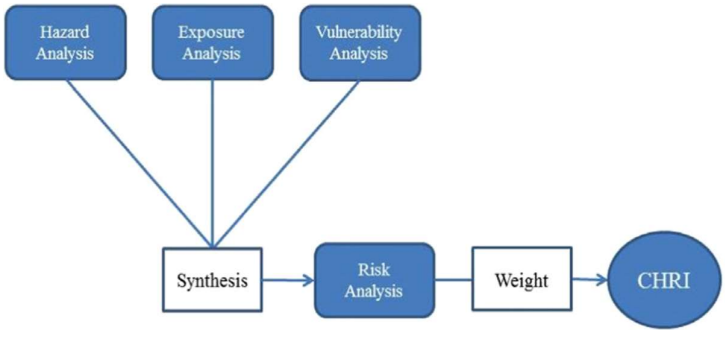

Figure 4.4. Analytical steps for calculating CHRI. Source: FORINO G., MACKEE J., VON MEDING J., *A proposed assessment index for climate change-related risk for cultural heritage protection in Newcastle (Australia)*. International Journal of Disaster Risk Reduction, 19; 2016: 235-248

[366] FORINO G., MACKEE J., VON MEDING J., *A proposed assessment index for climate change-related risk for cultural heritage protection in Newcastle (Australia)*. International Journal of Disaster Risk Reduction, 19; 2016: 235-248

Firstly, the hazard analysis assessment matrix is structured around four different attributes[367]. The first one is location, which plays a key role in assessing the risk associated with cultural heritage assets. This involves an examination of potential climate-related hazards that may be linked to the geographical location of the cultural heritage asset. The second attribute taken into account is the probability of occurrence. The sources utilized for this evaluation include archival and historical records, in addition to global climate modelling data from meteorological departments, national and local databases, and insurance companies' records. The data sources present information regarding the frequency of climate change-related hazards and their incidence in the proximity of cultural heritage assets. Indeed, comprehending the frequency of previous events and forecasting future ones aid in assessing the likelihood of their occurrence. The third aspect involves assessing the magnitude of climate change-related hazards relevant to the location of cultural heritage assets. Assessing the possible magnitude of hazards is crucial for understanding the potential harm that may result. An assessment of both the magnitude and likelihood of occurrence provides a meaningful indication of the hazard's overall impact. Additionally, the evaluation includes the duration of potential hazards, which is expressed in temporal periods ranging from seconds to years. The temporal dimension is crucial for an all-inclusive comprehension of the possible impact, delivering insights into the endurance and persistence of the hazards identified.

Exposure analysis examines the interface between an asset and its socio-economic context, assessing the possible harmful effects resulting from the asset's damage or loss. In other words, exposure is the value of the asset exposed to extreme weather events. The analysis involves measuring the potential direct and indirect economic consequences associated with the depletion of cultural heritage, which includes both tangible and intangible aspects that contribute to societal well-being. Therefore, the analysis of exposure uses an assessment matrix with three separate metrics: the current use of the cultural heritage asset, the direct economic impacts resulting from the loss of cultural heritage activities, and the indirect economic consequences of such losses.

Vulnerability analysis evaluates the susceptibility level of a cultural heritage asset and documents the historical incidence of damages to establish correlations between damage occurrences and the intensity of hazards. Consequently, three variables require consideration:

[367] The use of a matrix to execute the hazard, exposure and vulnerability analysis is justified by the fact that different factors have to be taken in consideration. In fact, the matrix rows are constituted by the attributes, such as location, probability of occurrence, magnitude and duration as for the case of the hazard analysis assessment matrix, that are peculiar of each element to be analysed. On the other hand, the columns of the matrix remain the same and are: data source; discussion regarding how to interpret and correctly analyse the data; method of measurement; additional notes.

structural condition, asset fabric condition, and historical damage. These evaluations rely on on-site assessments conducted by structural engineers, conservation specialists, or available reports, such as condition reports. In this context, vulnerability signifies the likelihood that the attributes (significance, authenticity) of a cultural heritage asset will be adversely affected by a specific climate event. The structural condition indicates the ability of the structure to withstand possible hazardous situations such as flooding, fire heat, and saltwater intrusion. This variable helps understanding inherent weaknesses that make cultural heritage vulnerable to climate change risks. The asset fabric condition assesses the ability of the materials constituting the asset to withstand possible threatening conditions. Lastly, historical damage examines the frequency of past hazardous impacts on the asset, offering insights into its vulnerability over time. This assessment considers the evidence and extent of previous damage, subsequent repairs, and the quality of restoration work[368].

After having conducted hazard, exposure and vulnerability analysis, a nominal scoring system, where the size reflects the scale of the risk, is used to assign a value to the possible impacts of the risks measured based on the findings of the assessment matrices previously analysed. Table 4.2 shows the final phase of the risk analysis. Individual assessment scores are inserted into the CHRI matrix for aggregation and weighting, resulting in an overall CHRI score. A weight of 10 is applied to streamline the scores to a manageable scale. A score of 1 represents the lowest conceivable risk, while a score of 10 indicates the highest potential risk requiring immediate action.

Analyses	Scores	
Hazard analysis	50	
Exposure analysis	20	
Vulnerability analysis	30	
Cultural Heritage Risk Index (CHRI)		
Weighted by a factor of 10 to give a score out of 10	100	**10**

Table 4.2. The matrix of CHRI. Source: FORINO G., MACKEE J., VON MEDING J., *A proposed assessment index for climate change-related risk for cultural heritage protection in Newcastle (Australia)*. International Journal of Disaster Risk Reduction, 19; 2016: 235-248

The paper "*Climate for Culture: assessing the impact of climate change on the future indoor climate in historic buildings using simulations*" presents a methodology intended for evaluating the risks that result from climate change on indoor collection in historic

[368] *Ibidem*

buildings[369]. The methodology is of great utility to heritage owners and managers since it functions as a decision-making tool, assisting in the proficient planning of mitigation and adaptation measures across various levels of an organization. The focus of this paper is to anticipate the potential implications of gradual climate change on historic buildings and their collections. Employing various emission scenarios, the study aims to predict indoor climate conditions within these structures. Damage functions are then utilised to evaluate the risks to both the buildings and the interiors. This comprehensive method allows for the production of maps that outline predictable climate-related hazards pertinent to the interiors and structures of historic buildings.

In particular, high resolution climate simulations are carried out across Europe via the regional climate model REMO[370]. Moreover, two moderate emission scenarios, the A1B scenario and the RCP 4.5 scenario of the IPCC assessment report 5 (AR5) are used[371]. In the A1B mid-line scenario, it is anticipated that carbon dioxide (CO_2) emissions will increase until 2050, followed by a decline. On the other hand, the second scenario outlines a global plan for the long term, covering greenhouse gas emissions, short-lived substances, and changes in land-use with a specific target for CO_2 levels by 2100.

Starting from the data set of climate indices form the global climate simulations, researchers have developed tools for predicting the indoor climates of historic buildings. For this purpose, they use building simulation models that consider the type of building use, heating, ventilation and air conditioning, and integrate both thermal and hygrothermal components to comprehensively assess indoor conditions. The outcome of these simulations covers hourly energy demand, indoor temperatures, relative humidity and hygrothermal conditions. A simpler approach was also used by employing state-space models as transfer functions that connect the indoor and outdoor conditions to predict the indoor temperature and

[369] LEISSNER J., KILIAN R., KOTOVA L., JACOB D., *Climate for Culture: assessing the impact of climate change on the future indoor climate in historic buildings using simulations*. Research article, Heritage Science, 3; 2015

[370] The REMO regional climate model offers projections of climate change for the entire European region with a spatial resolution of 12.5 km. In this study, REMO simulations are utilized to compute climate indices for the time spans 2021-2050 and 2071-2100, using the reference period of 1961-1990. The dataset encompasses over 900 locations across Europe, providing climate information at an hourly resolution. (for more information on the regional climate model REMO see JACOB D., ELIZALDE A., HAENSLER A., HAGEMANN S., *Assessing the transferability of the regional climate model REMO to different coordinated regional climate downscaling experiment (CORDEX) regions*. Atmosphere, 3; 2012: 181-199)

[371] Various future emission scenarios, devised by the Intergovernmental Panel on Climate Change (IPCC), drive global climate models (GCMs). These scenarios outline factors such as population growth and the adoption of technologies to mitigate CO_2 emissions. However, despite ongoing advancements, current GCMs offer information at a relatively coarse spatial scale, which proves inadequate for assessing the impact of climate change on historic buildings. Consequently, high-resolution regional climate models were required for the research's specific objectives. Source: LEISSNER J., KILIAN R., KOTOVA L., JACOB D., *Climate for Culture*, cit.: 2

relative humidity. This technique enables efficient simulations for various types of buildings across Europe.

The effect of outdoor climate on cultural heritage structures and indoor environments within buildings is significant. Because of this, future climate predictions are used to create outdoor impact and risk maps that are then merged with building simulations to allow the calculation of future indoor climates and risk assessment. In doing so, the researchers utilize the above-mentioned automated method developed by the Eindhoven University of Technology[372], which assesses indoor climate variables, damage, and risk parameters for biological, chemical, and mechanical damage. This method is applied to 16 different generic building types, accounting for variations in size, window area, construction, and moisture buffering capacity, across different European climate zones. Risk maps are than created to demonstrate the possible hazards for the various building types and their collections. The study delves into specific risks related to nine materials present in building interiors, presenting, for instance, future mechanical risks for marble, stone, and masonry due to changes in salt crystallization cycles (see figure 4.5).

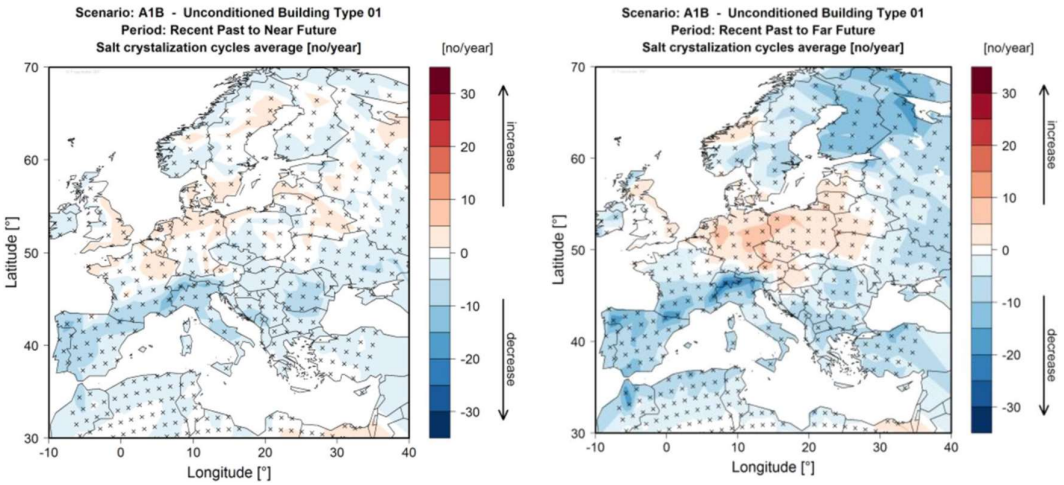

Figure 4.5. The graphic on the left illustrates the forecast for the near future based on the A1B emission scenario. It depicts a varied outlook in Northern Europe and the Mediterranean Area, with changes ranging from a decrease of 20 cycles/year in the Alps and much of Northern Europe to an increase of 10 cycles/year in other parts of Northern Europe, Southern Mediterranean, and the Spanish coast compared to the recent past. In the far future (on the right), the simulation predicts more substantial changes. For instance, a decrease of up to 40 cycles/year in salt crystallization cycles is anticipated in the Northern region and the Alps, suggesting a reduced risk of mechanical damage to masonry and stones. Conversely, in the rest of Europe, there is a projected increase in salt-crystallization cycles of around 10 cycles/year. Source: HUIJBREGTS Z., KRAMER R. P., MARTENS M. H. J., VAN SCHIJNDEL A. W. M., and SCHELLEN H. L., *A proposed method to assess the damage risk of future climate change to museum objects in historic buildings*. Building and Environment, 55; 2012: 43-56

[372] HUIJBREGTS Z., KRAMER R. P., MARTENS M. H. J., VAN SCHIJNDEL A. W. M., and SCHELLEN H. L., A *proposed method to assess the damage risk of future climate change to museum objects in historic buildings*, cit.: 43-56

The associated risk maps depict variations in different regions, indicating potential decreases or increases in risk levels based on anticipated future climate conditions.

Advancements in understanding the impacts of climate change on cultural heritage mostly result from the use of quantitative methods. Geographic Information Systems (GIS) and remote sensing technology have been pivotal in evaluating extensive urban areas. An example of the use of GIS for the scope of exploring and predicting the impact of climate change on cultural heritage sites is the recent study of Mengyuna et al., assessing the risk of flooding at cultural heritage sites in Shanxi Province, China[373].

4.2.2 Emergency management plan

The process of risk analysis and management is difficult, prompting consideration of how an insurance company can assist museums or collectors in undertaking protection projects for the works under their care. Major insurers can offer expert support and guidance for navigating the intricate methodology of risk assessment. Furthermore, they are ready to take part in disaster recovery efforts if necessary. This entails carrying out inspections, evaluating the security protocols both on the premises and related to existing management practices, and recommending any relevant modifications to decrease the level of risk. Additionally, such entities could provide contingency support triggered by weather alerts to help protect or move vulnerable artworks at risk due to expected natural events, like cyclones or river floods[374].

Within the sphere of fine art collections, the implementation of effective emergency plans holds paramount importance for mitigating risks caused by climate change. These plans, devised by institutions like museums and private collectors, encompass a comprehensive strategy delineating protocols to be adhered to in the face of diverse emergencies and crises that pose potential threats to the collections. Precision in executing these plans necessitates the imperative inclusion of insurers in the planning process, thereby ensuring a holistic approach

[373] MENGYUNA J., DING H., XIAOWEI H., HAORAN Z., SHUHUI J., JEI Z., *Exploring the impact of climate change on flood risk at cultural heritage sites using a GIS-based SCS-CN method: A case study of Shanxi province, China*. International Journal of Disaster Risk Reduction, 96; 2023. A geographic information system (GIS) is a computerized system used to capture, store, verify, and present data related to Earth's surface positions. GIS enables individuals and organizations to better understand spatial patterns and relationships by correlating seemingly disparate data. Remote sensing, which includes imagery and other data acquired from satellites, balloons, and drones, is a complementary tool for GIS.
[374] RESTI C., *Taking security seriously*, cit.: 26-28

to risk mitigation and recovery in unforeseen circumstances. Both museums and private collectors are advised to formulate extensive emergency plans facilitating prompt evacuation and treatment of affected objects. These plans should guarantee easy access to key contact information and include clear, detailed floor plans showing the exact locations of relevant objects. Executing these plans demands individuals with expertise in spatial organization of artworks and the specific recovery techniques essential for mitigating potential damage. The delicate nature of this phase underscores the need for consulting experienced restorers during the planning stage, as errors at this juncture can result in additional harm. Expert consultation proves invaluable in optimizing rescue operations during high-pressure situations, minimizing the need for rescuers to clarify safety measures and enabling them to concentrate on the time-sensitive requirements of the rescue mission. Efficiently managing the transition from discovery to professional recovery and security is pivotal for minimizing damage and subsequently reducing restoration costs[375]. In emergency scenarios, it is crucial to avoid reactive and hasty protective measures, emphasizing the establishment of proactive and holistic risk management strategies. In this vein, involving professionals in building security, as well as conservation and restoration during the operational planning phase is critical. Their swift engagement during a crisis assists restorers in streamlining operations and minimizing damage[376].

The facility report, a detailed document providing insights into the premises housing artworks, assumes a pivotal role within the framework of emergency plans. This type of document is regularly used by insurers to assess the safety and maintenance status of buildings that could potentially serve as permanent or temporary housing for valuable works of art. The fragility of the artworks is evaluated in the context of the environment and building to determine whether the associated risk is justifiable. For example, if a collection is susceptible to flooding, it should be placed on floors above ground level with access to alternative evacuation routes that avoid any ground-floor areas prone to flooding[377]. In such cases, it is recommended to display artworks on the ground floor that can be effortlessly moved or made of water and humidity-resistant materials. To ensure efficient evacuation, it is essential to create a priority list containing a detailed inventory of the items to be relocated. Additionally, the inventory attached to the insurance policy may be utilized. For objects that are too heavy, large, or numerous to move, as for example a library of books, it is vital to plan

[375] STOCK-NIEDEN D., *At war with water*. In: AXA XL, ed. *Insights from our experts*; 2020: 13-15
[376] *Ibidem*
[377] *Ibidem*

a "safe room". For objects that can be easily transported, it is crucial to plan the packaging material well in advance[378]. It is advisable to develop a plan to prioritise the preservation of the most important and/or easily transportable works of art in the event of an emergency, in particular if the collection contains a large number of works. Maintaining an up-to-date catalogue is crucial in this respect. A specialist insurer can help create a systematically organized list detailing the value, type of object and physical location. This provides several advantages because, in the event of an emergency, rescuers will have access to well-documented instructions on what to find and the most effective evacuation methods. This will result in saving valuable time[379].

An informative document providing guidance for dealing with art damaged by flooding is the one published by the Museum of Modern Art (MoMA) in 2012, subsequent to the occurrence of Hurricane Sandy[380]. Titled "*Immediate response for collections*", this document lays out detailed instructions for the preservation of artworks across various mediums that have been impacted by flooding, including library and archive collections. Moreover, the document includes a comprehensive directory listing suppliers and emergency services capable of providing the particular services detailed in its contents.

Another cultural institution that has demonstrated a robust commitment to emergency preparedness is the J. Paul Getty Museum particularly through the proactive engagement of the Getty Conservation Institute since the mid-1980s. Functioning as a stalwart advocate for the safeguarding of cultural property, the Institute has actively addressed technical challenges encountered in protecting collections and structures during emergency situations. The museum, situated in Los Angeles, has emerged as a noteworthy exemplar in the realm of emergency planning, serving as a model for numerous institutions across the United States. The institute's impactful initiatives extend beyond its locale, as evidenced by its involvement in the training and education of museum professionals.

A tangible outcome of this endeavour is the publication of the guide titled "*Building an emergency plan: a guide for museums and other cultural institutions*"[381]. This guide, a

[378] RESTI C., *Climate change and mitigating risk to art collections: the importance of protecting paintings*, available at https://artegenerali.com/news/climate-change-and-mitigating-risk-art-collections-importance-protecting-paintings (last consultation 1/12/2023)
[379] STOCK-NIEDEN D., *At war with water*, cit.: 13-15
[380] MOMA (curated by), *Immediate response for collections*. November 2012
[381] DORGE V., JONES S. L., *Building an emergency plan. A guide for museums and other cultural institutions*. Los Angeles: The Getty Conservation Institute; 1999

comprehensive resource organized into three parts, facilitates the development of tailored emergency preparedness and response plans. The concerted efforts of the director, staff, and the institution's emergency preparedness committee are essential for the success of this planning process. Notably, the guide offers practical steps that often require minimal financial resources but yield immediate returns on invested time. It provides distinct sections for the institution's director, the emergency preparedness manager, and departmental preparedness teams, fostering a comprehensive approach. Furthermore, valuable supplementary materials from various institutions, such as evacuation procedures and action checklists, are included in appendices, enhancing the guide's practical utility.

In accordance with insights from the Getty Conservation Institute, the implementation of a robust emergency preparedness and response program offers numerous benefits, encompassing the enhanced potential for safeguarding human lives and property, augmented safety awareness, asset preservation, heightened security measures, and potentially reducing insurance premiums through better risk management[382]. The resultant emergency plan, a linchpin of the program, encapsulates a structured chain of command, contact information, and comprehensive response and recovery procedures. Disseminated in the form of an accessible emergency plan handbook, this document ensures that pertinent information is readily available to all staff members.

The comprehensive emergency plan addresses four key protective measures: prevention, involving the elimination or mitigation of hazards; preparedness, encompassing personnel training and resource equipping; response, focusing on injury prevention and loss limitation; and recovery, delineating processes to restore operations to normalcy[383]. Activation criteria and communication strategies during emergency operations, including cessation declarations, constitute integral components of the plan. Moreover, the plan delineates specific duties and procedures, such as relocation or evacuation directives for collections, decision-making processes, insurance contact protocols, damage assessment procedures, protective measures for buildings and grounds, and inventory of necessary supplies. The plan's effectiveness is contingent upon active support from the director, governing body, and all staff levels. Essential attributes for a resilient emergency plan include simplicity, flexibility to accommodate unforeseen circumstances, realistic resource

[382] *Ivi*: 13-14
[383] *Ivi*: 15

assessments, and regular testing through emergency drills and debriefings, conducted at least annually[384].

The significance of collaboration with insurance companies in the development of emergency plans is underscored in various sections of the guide by the Getty Conservation Institute. For instance, the information case provided by the Barbados Museum and Historical Society highlights that during the implementation of the plan it was of fundamental importance for them to ask local insurance companies to supply risk management materials[385]. Beyond material provisions, insurance agents play a pivotal role by offering training in emergency response, conducting inspections, and providing advisory services. Their involvement extends to crucial aspects of plan preparation, including compiling a comprehensive report detailing essential documents, disaster-related requirements within the insurance policy, a roster of equipment, and procedures for visual documentation to support insurance claims[386].

The recovery plan, a distinct component incorporated into the emergency plan, delineates responsibilities of the recovery team, methods for documenting damaged areas and artifacts, identification of specialists for consultation, procedures for object handling, and inventory processes. These information bear vital significance in facilitating subsequent claims, since cultural institutions' insurance policies typically prescribe damage assessment and recovery procedures, specifying who should carry out the assessment, pre-movement inspection requirements, and requisite information for claims[387]. Finally, it is imperative to incorporate contact details for the institution's insurance agent within the emergency plan, recognizing that early and transparent communication with insurance agents is paramount for effective emergency preparedness[388].

In conclusion, meticulous documentation throughout the entire spectrum of emergency response, salvage operations, and recovery phases assumes paramount significance not only for insurance-related considerations but also for evaluating the efficacy of the instituted emergency plan. Institutions can alleviate the training burden by seeking support from specialized entities in emergency preparedness, such as insurance companies, which often offer complimentary inspections and advice. Comprehensive documentation, encompassing physical damages, protection procedures, and implemented preventive measures, serves a

[384] *Ivi*: 16
[385] *Ivi*: 19
[386] *Ivi*: 58
[387] *Ivi*: 66
[388] *Ivi*: 69

dual purpose: facilitating communication of progress in emergency preparedness and furnishing evidentiary support for insurance or legal proceedings. Essential to this process is the secure storage and accessibility of claim forms and documentation equipment. Prioritizing the handling and potential evacuation of items mandates alignment with the institution's insurance policy, including stipulations on salvage and stabilization priorities and procedures. The effectiveness of the emergency plan hinges on the clear delineation of authorities for decision-making, object movement, and documentation, ensuring adherence to insurance policy guidelines at every stage of the recovery and preparedness process.

Post-emergency, a thorough assessment of insurance coverage adequacy and reimbursement entails collaborative consultation with the insurance company or agent. Key considerations during this evaluation encompass risk assessment procedures, protection priorities, up-to-date collection valuations, preparedness measures, response and recovery procedures, and incurred costs. Understanding the policy's scope is critical, encompassing loan exhibits, objects in transition, preventive and response equipment, relocation expenses, conservation services, replacement value, liability coverage for staff members, and requisite documents for filing a claim. Maintaining copies of insurance claims alongside emergency supplies, photographic equipment, and relevant documentation serves as a strategic measure for comprehensive evidence substantiating the institution's diligence in disaster prevention, mitigation efforts, and accurate evaluation of post-emergency conditions and loss[389].

4.3 Insurance for climate change-related risks to cultural heritage

Given the seriousness of the threat posed by climate change, it is essential to create and implement financial risk-sharing mechanisms. The European Union, in particular, supports the use of insurance as a way to tackle weather-related disasters[390]. Insurance functions as a means for sharing and providing coverage for risks while additionally playing a critical role in enhancing risk awareness, ultimately encouraging more action and strengthening preventive capacity. By providing financial coverage and expediting the recovery process, insurance can significantly enhance resilience in the face of climate-related

[389] *Ivi*: 210-212

[390] LE DEN X., PERSSON M., BENOIST A., HUDSON P., DE RUITER M., DE RUIG L., KUIK O., *Insurance of weather and climate-related disaster risk: inventory and analysis of mechanisms to support damage prevention in the EU*. Publications Office of the European Union; 2017. The European Commission commissioned Ramboll and the Institute for Environmental Studies to undertake a study focusing on the insurance of risks associated with weather and climate-related disasters.

challenges. Its growing significance is evident in preplanning, mitigation, and adaptation strategies, incentivizing interventions intended to reinforce infrastructure and reduce risk exposure. As previously mentioned, the assessment, monitoring and protection of cultural heritage represent essential elements of implementing an effective plan to reduce the impact of natural disasters caused by climate change. In this regard, insurance becomes a significant instrument for managing these risks more efficiently and effectively[391].

Francesco de Masi corroborates this concept by stating that «The use of insurance contracts should not be considered exclusively within a purely private scenario. Forms of public-private partnership, in fact, must be considered to implement effective and efficient risk management and mitigation policies»[392]. Donatella Porrini, advocates for the mandatory implementation of insurance policies for cultural property to cover risks associated with climate change. She emphasises the importance of the government creating an insurance scheme that cultural property owners, whether public or private, can follow to take out their own policies[393].

The expedited recovery allowed by claims compensation to affected parties not only helps to mitigate immediate adversities but also reduces the long-term impacts of a catastrophe. Furthermore, the effectiveness of insurance systems depends on a thorough comprehension of the risks they cover. Consequently, insurance companies have a crucial responsibility in assessing and signalling potential hazards, offering valuable knowledge to fully grasp the scale of the dangers that can be encountered. The creation and implementation of insurance schemes require a comprehensive evaluation of potential risks, leading insurance stakeholders to institute a structure that encourages and compels the adoption of effective risk management procedures. As a result, this serves as a powerful deterrent against the adverse effects of severe weather phenomena. By strengthening the insurance sector's role in risk mitigation and enhancing both preventive and adaptive measures, a robust framework is established that mitigates the impact of extreme weather events on cultural heritage assets and enhances overall disaster resilience[394].

In particular, the implementation of risk-based premiums provides an incentive for policyholders to actively engage in risk reduction strategies. Despite the increasing frequency

[391] DE MASI F., PORRINI D., *Managing climate change risk*, cit.: 2
[392] Author's interview with Francesco de Masi, researcher at the Department of Economics at the University of Salento in Italy, 19 December 2023. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.
[393] Author's interview with Donatella Porrini, associate professor at the science of economy department at the University of Salento, Italy, 19 December 2023. The interview was conducted via email using an open-ended questionnaire, with questions that varied based on the respondent.
[394] EUROPEAN COMMISSION (curated by), *Insurance of weather and climate-related disaster risk*, cit.: 38

of extreme weather events, which indicate an overall rise in risk, empirical evidence from the study conducted in 2015 by Ramboll and the Institute for Environmental Studies indicates that insurance companies are performing sub-optimally in providing effective incentives for reducing risk. Several factors contribute to this observed deficiency. Firstly, the insurance industry's focus on delivering widespread or affordable coverage often distracts from prioritising risk reduction measures. Secondly, the interplay between the indemnity principle, where compensation corresponds with incurred losses, and strong competition among insurers acts as a deterrent, which limits the adoption of strict requirements or incentives for risk reduction. This is because policyholders may opt for policies with less demanding terms. Thirdly, the provision of tangible incentives, such as premium discounts, for a diverse range of risk-reduction measures can be impeded by information asymmetries and transaction costs, given the potential expense associated with monitoring their implementation. Finally, insufficient transparency regarding insurance premiums, often bundled to include numerous risks, creates difficulties for policyholder in identifying the precise allocation of risk for extreme weather events and comprehending the degree of risk distribution among the insured assets[395]. Aligning insurance practices with the evolving landscape of increased climate-related risks and fostering a more robust framework for incentivising and promoting risk reduction measures within the industry requires addressing these barriers.

The interview conducted by Artwork Archive, an art management organization founded in 2010, with Jennifer Schipft, AXA XL's Global Chief Underwriting Officer for Fine Art & Specie, offers valuable insights into the developing issues related to art insurance against the backdrop of climate change. The specialist emphasises the notion of "all-risk coverage" employed in the vast majority of art insurance policies, which denotes that losses are covered by the policy unless they are explicitly excluded. Although fine art policies generally cover damage caused by natural disasters, there may be specific terms and conditions regarding earthquakes, wind, or hurricanes. It is vital to comprehend the policy's details thoroughly before incurring any losses, and insurance brokers can provide assistance in understanding the intricacies involved[396]. Moreover, Schipft highlights that it is rare for a work of art to be excluded from coverage. Hence, if such an exclusion takes place, it is probably due to the art piece's deficiencies or because it presents a higher risk than the other items in the collection. For example, outdoor sculptures situated in hurricane-prone areas or

[395] *Ivi*: 10
[396] TRICE E., *When the levee breaks – art insurance & eco-disasters*, «Artwork Archive», 14 April 2021

glass sculptures lacking adequate protection in earthquake zones are instances of higher risk situations. Nevertheless, even in these instances, insurance policies for art generally offer coverage probably at higher prices[397].

This the case of California, Florida, and other states confronted by weather-related disasters amplified by climate change, resulting in a significant rise in the cost of fine art insurance, with policies increasingly difficult to acquire ore renew, and with new restriction introduced. Specifically, Amee Yunn, Assistant Vice President at Berkley Asset Protection, a New York-based insurer specializing in high-value assets including fine art and jewellery, revealed to The Art Newspaper the significant impact on California[398]. Fine art insurance premiums in the state skyrocketed between 5% and 12% in 2022 due to the onslaught of massive wildfires and landslides. Meanwhile, Florida, confronted with intensifying hurricanes and floods, has also become a focal point of concern for the insurance industry. Yunn emphasizes that the significant increase of wealthy individuals relocating to Florida during the pandemic, accompanied by their valuable art collections, has heightened the concentration of wealth assets in flood and hurricane prone areas. This concentration poses a substantial risk to the financial stability of insurance providers, with a marked increase in billion-dollar claims over the last years. As a result, insurers feel compelled to limit new policy issuance, raise premium fees, and impose additional exclusions and deductibles, highlighting the gravity of the issue. Emphasizing the inherent risk management aspect of insurance, William Fleischer, President of Bernard Fleischer & Sons, an insurance company headquartered in New York acknowledges in an interview with The Art Newspaper that clients residing in regions prone to recurring natural catastrophe losses are experiencing premium increases of up to 25% when renewing their policies[399]. Fine art insurance policies have traditionally not included deductibles, but many insurance providers now require them for collectors in states or regions prone to climate change-related natural disasters. Deductibles are based on potential loss, ranging from 5% to 10% of the total value of art collections: while seemingly modest, this deductible system can result in significant amounts, as illustrated by a collection worth $50 million incurring a deductible of $5 million.

In conclusion, insurers have the potential to play a crucial role in fostering collaboration by providing innovative risk management solutions. Insurers should promote innovative approaches, support prevention measures and building resilience, share their risk

[397] *Ibidem*
[398] GRANT D., *'The only way to stop the bleeding is to stop writing policies': climate change is making it more expensive to insure art*, «The Art Newspaper», 22 April 2022
[399] *Ibidem*

management expertise, and participate in fostering a shared risk culture. Evidence from history shows that whenever peculiar sources of uncertainty have arisen, insurers have proven their ability to create practical solutions. The insurance industry itself originated in the 1600s in London in response to a newly found treat: the sinking of ships carrying valuable goods, a consequence of increased international trade furthered by the exploration of the New World. The Great Fire of London, which devasted over 13,000 buildings in 1666, served as a reminder of the vulnerability of property to fire. In answer to public concern, marine insurers diversified their services to encompass fire insurance. This trend has endured for centuries, with the insurance sector continuously adjusting and innovating new offerings and services to address emerging risks[400].

4.3.1 Insurability challenges for climate change-related risk on cultural heritage

The international workshop entitled "*Insurance to protect natural and cultural heritage against catastrophe risks: What role and perspectives*", held in Lecce, Italy, in December 2016, was a collaborative effort between the University of Salento and CNR-IBAM, under the auspices of ENCATC, the European Network on Cultural Management and Policy[401]. The main objective of the workshop was to explore the potential contribution of insurance instruments to public policies for the management of catastrophic risks to cultural heritage. The workshop, characterised by its explanatory and multidisciplinary nature, focused on the challenges specific to the Italian context, with implications that can be extended to various global contexts. The discussions served a dual purpose: firstly, to establish a conceptual framework to contextualise the problem and its challenges, and secondly, to outline a prospective research agenda for future studies on the intersection of insurance mechanisms and the management of catastrophic risks to cultural heritage.

In particular, the article presented by S. Adamo and F. Imperiale at the workshop addresses the managerial challenges inherent in the mutually beneficial relationship between insurers and entities covered against catastrophic risks[402]. Their approach is based on the theory of insurance capacity, which investigates the technical conditions to evaluate the feasibility of insurance in mitigating catastrophic risk in Italy, specifically in the cultural

[400] AXA (curated by), *Future risks report*, cit.: 26
[401] GRINGARTEN H. (curated by), *Journal of Multidisciplinary Research*, (9) 1; 2017. This paper collects a selection of five articles presented during the Lecce event.
[402] ADAMO S., IMPERIALE F., *Cultural heritage and challenges for catastrophic risk management in Italy*, cit.

heritage sector[403]. Notably, the study emphasizes the prevalent implementation of an ex-post compensation model in Italy's regulatory framework for risk management. This model heavily relies on retrospective analysis of actual outcomes and the implementation of extraordinary measures to fund losses. In contrast, the researchers advocate for the implementation of an ex-ante compensation approach, which anticipates and establishes compensation prior to an event, utilizing insurance tools to proactively manage catastrophic risk. Given the extensive distribution of the Italian cultural heritage, the study suggests that an effective risk management strategy should involve accepting risk and adopting measures to proactively reduce risk exposure, aligning with an ex-ante perspective.

In the realm of risk management strategies addressing the scale and distribution of potential damages arising from catastrophic events related to climate change, insurance emerges as a collaborative mechanism. This involves the capacity of a risk-exposed economy to transfer the prospective risk to a collective of economies with comparable risk exposure. The possibility of risk transfer relies on the potential mutual benefit for both the insured and the insurer. The insurance company, undertaking the risk transfer, evaluates the advantages attainable within a comprehensive strategy aimed at capital maintenance. This strategy relies on generating operational revenue that enables the company to survive, remain stable and profitable in the long run. On the other hand, the policyholder considers the affordability of risk transfer when evaluating the fairness of the insurance premium charged. This assessment is based on aligning premiums with the insurer's expected utility function, reflecting their personal risk aversion.

However, insurance transfer of catastrophic risks presents a complex challenge to this mechanism of mutual convenience. In fact, from the insurer's perspective, catastrophic risk is a risk characterized by a distribution of losses inversely proportional to the occurrence and magnitude of the risk. This implies a decline in the rate of occurrence as the severity of the risk increases. It is also referred to as a high-capacity risk which significantly amplifies an insurance company's entire risk portfolio exposure. This increased exposure requires a significant allocation of insurance capacity in terms of both financial capital and the size of operational incomes to achieve and maintain operational stability. It also raises the risk of

[403] Generally speaking, the insurance capacity theory is a conceptual framework utilised in the insurance industry to evaluate and comprehend the ability of insurers to offer coverage for various risks. It involves the examination of the financial strength, resources, and capabilities of insurance companies to underwrite policies and pay claims. This theory is particularly important when dealing with complex and catastrophic risks, such those related to climate change, which may have a considerable financial impact. For more information see STONE J. K., *A theory of capacity and the insurance of catastrophe risks (Part I)*. The Journal of Risk and Insurance, 40(2); 1973: 231-243 and STONE J. K., *A theory of capacity and the insurance of catastrophe risks (Part II)*. The Journal of Risk and Insurance, 40(3); 1973: 339-355.

default, necessitating the establishment of stability constraints. Meeting such constraints requires a demand for numerous similar independent risks, coupled with the application of sufficiently high insurance premiums. The requisite conditions for stability also extend to the absence of moral hazard and adverse selection by policyholders[404]. However, this challenge is more complex in countries like Italy, where the dominating ex-post compensation model utilized by the central government after natural disasters leads to charity hazard phenomena[405]. This situation discourages reliance on the insurance market and preventive measures. In addition, despite adequate aggregate insurance capacity in the Italian market, public owners remain the potential primary demanders of insurance coverage against catastrophic risks, given that the State and local governments own the majority of Italy's cultural heritage. However, the practice of insuring cultural properties within the Italian public sector is not yet widespread. The decision-making process for public entities to opt for insurance coverage is characterized by a careful and detailed cost-benefit analysis. This thorough evaluation aims to weigh the potential advantages of insurance against the costs involved. The overarching objective is to minimize the overall public expenditure required for disaster compensation. In other words, public owners are judiciously considering the financial implications and benefits of obtaining insurance coverage for cultural heritage, with a focus on ensuring that the costs of insurance are justified by the potential savings in the event of a catastrophic event. This cautious approach reflects a strategic consideration of financial resources and a commitment to optimizing public spending in the face of potential disasters affecting cultural assets.

Nevertheless, the formidable challenge faced by insurance companies in effectively managing climate change-related risks stems from a temporal misalignment between the linear flow of premiums collected annually and the significantly non-linear flow of annual costs arising from claims. This discrepancy poses a significant threat to the solvency and

[404] Adverse selection and moral hazard both come from an asymmetry of information between the insurance company and the policyholders. In particular, adverse selection refers to the tendency for those facing higher risk to seek coverage. For example, a property owner may have more information about potential damage to his/her property than the insurance company, which usually relies on regional averages. Consequently, individuals with below-average risks may be hesitant to purchase insurance at a community-rated price, while those with elevated risk levels are more likely to seek coverage. To summarize, such behaviour has the potential to either undermine the stability of the insurance market or hinder its establishment altogether. Conversely, moral hazard refers to the dishonest conduct of policyholders. It occurs when individuals reduce their efforts to mitigate risks after securing insurance. For more information see: EUROPEAN COMMISSION (curated by), *Insurance of weather and climate-related disaster risk*, cit.: 42

[405] Charity hazard is the phenomenon where individuals choose not to secure insurance against potential natural disasters because they believe that assistance will be provided by other sources, such as government emergency programs. Source: EUROPEAN COMMISSION (curated by), *Insurance of weather and climate-related disaster risk*, cit.: 43

overall existence of the insurer, especially if claims require important immediate financial expenditures. Expanding insurance capacity at both the individual and aggregate levels is crucial to address this matter. This requires leveraging low exposure rate risks, implementing self-insurance measures, and enabling sharing of aggregate surplus via co-insurance and layering mechanisms. Effective management of this challenge is dependent on the availability of significant financial resources to cover losses of uncertain extent and occurrence. Therefore, there is a need to increase financial capacity. Legal and institutional factors play a vital role in this regard, including the establishment of technical provisions for catastrophic risk losses and tax and regulatory incentives influencing financial capacity. Simultaneously, a challenge emerges from obtaining sufficient capital from external sources, facilitated through mechanisms such as reinsurance[406]. Nevertheless, inherent transaction costs, information asymmetries, and moral hazard that affect the operational management of climate change-related risks, impede the efficient allocation of resources. Therefore, in instances where the intricacies of handling catastrophic risks surpass the capacities of private organizations, governmental intervention becomes essential as a final safety net, acting as a reinsurer of last resort[407].

An alternative approach for reducing solvency risks, as highlighted in the study presented by F. T. Gizzi and D. Porrini during the workshop held in Lecce, involves the establishment of a mixed public-private system[408]. Drawing insights from international experiences with such systems, the State can assume multiple roles within this framework. It can act as the primary insurer, function as a re-insurer, or create regulatory frameworks that empower the private sector to offer insurance. As emphasized in the study, this hybrid model has a number of benefits: it promotes active citizen participation in mitigating catastrophe risks, reduces apprehension around adverse selection, and guarantees the availability of financial resources to cope with losses above the private system's capacity, all thanks to State intervention.

In certain scenarios, the State assumes the role of the primary insurer and bears the full consequences of catastrophic risks. Usually, the premiums and compensations related to this approach are proportionate, broad-based and predetermined. This structure could lead to the perception of premiums being similar to taxes meant for the provision of public support rather

[406] One or more insurers may choose to reinsure a catastrophic risk, which can mitigate the risk of insolvency and increase underwriting capacity. This can be achieved through securitisation of the catastrophe risk in the capital market. Source: GIZZI F. T., PORRINI D., *Policy choice and insurance system for catastrophic risks: the case of cultural heritage*, Journal of Multidisciplinary Research, 9; 2017: 63-77

[407] ADAMO S., IMPERIALE F., *Cultural heritage and challenges for catastrophic risk management in Italy*, cit.

[408] GIZZI F. T., PORRINI D., *Policy choice and insurance system for catastrophic risks*, cit.

than an obligation resulting from insurance coverage. Notable examples of this approach can be observed in Sapin and the USA, particularly in relation to flood insurance.

In other cases, the State acts as a reinsurer, as demonstrated by the United Kingdom, with the private insurance sector sharing a portion of the risk exposure. Nevertheless, the State utilises administrative mechanisms, including policy formulation and claims assessment and settlement, that are inherent in the private insurance industry. This collaborative model improves the effectiveness of the private market, with the public system intervening if necessary, thus promoting a more agile and responsive risk management framework.

Additionally, the State can assume a regulatory function, setting out particular regulations that establish responsibilities and define precautionary and preventive obligations. This framework enables the private sector to effectively handle specific risks whilst ensuring conformance to established guidelines and standards.

In conclusion, the use of insurance undoubtedly helps to mitigate the impact of unforeseen financial difficulties in the aftermath of a disaster, while at the same time strengthening risk preparedness from an ex-ante perspective. However, it is important to recognize that insurance risk transfer is not an absolute remedy. Relying solely on the insurance market for risk transfer could worsen the situation and potentially lead to a secondary catastrophic effect. This stems from the potential risk that an excessive reliance on insurance could lead to additional harm by disrupting the insurance industry through induced defaults. Therefore, State intervention is crucial, especially when it can strategically and effectively collaborate with, and serve as a guarantor for, private entities. This highlights the necessity of a well-balanced and collaborative approach, with the State acting as a support system alongside private mechanisms to guarantee an all-encompassing and fruitful strategy for dealing with the intricate dynamics of climate change-related risks[409].

The challenges faced by underwriters extend to the repercussions of climate change on catastrophe models employed in premium pricing. Catrin Povey, an insurance associate in the team for Financial Services and Insurance at Capital Law, suggests a potential solution with the usage of parametric insurance[410]. Although parametric insurance is based on the same catastrophe models, it differs as it guarantees a predetermined payout in the event of a specific triggering event, irrespective of whether the policyholder has suffered a loss and without

[409] ADAMO S., IMPERIALE F., *Cultural heritage and challenges for catastrophic risk management in Italy*, cit.
[410] POVEY C., *Insurance in the age of global warming: how to protect your art against flooding and extreme weather events*, «The Art Newspaper», 11 February 2022

regard to the actual size of the loss. For instance, in the context of earthquake coverage, if a seismic event exceeding four on the Richter scale occurs, the parametric insurance automatically pays out the agreed-upon amount. This approach is designed to avoid high transaction costs of indemnity-based insurance systems, since parametric insurance, also known as index-based insurance, makes payouts dependent on a physical trigger, thereby avoiding pricey claims handling[411].

However, when considering parametric insurance for fine art, it is essential to recognize the singular nature of insuring irreplaceable items. Unlike replaceable assets, a work of art, once lost, is irretrievably gone. This introduces unique considerations into the parametric insurance framework for fine art.

4.3.2 Sant'Emidio Project

The "*Sant'Emidio Project*" refers to the agreement that was made in July 2018 between the Italian Episcopal Conference (CEI) and an Italian insurance company with the purpose of setting up a national insurance plan to protect the cultural heritage embodied by churches.

The increasing occurrence of meteorological, hydrogeological, and climatological events worldwide over the past few decades, mostly linked to the phenomenon of climate change, poses a significant risk to cultural heritage. Italy boasts a rich cultural heritage, considered to be one of the world's largest. Conversely, Italy is also a nation vulnerable to natural disasters. To gain an understanding of the impact of climate change on Italy's cultural heritage, the Italian Institute for Environmental Protection and Research (ISPRA) produces reports on hydrogeological risks such as landslides and floods[412]. These risks are linked directly to climate change due to rising temperatures, making them a consequence of this phenomenon in Italy. ISPRA has recently provided data on the cultural assets that are at risk of landslides across the nation, identifying 38,000 at risk assets, equivalent to 17.9% of the total. Additionally, 7.8% of cultural assets are at high risk of floods, with 16.5% considered to

[411] *Ibidem*
[412] ISPRA (curated by), *Dissesto idrogeologico in Italia: pericolosità e indicatori di rischio*. 2021 edition. ISPRA considers cultural assets, encompassing historical town centres, medieval villages, landmarks, historical and religious structures, churches, and archaeological sites.

be at medium probability hazard. The assets exposed to a low-probability hazard flood scenario represent 24.3% of the total[413].

The responsibility of overseeing all aspects of religious administration, including risk management, falls under the purview of the CEI. Italy is home to 25,598 Parish Churches, and as per ISPRA's data analysis, these historic structures are at risk of climate-related disasters. This insight informs the rationale behind the project, which has been named after the patron saint of Ascoli Piceno, a protector against the frequent earthquakes that hit the region in the Centre of Italy where the city is located. This agreement marks the initial national-level accord for insuring a particular cultural heritage[414].

This agreement can be classified as a private contract as it involves two private entities without any state subsidies characteristic of a multi-sector partnership. The distinctive feature of this system is its dual-track policy contract, which complements each other. The initial stage of this contract-type encompasses a national-level natural disaster coverage policy, while the secondary stage regulates the inclusion of other coverage types. More specifically, the primary track operates nationally and is directly signed by the CEI which, in this way, assumes the responsibility of managing high risks. On the other hand, at a local level, each diocese may opt to establish a supplementary policy, with any insurance company, for insuring churches against other risks[415].

Before the Sant'Emidio Project, commenced in July 2018, each diocese had the option to sign a complementary insurance contract to cover damages resulting from natural disasters. In the early months of 2018, a survey carried out by Francesco De Masi and Donatella Porrini[416] found that 62% of the Italian dioceses interviewed had taken out insurance policies to cover damages caused by natural disasters, thus demonstrating their pre-existing intention to protect against such risks[417]. In contrast, ANIA reports a significantly lower prevalence of natural catastrophe insurance in the Italian market of private homes. When accounting for insurance policies that do offer such coverage, only 2.5% of private houses in Italy are insured, a notably low penetration level[418]. The apparent justification for the higher insurance spread for cathedrals, compared to insured private houses, can be attributed to the financial

[413] ISPRA (curated by), *Dissesto idrogeologico in Italia*, cit.: 147, 198
[414] DE MASI F., PORRINI D., *Managing climate change risk*, cit.: 9
[415] *Ivi*: 12
[416] DE MASI F., PORRINI D., *Cultural heritage and natural disasters: the insurance choice of Italian Cathedrals*. Journal of Cultural Economics, 45; 2021: 409-433
[417] The research was carried out using a representative sample of 65 Italian dioceses from a total of 224 contacts.
[418] ANIA (curated by), *L'assicurazione Italiana, 2017–2018*. Rome; 2018

resources available to each, given private citizens can only use personal funds, whereas cathedrals can draw upon the economic resources of dioceses for underwriting. However, an important reason for this disparity is rooted in the difference in the values embedded in the insured property. Cathedrals are significant not only as cultural artifacts, but also as repositories of relevant artistic objects such as paintings and monuments. Furthermore, they play a vital social role by serving as community meeting places[419].

Using the Pearson correlation method, researchers explored potential correlations within the survey data. Notably, a strong correlation emerges between variables related to the presence or absence of insurance contracts and the variable indicating past experiences with natural disasters. This suggests a robust connection between the decision to acquire insurance and past disaster occurrences. Specifically, dioceses that had previously faced disasters are more inclined to seek coverage for such events. Moreover, another finding indicates that the decision to acquire insurance arises from both awareness regarding future trends in natural disasters and past experience. Fundamentally, the choice to be insured appears to be influenced by informed knowledge about the vulnerability to risk. When examining the variable of risk perception, a high correlation is observed with the variable measuring the importance attributed to insurance. This highlights that the perception of risk is directly linked to the importance of insurance as a means of mitigating the impact of natural disasters. In essence, the higher the level of risk perceived by individuals, the more likely they are to opt for insurance coverage. Additionally, dioceses that have received insurance refunds are more likely to recognise the significance of maintaining an insurance policy[420].

Specifically, the examined data reveals that Italian dioceses have mainly chosen to acquire insurance coverage for meteorological events, with a percentage of 97.37%. Floods and earthquakes are the subsequent options with 47.37% and 44.74% respectively, whereas other events are considered less noteworthy. The significant finding is the value attributed to meteorological events, marked as the prevalent perceived risk, and thus contributing to the need for insurance policies to safeguard against potential financial losses. Put of all the cases, 42.11% of respondents selected insurance solely for meteorological events, while the rest of 57.89% opted for a combination of meteorological events and other risk factors[421].

Regarding the premiums paid by the dioceses, variation is evident due to various factors, namely the nature of the insurable incident, geographical location, size, and historical

[419] DE MASI F., PORRINI D., *Cultural heritage and natural disasters*, cit.
[420] DE MASI F., PORRINI D., *Managing climate change risk*, cit.
[421] DE MASI F., PORRINI D., *The role of insurance in the management of disaster risk: the case of the Italian Cathedrals*. Insurance Markets and Companies, 10; 2019: 9-25

context, each contributing towards distinct evaluations for each insurer. Consequently, each insurance contract necessitates specific assessment tailored to the unique attributes of each diocese, regardless of the intended coverage event[422].

Francesco De Masi and Donatella Porrini have also considered dioceses that have opted not to secure an insurance contract, with the aim of understanding the motivations behind this decision. In 26.09% of cases, respondents pointed to inadequate financial resources as the primary obstacle to subscribing to an insurance policy. This motivation stands out with a higher percentage than any other, emphasizing the importance of assessing the financial capabilities of each diocese in allocating resources for such interventions. Another noteworthy motivation, albeit slightly lower at 21.74%, is the belief that insurance is unnecessary due to the perceived low risk of natural calamities in the territory. This perspective may arise from past financial constraints, indicating that some Dioceses may not feel compelled to assign a portion of their liquid funds towards this investment, due to insufficient funds or a well-informed decision, as the perceived risk is relatively low. 13% of the non-insured respondents stated a lack of awareness about the insurance product as the reason for not subscribing. An equal percentage corresponds to cases where individuals believe that insurance is unnecessary because they trust in receiving first aid from the state in the event of a calamity. These considerations collectively indicate that, for 26% of the non-insured, the lack of knowledge about the product and its practical utility plays a significant role in their decision-making process[423].

The national scheme of the Sant'Emidio Project, providing uniform insurance contracts for all Italian Churches, proves to be especially effective in mitigating the problem of "adverse selection", which is a typical issue in the natural disaster insurance market. Adverse selection occurs when there are imperfections in the information available to insurance providers, resulting in coverage being extended to applicants whose risk is significantly higher than what the insurance company is aware of. As a result, the insurance company may experience unfavourable effects, such as offering coverage at a cost that does not accurately reflect their true risk exposure[424]. Furthermore, the national contract covering all Italian Churches enhances market efficiency and lowers overall premium levels[425]. Due to varying levels of risk corresponding to different premiums, coverage for natural disasters

[422] *Ibidem*
[423] *Ibidem*
[424] DE MASI F., PORRINI D., *Cultural heritage and natural disasters*, cit.
[425] DE MASI F., PORRINI D., *Managing climate change risk*, cit.

necessitates high premium payments. Thus, management responsibilities are bestowed upon the CEI, a national institution with greater financial means that the local Dioceses. The latter have the option to establish supplementary insurance contracts for events with smaller risks and lower premiums.

The national agreement features a flexible structure, since it constantly adapts to various technical contract elements that may alter over time, namely those related to risk exposure and corresponding premium. For instance, in the event of reinforcement work, the agreement may change to obtain a reduced premium[426].

Another significant and pioneering aspect of the Sant'Emidio Project lies in the determination of the insurable value. In fact, assessing the value of highly valuable objects such as churches can be a major problem. However, this technical issue has been successfully resolved in the case of Italian churches by identifying conventional values derived from a national average of church values. Through this process, different value categories with corresponding premiums have been established. The criteria used to determine the conventional value of Parish Churches are based on the following five factors: historical precision, amount and quality of cultural assets within the church, recent restorations, and architectural importance. Using actuarial methodology, a specific value class is associated with a corresponding relative premium, based on how each church corresponds to five specific criteria. The result is the identification of a method to assign an economic value to this significant cultural heritage (see table 4.2)[427].

Elements	Description
Nature	Private contract—No state intervention or imposition
Contractor	CEI—Italian Episcopal Conference
Negotiation	National
Typology	Smart contract—It is constantly evolving in relation to some technical contractual aspects that can change over time. According to needs expressed by the CEI, some changes can be applied, considering especially those related to risk exposure and relative premium
Structure	Double track: Directly signed by the CEI, it aims to cover churches from natural disasters Signed by each Diocese, it aims to cover churches from all the other events, in a complementary perspective
Coverage	National coverage—All Italian Parish Churches are insured against natural disasters
Estimation	Conventional values based on a national mean of church values, with the identification of classes of values and the relative premiums associated with each class

Table 4.2. Main features of the insurance contract. Source: DE MASI F., PORRINI D., *Managing climate change risk: the case of the Italian Churches*. Natural hazards, 105; 2021

[426] *Ibidem*
[427] DE MASI F., PORRINI D., *Managing climate change risk*, cit.

The study conducted by Donatella Porrini and Francesco De Masi[428] highlights the benefits and positive impacts of this insurance policy tailored for mitigating damages deriving from climate change. Firstly, opting for an insurance contract is crucial as it provides economic resources for reconstruction through reimbursement obtained under the insurance contract. Additionally, the supplementary policy framework ensures widespread insurance coverage as all Italian Churches are included, leading to better risk assessment and insurance premiums evaluation. Thirdly, national negotiations enable the economically consistent institution of CEI to pay the premium, preventing adverse selection and local-level insurance company monopolies. The contract's flexibility allows for adjustments to its terms, while also incentivising prevention measures. Using a conventional value instead of precise estimation ensures a risk class based on the national average. This approach accelerates the underwriting and claims payment process.

The well-structured agreement can be seen as a possible benchmark in disaster risk management.

[428] *Ibidem*

Conclusions

The purpose of this thesis is to analyse current trends in the art insurance industry. The text initially focuses on general considerations within this niche sector, highlighting its complex nature. The research thoroughly explores the intricacies involved in the underwriting process, considering various characteristics of artworks, its value and the assessment of potential risks. The study highlights the multifaceted nature of the art insurance sector, involving a diverse array of professionals such as brokers, restorers, art historians, transporters, and risk managers. Furthermore, the art industry's growing recognition of the significance of insurance coverage for cultural assets is evident in its efforts to provide more specific and detailed coverages. The creation of new platforms to facilitate policy subscription and easy access to a wider range of services highlights the industry's dedication to adaptation and improvement.

The study aims to identify the strengths and weaknesses characterizing the art insurance industry. Risk mitigation and protection are identified as positive aspects of art insurance. Firstly, art insurance serves as a vital tool for mitigating risks associated with the protection of valuable artworks, providing financial security in the event of theft, damage, or natural disasters. Moreover, insurance mechanisms within the underwriting phase also enhance conservation and restoration efforts. The art insurance industry benefits from the expertise and investigations conducted by professionals within the sector. Their capabilities inspire a heightened exploration of methodologies for mitigating and identifying specific risks associated with art. Consequently, art insurance plays a crucial role in recognizing and addressing risks, proving significantly beneficial within the artistic realm. The insurance industry's commitment to seeking innovative ways to safeguard artworks makes a positive contribution to the art world. Art insurance policies can be tailored to suit the unique needs of individual artworks, ensuring that coverage is specifically designed to address the distinct characteristics and vulnerabilities of each piece.

However, a significant weakness lies in the challenge of accurately valuing unique and subjective artworks. This difficulty may result in potential gaps in coverage, as determining precise values can be a complex and subjective task. Another weakness of the art insurance sector is the potential for subjective evaluations during the claims process, which can introduce ambiguity and lead to disputes over the valuation of damages and coverage. It is important to strive for objectivity in the evaluation of claims to avoid such issues. Lastly, a notable drawback is the high cost of premiums associated with art insurance, which can be a

significant financial burden for artists, collectors, and institutions, making it a less accessible option.

The emerging challenges posed by the advent of new art forms, such as crypto art, along with new risks associated with climate change, significantly test the capabilities of art experts in the insurance sector to provide comprehensive and up-to-date coverage. The evolving artistic expressions and environmental factors introduce dynamism, which demands that insurance professionals continually adapt their expertise. Additionally, the integration of new technologies presents challenges and opportunities for the art insurance sector. In light of these findings, the research project advocates for ongoing exploration and inquiry by industry experts. This proactive approach is crucial for the art insurance sector to benefit from technological advancements while addressing the complexities of contemporary art forms and the changing risk landscape. By doing so, the industry can safeguard the interests of both artists and stakeholders in the dynamic and evolving art market. Overall, this thesis provides valuable insights into the field, bridging gaps in knowledge and fostering a deeper understanding of the challenges and opportunities within the art insurance landscape.

To enhance and differentiate art insurance offerings, it is important to foster collaboration among industry experts. Collaboration should not be perceived as a threat within the competitive market landscape. Experts in the field, including insurers, art specialists, restorers, and risk managers, should recognize the potential benefits of pooling their collective knowledge and strengths to enhance and differentiate art insurance offerings. By collaborating, insurance professionals can create comprehensive policies that cover all aspects of insurance. However, their collaboration should extend beyond mere policy creation to encompass a holistic approach. This will not only result in tailored policies but also enhance the range of services offered to clients. The perspective should be shifted from viewing insurance solely as a financial safeguard in the event of damage or loss, to conceptualising it as an integrated system that ensures the survival and complete preservation of the artwork. This collaborative effort would not only enrich the quality of insurance products but also redefine the industry's approach to client services. Clients can benefit from a more comprehensive and efficient insurance system when viewing it as a means of preservation rather than just financial reimbursement. The expertise of insurers, art specialists, restorers, and risk managers can contribute to this paradigm shift, positioning insurance as an integral component in the ongoing survival and protection of artworks.

In essence, prompting a collaborative ethos within the industry has the potential to enhance the value proposition of fine art insurance beyond financial indemnification. It

provides an opportunity to establish a more comprehensive, customer-focused system that prioritises the complete preservation and protection of artistic treasures.

In order to analyse tendencies in the art insurance industry, comprehensive research was conducted. This included examining broader insurance industry trends, specific offerings within the fine art sector, and overarching trends within the art world. This multifaceted approach resulted in a holistic understanding of the dynamics at play in the intersection of art and insurance. The research began with an in-depth examination of broader trends in the insurance industry. This included examining changing practices, regulatory frameworks, and innovative strategies used across various insurance sectors. By establishing a foundational understanding of broader industry dynamics, the research aimed to identify general trends, such as technological advancements, insurance solutions for the NFTs' coverage, and the elaboration of new insurance methods to mitigate climate change related risks, that could impact or resonate within the fine art insurance niche. Subsequently, focusing on exemplary cases, such as ARTE Generali's insurance propositions, a focused analysis of unique offerings within the fine art insurance sector was conducted. The aim of this research was to identify the distinctive features and challenges inherent in fine art insurance policies. This resulted in the identification of various aspects, such as the methods used to assess the value of art pieces, the diverse professional figures that are essential to the underwriting and claims processing phases, the complexities arising from the intrinsic value of cultural assets, extending beyond mere economic valuation. Additionally, the research extended its purview to encompass new trends within the art world, including the rise of crypto art. Comprehending these patterns was considered necessary to anticipate the evolving nature of artworks and the corresponding risks that may require innovative insurance solutions. This approach triangulates general insurance trends, fine art insurance specifics, and overarching art world dynamics to provide a nuanced and comprehensive perspective on the subject.

The aim of the research was to improve understanding of the relationship between insurance practices and the art industry. The study aimed to create a foundation for a more proactive and adaptable approach within the fine art insurance sector, enabling it to better address contemporary challenges and opportunities in the constantly evolving intersection of art and risk management. In analysing contemporary trends in the fine art insurance sector, particularly emerging technologies, crypto art, and climate change-related risks, it is evident that there are gaps in the industry's preparedness and adaptability. This study has highlighted

the need for a more proactive engagement from the cultural asset insurance sector to respond adeptly to these transformative shifts.

One of the significant revelations pertains to the industry's current limitations in addressing the multifaceted challenges posed by novel artistic expressions and environmental factors. The advent of crypto art, for instance, introduces intricate valuation and authentication complexities that demand nuanced solutions. Concurrently, the evolving risks associated with climate change bring forth a need for dynamic risk assessment models and coverage frameworks. These gaps highlight a critical turning point for the industry to re-evaluate and strengthen its capabilities.

Further scholarly exploration is needed to examine the application of new technologies in fine art insurance. While the potential benefits of incorporating technologies like blockchain into the insurance landscape are increasingly recognized, their nuanced integration, particularly in relation to fine art, has not been extensively researched. An emerging and intriguing facet is the coverage of artworks associated with non-fungible tokens. As the art world increasingly embraces digital ownership through NFTs, the development of insurance policies tailored to protect these unique digital assets is a nascent and under-researched domain. This uncharted territory raises questions regarding valuation methodologies, authentication processes, and the intricacies of insuring intangible, yet highly valuable, digital artworks. Similarly, the subscription to policies aimed at safeguarding cultural assets from catastrophic damages is a crucial yet underexplored area in current scholarly discourse. The complexity of catastrophic risks related to climate change, requires a comprehensive examination of insurance frameworks capable of providing effective protection for cultural heritage. In conclusion, the fine art insurance sector has seen important developments with the incorporation of new technologies and the creation of comprehensive coverage for NFT-related artworks and catastrophic damages to cultural assets. However, these areas remain relatively unexplored by scholars. As the field is dynamic and continually evolving, prioritizing future research becomes imperative to advance our understanding of the implications posed by emerging trends in the fine art insurance landscape.

The research proposal recommends increased industry proactivity to comprehensively adapt to these new changes. The ultimate objective is to offer clients, whether private or public custodians of artworks, with a more diverse and customized range of insurance products and services. By doing this, the industry can facilitate a more nuanced and effective implementation of positive risk-sharing dynamics and prevention strategies. Moreover, the call for proactivity extends beyond mere risk mitigation. It requires a fundamental shift

towards embracing innovation and technology integration within the art insurance landscape. The industry should utilise emerging technologies, such as blockchain, artificial intelligence and machine learning, not only to tackle challenges but also to promote transparency, security, and efficiency in transactions. This proactive integration of technology can enhance the industry's ability to provide innovative solutions that align with the evolving needs of art owners.

In essence, the identified gaps represent more than just challenges; they highlight the need for the art insurance sector to redefine its role and strategies. The proposed research aims to drive this transformation, encouraging the sector to shift from a reactive to a proactive stance. By enhancing its flexibility, adopting technological advancements, and broadening the selection of customisable options, the industry can establish itself as a valuable partner in navigating the complexities of contemporary art ownership and associated risks. Ultimately, this approach aims to strengthen the industry's resilience, responsiveness, and ability to promote positive risk management practices in the ever-evolving arts landscape.

While the study aims to provide a comprehensive analysis of trends in the fine art insurance industry, it faces both strengths and limitations, which are largely influenced by the inherent lack of transparency within the sector. A notable constraint is the challenge of accessing specific materials detailing insurance solutions offered by various fine art insurance companies and scientific analyses of market trends. The lack of transparency in the sector, due to the uneven availability and accessibility of detailed policy information and market analysis, has hindered a comprehensive analysis of proprietary insurance products.

However, this research has greatly benefited from the collaboration with industry experts, whose insights and cooperation have been invaluable in illuminating aspects that may have otherwise remained obscure. The collaborative effort has been particularly instrumental in exploring innovative aspects of art and insurance. The experts' contributions have highlighted crucial considerations, including protecting crypto art and cultural assets susceptible to the risks posed by climate change.

In conclusion, although the sector's opacity has limited access to specific data, collaborating with industry experts has helped to mitigate these constraints. This study acknowledges its limitations and provides insights into the innovative dimensions of fine art insurance. It offers a foundation for future research to further unravel the complexities of the intersection of art and risk management.

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