

A method for the integration of public art in risk management frameworks: challenges and opportunities

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Abstract

Purpose. The research aimed to develop an integrated and systematic method for assessing risk in contemporary public art collections. The research outlines key elements of a public-art risk-management plan. Emphasis is placed on enhancing heritage protection from natural hazards and extreme events related to climate change and, more significantly, on how such a plan can strengthen resilience in the social and historic built environment.

Methodology. To develop the method, the World Heritage Historic Center of San Gimignano (Italy), comprising both medieval heritage and contemporary public art, is investigated because of its unique cultural landscape. The landscape's contemporary elements exist as the result of several cultural initiatives: *Affinità Elettive* (1994), *Arte all'Arte* (1998-2005), and *UmoCA* (2011). This research highlights how the ensured survival of San Gimignano's public art is severely conditioned by the coexistence of physical, contextual, and managerial factors (hazards and vulnerabilities).

Findings. Based on case studies, the research develops indicators and criteria for vulnerability and risk analysis. Moreover, the integration of public art into, and its contribution to, general DRM frameworks is discussed. Despite the fact that public art's values can contribute to the resilience of historic urban centers, the research reveals important challenges to overcome if public art is to be incorporated into general risk-management policies.

Originality. In light of this, a risk-analysis model has been developed following international policies and frameworks, the results of which could be integrated into the general-management and conservation plan for the contemporary collections in the public space. Moreover, in recognition of the importance of social, cultural, and economic processes in the conservation of public spaces, a values assessment has been incorporated into the risk management framework.

1. Introduction

Within the framework of disaster risk management, this article proposes a methodological process for improving the resilience of contemporary public art to both man-made and natural hazards.

The starting point of the research was to identify hazards and to analyze and prioritize those hazards that have the potential to cause damage to contemporary artworks situated in a historic urban center. In this way, a taxonomy of hazards and threats was obtained, both common to other heritage typologies and specific to public art. The vulnerability analysis considered three typologies of vulnerability (physical, contextual, and institutional) that served as the basis for the development of risk analysis and evaluation. Risk is calculated for each vulnerability class with respect to the main hazards and threats. The procedure includes records, tables and a workbook to equip stakeholders with a better understanding of multiple hazards.

Application of the proposed method is presented here with reference to one of the most emblematic case studies in Italy: the collections in the medieval town of San Gimignano, near Siena. The collections proceeded from three artistic events, *Affinità*, *Arte all'Arte*, and *UmoCA*, which were promoted by several curators between 1994 and 2011 and involved around eighty international artists (Figure 1).



Figure 1. Luciano Fabro, *Italia all'asta*, 1994 (Source: Marta Gómez)

The overall goal is to support cultural institutions by providing them with a method for prioritizing the most difficult decisions when faced with complex risk scenarios. Finally, in drawing upon this example, the integration and contribution of contemporary public art in the risk management framework is discussed.

1.1. The role of cultural heritage in sustainability and resilience agendas

Recent risk-management policies have recognized cultural heritage as an integral part of the built environment. The 2030 Agenda for Sustainable Development (UN 2015) has included cultural heritage among its targets. Goal 11 explicitly refers to the need to make cities and human settlements “inclusive, safe, resilient and sustainable” through “planning and management” (Target 11.3), and to the “efforts to protect and safeguard the world’s cultural and natural heritage” (Target 11.4) (Nocca 2017). Following the Sustainable Development Goals (SDGs), the United Nation’s report for the Post-2015 Development Agenda, “Realizing the Future We Want for All” (UN 2012), highlights the importance of risk reduction and resilience within the context of sustainable development. The integration of cultural heritage into disaster resilience has been emphasized in the recent Sendai Framework for Disaster Risk Reduction (SFDRR) 2015–2030 (UNISDR 2015), particularly in the Priority for Action 1, “Understanding disaster risk”, and in Priority for Action 3, “Investing in disaster risk reduction for resilience”, (UNISDR 2015).

Consequently, international organizations, such as UNESCO (United Nations Educational, Scientific and Cultural Organization) and ICOMOS (International Council on Monuments and Sites), highlight the key role of culture in achieving sustainable and resilient development (Hosagrahar et al. 2016). Furthermore, the New Urban Agenda (UN 2016) recognizes cultural heritage as an important factor for urban sustainable development that plays an important role in “rehabilitating and revitalizing urban areas, and in strengthening social participation and the exercise of citizenship” (Point 38). Culture is recognized as a priority component of urban plans and strategies in the adoption of planning instruments (Potts 2016).

In conclusion, cultural heritage must be protected and incorporated into risk management frameworks in recognition of the role it plays in the sustainability and resilience of cities and communities.

1.2. Disaster risk frameworks applied to public art collections

According to the policies mentioned above, public art becomes another essential element of the cultural landscape thanks to which institutions and communities can better deal with material changes while “retaining heritage values” (Australia State of the Environment 2011, 780). In fact, since the beginning of the phenomenon, in the 1970s, public art has become a crucial element in the regeneration and revitalization of cities, due as much to the social recognition it enjoys as its inclusion in local development policies.

Nevertheless, the survival of public art is strongly conditioned by the coexistence of a multiplicity of hazards and threats that jeopardize its resilience. In consequence, significant losses of physical integrity can occur, including the risk of disasters. In the context of public art, a “disaster” can be defined as a serious disruption to the use of and accessibility to a public art collection due to hazardous events interacting with onsite vulnerabilities and institutional weaknesses. In the absence of preventive conservation plans based on risk management that make it possible to avoid such disasters, the local institutions that manage the collections have carried out emergency restorations that do not by themselves fix the weaknesses in the artworks. Indeed, in many cases, they threaten the maintenance of the tangible and intangible values of these collections.

Conversely, the concepts of sustainability and resilience, which today inform cultural heritage conservation programs, highlight the importance of long-term conservation strategies that deal holistically with a multitude of interconnected hazards and threats (Lizarralde, Chmutina, Boshier and Dainty 2015, 96). Nevertheless, resilience thinking involves approaches that rely on continuity of significance rather than simply on materials, in recognition of the landscape as “living heritage”, an “organism” made of complex characters and relationships (UNESCO 2011).

In conclusion, public art resilience, and particularly continuity of significance, require “risk reduction policies, processes and actions” UNISDR (2015). Risk Management consists of “communicating, consulting, establishing the context, and identifying, analyzing, evaluating, treating, monitoring and reviewing risk” (ISO 2018) with the aim of identifying and prioritizing appropriate conservation actions.

1.3. Risk analysis methods apply to cultural heritage

The discipline of preventive conservation has incorporated the risk-management cycle, which establishes risk in terms of loss of values of artworks (Pedersoli 2016), as its primary and essential standard.

Since the introduction of this method, in the 1990s, to assess risk to collections (Muething, Waller and Graham 2005), and as the result of the pioneering work of Jonathan Ashley-Smith, Stefan Michalski and Robert Waller, the discipline has undergone a genuine transformation that has facilitated the transition to a predictive, holistic and multi-risk approach, based on a scientific process (Fifield, Arenstein and Gleeson 2013, Henderson 2018). Risk analysis has, therefore, made it possible to configure a preventive conservation plan for cultural heritage as an effective, efficient and systematic system within which to develop treatments that reduce damage to works of art (Michalski 1990).

Although recent researches (Brokerhof, Ankersmit, Scholte, Wijers and Vermaat 2011) have contributed to the application of this method in the field of contemporary art, there is still a lack of specific methodology for public art. Tools for guiding the logical process of risk analysis are needed in order to guarantee a global vision of all possible risk scenarios at a territorial scale. They must also take into account any potential loss of a collection’s meaning. In light of this, different methods and tools for assessing the disaster risk to public art have been implemented. An assessment framework, proceeding from an analysis of a study area in San Gimignano, has been proposed to capture the multiple risk factors faced by a public art collection. The model proposed incorporates the systematic identification of key risks, and an assessment of their impact as a function of a collection’s vulnerability. Following the resilience paradigm, the framework also seeks to identify and remove systemic weakness from cultural heritage institutions that manage collections. Moreover, in recognition of the importance of social, cultural, and economic processes in the conservation of urban areas (UNESCO 2011), a values assessment has been incorporated into the risk management framework.

1.4. Public art collections in a historic urban context: the case study of San Gimignano (Italy)

The methodology has been tested in the case study of San Gimignano (Italy). San Gimignano was chosen to trial the procedure due to its unique cultural landscape comprising a medieval fabric and contemporary artworks.

San Gimignano is a medieval town sited in a rural landscape on the top of one of the septentrional hills. The area preserves an authentic and important character of medieval civilization. The historical center was declared “World Heritage” in 1990 because of its exceptional value: it has maintained its architectural homogeneity and its original urban layout.¹ The area is rich in Etruscan settlements, attested by numerous discoveries. Between the ninth and twelfth centuries, these settlements formed an essential axis of communication, with roads such as the Romea and the Francigena connecting Rome and the north. San Gimignano was embellished with several notable palaces and has retained its feudal atmosphere and appearance. Since 1965, the historical center has been protected by a landscape constraint (Legislative Decree 42/2004) (D.M. 25 March 1965). Furthermore, 122 historic buildings are protected by historical and cultural constraints (art. 10, Legislative Decree No. 42/2004). The area functions as a buffer zone that affords an added layer of protection. Nine site-specific environmental artworks by renowned international artists are scattered throughout the surroundings and inside the medieval urban center (churches and buildings, fountains, gardens, and walls). These artworks are the product of three artistic events: *Affinità Elettive* (Briganti and Laureati 2007), *Arte all’Arte* and *UmoCA* (Bonito and Putnam 2004).

Affinità Elettive was a project curated by Giuliano Briganti and Luisa Laureati between 1991 and 1994. Artworks made by five artists from the Arte Povera are located at the church of San Jacopo (Jannis Kounellis, *San Gimignano*, 1994) and St. Augustin, Giulio Paolini, *Meridiana*, 1994) (Figure 2), on the vault of the Bongi street (Nunzio, *Untitled*, 1994), in the Palace of Podestà (Luciano Fabro, *Italia all’asta*, 1994) (Figure 3), and on a spur of the medieval wall (Eliseo Mattiacci, *Equilibrio compresso*, 1994). A series of artistic events named *Arte all’arte* were developed between 1998 and 2005 with artworks placed in various municipalities across Siena (Italy), in San Gimignano, Colle di Val d’Elsa, etc. The project was coordinated by the cultural association Continua and aimed to create a new equilibrium in the relationship between the city and the countryside. The starting point was to encourage artists to work in public spaces. Each year, a group of artists were selected by curators and invited to participate. Each artist conceived and executed a project to transform or reinterpret a particular site through a site-specific installation. The project was realized in collaboration with the local municipality and accompanied by workshops and meetings between the local population and the artists. A total of 84 artists were invited by the 20 curators. Today, only a few of these artworks remain as permanent fixtures. At San Gimignano, the permanent artworks are located in the public garden – Joseph Kosuth, *La sedia davanti alla porta*, 1999 – at the medieval fountains – Luisa Rabbia, *Il riposo del tempo*, 2004 – and inside a spur of the medieval wall – Anish Kapoor, *Underground*, 2005. *UmoCA* (Under Museum of Contemporary Art) is the project carried out by the artist Kiki Smith at the invitation of Cai Guo-Qiang. Smith

¹ For more details, see: <https://whc.unesco.org/en/list/550/>.



Figure 2. *Giulio Paolini, Meridiana, 1994.* (Source: Marta Gómez)



Figure 3. *Nunzio, Untitled, 1994.* (Source: Marta Gómez)

created a series of sculptures sited in various municipalities of the Elsa Valley (San Gimignano, Colle di Val d'Elsa, Poggibonsi).

Collections were created to bring contemporary art to provincial towns and explore its relationship with the historic environment. Moreover, artworks aimed to revitalize the cultural and aesthetic values of this renowned historical environment, to improve the degraded perimeter area of walls and medieval fountains in San Gimignano (Figure 4), and to recover the relationship between the contemporary city and the countryside. Each of the artists involved chose a site for their work whose characteristics contributed to the message of their artwork. Thanks to the high regard in which the collections are held by the community, some of the installations have been acquired by the public administration.

Conserving the material integrity of the artworks is crucial for maintaining the value of the collection and the urban landscape. Lack of maintenance and environmental factors have



Figure 4. Luisa Rabbia, *Il riposo del tempo*, 2004. (Source: Marta Gómez)

eroded the surfaces of artworks and compromised, in particular, architectural supports and assembly systems. The existing conditions present mostly atmospheric soiling and biological colonization, which leads to the disaggregation of materials and the formation of cracks or the detachment of fragments from the support.

2. Methodology

In line with the international standards (ISO 31000 'Risk management – Principles and guidelines 2018) and the Historic Urban Landscape approach (UNESCO 2011), the risk-management framework proposes qualitative and semi-quantitative methods for data collection and the analysis process.

The procedure develops a stage-by-stage process that informs the logic behind the framework to guarantee Public Art Resilience (PAR): values assessment, hazard/threat identification; vulnerability assessment; analysis and evaluation of risks (Table 1). As stated by Bülow, a useful starting point is an assessment of the collection in terms of its value as well as its vulnerability (Bülow et al. 2016, 101). This first vulnerability analysis, of a qualitative nature, has the advantage of offering a panoramic view of the main risks that are analyzed in depth at a second level. For the risk analysis, a semi-quantitative method adapted from the risk-assessment method proposed by ICCROM (Pedersoli 2016) has been used. These approaches have been reviewed with the case study as a starting point.

Table 1. Public art resilience framework: stages description

PUBLIC ART RESILIENCE (PAR) FRAMEWORK	
STAGE	DESCRIPTION
1. Values assessment	The process of assessing the significance and identifying key elements that define the heritage character
2. Hazard/threat identification	The process involves finding and describing the hazards and threats to which the collection is exposed due to its location
3. Vulnerability assessment	The process of assessing the susceptibility of the artworks to a hazard/threat that can lead to a loss in values
4. Risk analysis and evaluation	The process of identifying and analyzing the magnitude of a risk, expressed in terms of likelihood and impact

2.1. Values analysis

Since heritage resilience relies on the continuity of values, specific requirements regarding significance, authenticity and integrity also need to be addressed in the risk-assessment procedure. The following methodology emphasizes the assessment of values as a central component to identify key elements that define the heritage character of a public art collection (Australia ICOMOS 2000).

Table 2. List of values and attributes

WHY			
VALUES			
Cultural Historical	Scientific	Social	Economic
Artistic	Use	Educational	
WHAT			
ASSET			
	TANGIBLE ATTRIBUTES	INTANGIBLE ATTRIBUTES	
Sculpture	Style, form, design	Character	
Paint or panel	Materials	Representativeness of a concept or artistic trend, artist, style, school	
Installation	Surface features	Provenance, information about asset	
Architecture	Ensemble, display	Location (original location)	
Urban element	Completeness	Accessibility	
Natural element	Condition		
AREA			
Urban context	Relation to environment, architecture elements	Use, function	
Gardens		Knowledge, traditions, practices	
Countryside		Relation(s) to meaning (association) Community / people(s)	
LANDSCAPE			
	The result of layering	Relation to urban and natural landscape	

values (Table 2). Values are divided into the following clusters: cultural-historical (related to historic and information values), artistic, scientific, use (related to usability by an organization and its public), social (including personal-experience values), educational, and economic. Attributes, which are divided into tangible and intangible, consider elements from the artwork, the area, and the landscape that contribute to the message of the artwork. Among the attributes, there are conditions, such as conservation state and maintenance of environmental characteristics, that can be considered variables that contribute to an increase or decrease in values. To guarantee a standard and comprehensive description of significance, a set of questions has been made available to guide the arguments. For example, regarding condition, the following questions are asked: Is the item physically integrated? Is the item chemically or mechanically stable?

2.2. Classification of hazards and threats

Collections of contemporary art situated in spaces for public use are subject to a multiplicity of dangers that act simultaneously. This simultaneity amplifies the effects of the dangers and strongly conditions the life of the works. Given these facts, the identification of hazards and threats requires a holistic approach. Therefore, the territory, the community, and public institution's profile have been analyzed to understand which hazards derive from the physical environment and which from the cultural context.

The classification incorporates hazards and threats to describe actively-interacting risk factors. According to the HUL approach (UNESCO 2011), these hazards and threats have



Figure 5. *Jannis Kounellis, San Gimignano, 1994.* (Source: Marta Gómez)

been categorized into natural, socio-cultural, and institutional hazards. Moreover, the approach divides the current classification of environmental hazards into rapid-onset and slow-onset (UNDRR 2020).

In the case study analyzed, the survival of the public artworks is severely conditioned by the numerous hazards and threats found in the environment. The topographical, morphological, and climatic characteristics of the territory generate hazards that relate as much to continual natural events as to sudden ones. Among the sudden-onset hazards, wind and rainstorms are the most important. And these hazards are likely to be exacerbated by the increase in intensity and frequency predicted by climate-change models – for example, the windstorm that ravaged the Tuscany region in 2015, which caused severe damage to an outdoor sculpture (Figure 5). It is also necessary to consider the elevated humidity levels that characterize the environment during certain months of the year.² In terms of social threats, the historic urban center suffers pressure from tourism. Finally, much of the architectural heritage has been converted into lodgings, and there is occasional vandalism of the most accessible works and of those located outside the center.

Although these dangers are common to all cultural heritage in an external environment, the study has made it possible to identify other dangers that could be considered specific to public art and that are largely related to institutional dangers. First and foremost of these is the lack, in many cases, of appropriate artistic-historical legal status under current Italian law. A series of secondary dangers derive from this lack: works of public art are not included in an official catalog; it is not compulsory for a restorer to intervene in the event of damage; only local institutions are in charge of the works’ guardianship; and the generally scarce resources available to those institutions prevent the implementation of periodic maintenance programs.

In addition, since the message of public works of art is in many cases related to their physical and cultural environment, the degradation or loss of urban elements or the interruption of cultural processes can be considered dangers that affect their conservation. For example, the meaning of the work of Jannis Kounellis is related to the presence of a medieval bell tower and that of Joseph Kosuth to theatrical activities.

Based on the information acquired, a total of nine hazards have been selected for the hazards assessment (Table 3).

Table 3. *Hazard and threats in public art collections*

RISK FACTORS	SLOW HAZARDS	SUDDEN-ONSET HAZARDS
Environmental	High humidity, heatwave, rain Biological, air pollution	Earthquakes (Landslide, Fire) Windstorm
Contextual	Deterioration of annex buildings or urban elements	Collapsing of annex buildings or urban elements
Socio-cultural	Poor societal value / Vandalism / Interruption of cultural activities	
Economic	Changes in traditional life / Mass tourism	
Institutional	Lack of a legal status as artwork / Lack of cataloguing / Lack of maintenance and professionals in preventive conservation	

² For more information on climate factors (temperature, humidity) and air quality see ARPAT, Regional Agency for the Ambient Protection, Tuscany, Italy. <http://www.arpat.toscana.it>.

2.3. Vulnerability analysis

An indicator-based vulnerability assessment is applied to the risk assessment procedure to adequately analyze the vulnerability components. Performing a vulnerability assessment on a territorial level for a large number of assets and multiple hazards requires an approach that takes into account the purpose and scale of assessment. The proposed vulnerability assessment focuses on understanding comparatively the susceptibility and level of exposure of each artwork to the impact of the hazards. Moreover, a significant factor which may influence vulnerability, and consequently the risk, is the coping capacity, that is “the ability of people, organizations and systems, using available skills and resources, to manage adverse conditions, risk or disasters” (UNISDR 2009) and the characteristics and circumstances of a community (Birkmann 2006). Based on these definitions, and following work developed at the archaeological site of Petra (Jordan) (Paolini et al. 2012), the concept of vulnerability in this research comprises three components: susceptibility or sensibility of each item, exposure to hazards, and coping capacity.

In light of this, vulnerability assessment is divided into physical (sensibility), contextual (exposure), and institutional vulnerability (coping capacity). Vulnerability assessment has been enriched with a standard set of specific indicators developed to ensure homogeneity in the analysis. For each indicator, a set of ranking criteria was defined to score vulnerability and equate it to the ranking categories of Low, Medium, and High (Table 4).

Table 4. Indicators and criteria for vulnerability analysis in the public art resilience framework

PAR FRAMEWORK			
PHYSICAL VULNERABILITY (SUSCEPTIBILITY)			
CLASS	HIGH	MEDIUM	LOW
INDICATOR	CRITERIA		
Material: type of material	Paint, wood, light	Ceramic, mortar	Stone, metal
Structure: type and quality of structure (ensemble and display)	Heavily damaged structures or inappropriate ensemble materials	Medium quality of the structure materials; insufficient elements	Good quality of the structure elements or appropriately reinforced
Condition and loss of elements, improper restoration materials	Structural crack, detachment	Loss of material (erosion)	Biological colonization, efflorescence
Foundation/ground: type of foundation	No foundation (item directly on ground)	Inappropriate foundation	Properly constructed foundation
Architecture (wall) condition	Poor state of conservation	Sufficient state of conservation	Good state of conservation
CONTEXTUAL VULNERABILITY (EXPOSURE)			
CLASS	HIGH	MEDIUM	LOW
INDICATOR	CRITERIA		

Exposure: type of exposure to climate factors	Total	Partial	No exposure
Accessibility	Direct contact	Partial or distant contact	Not accessible
Urban location: type of location	Traffic area Garden	Outside historic urban center	Historic center
INSTITUTIONAL VULNERABILITY (COPING CAPACITY)			
CLASS	HIGH	MEDIUM	LOW
INDICATOR	CRITERIA		
Lack of CH protection	No CH protection	No CH protection	CH protection
Information, inventory and documentation system	No inventory	Inventory	Registered in an official inventory
Prevention plan and maintenance program	No prevention program	Asset is periodically controlled	Exiting maintenance activities
Professionals available	No professionals available	Occasional team	Expert team

Indicators are variables which act as an operational representation of an attribute, such as quality, characteristic, and property of a system (Gallopín 1997). The data required to measure the indicators of vulnerability has been gathered via: the expert questionnaire (institutional vulnerability), in situ observation and condition assessment (physical vulnerability), and territory analysis (contextual vulnerability).

The indicators for physical vulnerability (Table 5), defined based on the potential impacts of hazards and threats on the collections, are as follows:

- Type of material and type and quality of structure are fundamental factors contributing to the performance of artworks during an event or a process. Multi-material artworks or artworks composed of several elements are generally more vulnerable to hazards if they are not properly erected or reinforced.
- Condition and loss of elements are considered as an augmenting factor. Cracks and detachments are parameters which affect structural integrity and reduce performance of the entire structure, while material losses or improper interventions cause gradual deterioration and weakness.
- Type of foundation or ground and the condition of connected architecture are other key factors contributing to the extent of damage since several agents, such as water infiltration and biological colonization, can be transferred to the artworks.

Table 5. Indicators of physical vulnerability class related to natural, socio-cultural, and institutional hazards applied to public art collections

VULNERABILITY CLASS	PHYSICAL VULNERABILITY		
Hazards	Natural	Socio cultural	Institutional
Class I High V	Paint, light, wood artworks Artworks attached to a weak support/foundation or in poor state of conservation	Paint artworks in a poor condition	Paint, light and wood artworks in a poor condition
Class II Medium V	Ceramic and mortar artworks Artworks directly on the ground in sufficient condition	Artworks in sufficient condition	Artworks in sufficient condition
Class III Low V	Stone, metal artworks enssembled in an appropriate support/foundation Artworks in good condition	Artworks in good condition	Artworks in good condition

The indicators for contextual vulnerability (Table 6), based on the characteristics of the territory, are as follows:

- Type of exposure to climate factors that depend on display location: outside (totally exposed), under architectural constructions (partially exposed) or inside buildings (not exposed).
- Accessibility to the artworks and their surroundings that influences the possibility of damage derived from shocks or vandalism.
- In general, urban location is a key factor considering the variety of sites that influence the impacts of hazards on the collections: traffic areas, gardens, tourism areas, abandoned areas, etc.

Table 6. Indicators of contextual vulnerability class related to natural, socio-cultural, and institutional hazards applied to public art collections

VULNERABILITY CLASS	CONTEXTUAL VULNERABILITY		
Hazards	Natural	Socio cultural	Institutional
Class I High V	Artworks totally exposed or in a traffic area	Artworks accessible	Artworks outside the center
Class II Medium V	Artworks partially exposed or in gardens	Artworks partially accessible	Artworks outside the center
Class III Low V	Artworks inside buildings (covered)	Artworks not accessible	Artworks in the historic center (D.Lgs. 42/2004)

In the case of public art collections, coping capacity relies mostly on local administration and, in a broader context, on regional planning. Based on the case study, the most significant indicators for institutional vulnerability (Table 7) are as follows:

- Lack of national CH protection that represents the status of the legal framework for conservation and management, including cooperation between heritage organizations and disaster management bodies.
- Partial information about the collection from an artistic-historical point of view, coupled with a lack of digital systems to record periodically collected data on risk.
- Lack of existing prevention programs that include risk assessment and control, emergency response and recovery plans.
- Inappropriate restoration or emergency interventions carried out by unqualified personnel.
- Lack of availability of professionals with specific training in risk prevention.

Table 7. Indicators of institutional vulnerability class related to natural, socio-cultural, and institutional hazards applied to public art collections

VULNERABILITY CLASS	INSTITUTIONAL VULNERABILITY		
Hazards	Natural	Socio cultural	Institutional
Class I High V	Artworks not subject to any kind of protection against hazards (control, prevention activities)	Artworks that are not registered as a CH property	Artworks that are legally protected
Class II Medium V	Artworks not subject to conservation activities without control	Artworks that are not registered as a CH property	Artworks that are vulnerable due to the legal and institutional framework that provides partial legal protection
Class III Low V	Artworks that are protected and managed through a control and prevention program	Artworks that are registered as a CH property	Artworks that are legally protected

2.4. Risk analysis

A risk index has been applied to measure the level of risk to the collection’s assets. The proposed method defines the risk for each vulnerability class (physical, contextual, and institutional) to the main hazards. Risk has been calculated using a semi-quantitative method, described by CCI and ICCROM (Pedersoli, Michalski 2016), to allow for the aggregation of the scores assigned to the components of risk: frequency (F) and impact (I).

The base parameter for the frequency score is the mean time between dangerous events. The impact depends on the calculated level of vulnerability (high, medium, or low) and is expressed as a percentage. The overall vulnerability scores assigned to each heritage element will be integrated into the risk assessment. To this end, and in accordance with the vulnerability indicators, each class of vulnerability has been related to an impact percentage based on the ability of a hazard to cause damage. For example, in the case of vandalism, the lowest vulnerability is represented by works in an inaccessible position, so the impact

there is zero. Conversely, in the case of humidity, all works, including those located in confined environments, suffer serious damage. For the risk analysis, a score has been assigned to each impact percentage (Table 8).

Table 8. *Impact % and score*

IMPACT	SCORE
%	
80-100%	5
60-80%	4
40-60%	3
20-40%	2
0-20%	1

The Magnitude of Risk for a specific hazard is obtained from the sum of the three scores deriving from physical, contextual, and institutional risk. Each risk typology derives, in turn, from the sum of the frequency of a certain hazard, with its impact calculated on the basis of the vulnerability type. The highest total-risk score of the total vulnerability is 30 and is derived from the sum of the three types of risk as a function of the frequency. The formula used is:

$$MR = PR (F + IPV) + CR (F + ICV) + IR (F + IIV)$$

where MR = Magnitude of Risk

PR = Physical Risk

F = Frequency

IPV = Impact Physical vulnerability;

CR = Contextual risk;

ICV = Contextual vulnerability;

IR = Institutional Risk;

IIV = Institutional vulnerability.

3. Results

The case study of San Gimignano has made it possible to verify the adopted methodological process and to obtain an evaluation of risk to the collection.

The process, following a procedure divided into stages, derives specific indicators and criteria to analyze the components of risk (hazard, sensibility, exposure, and coping capacity). To enhance the quality of the procedure and its findings, a triangulation of methods was applied to the data collection and analysis. Data from official reports, in situ observations, interviews and an expert questionnaire were used to evaluate risk awareness and hazards. Specific data analysis methods, such as indicator-based vulnerability assessment and risk index, have been applied.

3.1. Values assessment

The method integrates a values-assessment analysis to highlight any potential loss of the collection's significance. Tangible and intangible attributes that determine values have been identified from the study of public art as a cultural phenomenon.

Firstly, the analysis of values has made it possible to identify key elements that define the heritage character of the collections as a landmark of the public art phenomenon. Secondly, evaluation of the attributes of each work has made it possible to identify key elements that define the heritage character of the artworks and determine the values that each contains. The heritage value of San Gimignano's collections lies in their capacity to regenerate the historical landscape and to modernize the well-known medieval image of the town. Collections are a representative and significant example of a typically Italian artistic tendency, from the 1970s, to explore the relationship between contemporary installations and historical contexts. Artworks – which are curated by important contemporary researchers – are recognized at the international level because of their high artistic value. Each artist has chosen the context to realize a *site-specific* project, which bears significance related to the history of the territory. Installations stand out for their attempt to understand the cultural landscape and integrate with it, their form and design having been conceived as a function of the location in which they are placed. They have been realized with local materials such as stone, iron, ceramic, and mortar, and recall simple vernacular building traditions and construction materials. Collections have also placed value on local crafts since many of the artists used local craftspeople to execute their projects. Collections are also important for their educational value. They have high social value given that they were created with the principal aim of bringing contemporary art into the community. With this aim in mind, all the projects were accompanied by workshops and meetings between the local population and the artists.

A value-based approach should be integrated into the risk analysis process to determine how vulnerability and risk affect the attributes of each of the works of art. Despite the values assessment guide the decision-making process for treatments (Chmutina 2014), a methodology to assess the loss of value of cultural heritage is still extremely complex (Ravankhah, Chmutina, Schmidt and Boshier 2017). Loss of value is linked to the impacts identified in the following vulnerability analysis. However, in the case of public art, it is interesting to note how impacts are not always linked with a loss of value. For example, in the case of Luisa Rabbia, biological colonization forms part of the work's message. Consequently, cleaning can only be carried out in exceptional circumstances and as a measure to avoid significant damage. For that reason, the relationship between impacts and loss of tangible and intangible attributes should be established case by case, following the proposed indicators. In short, the balance between the significance and use of public art collections is very difficult to maintain and may require a review of current conservation theories.

3.2. Vulnerability assessment

The physical and contextual vulnerability index of the San Gimignano collection was determined via a study and comparison of the conservation state based on the level of exposure to the agents of degradation. Relating deterioration to indicators has established the criteria of high, medium and low vulnerability. Following the proposed indicators, it has been

found that, along with material, the type of structure and the display modality are the two determining factors for physical vulnerability. In this case, the resilience of the works could have been increased if the artist had been advised during the project by structural experts and restorers. The analysis has shown that the highest vulnerability is due to the parameters related to contextual vulnerability, which suggests the need for continuous monitoring. Finally, there is a clear division in institutional vulnerability between protected and unprotected works, although preventive conservation programs are non-existent in all cases. To verify the method, these criteria have been applied to each of the works in the San Gimignano collection. The analysis has determined that the most vulnerable works in the collection are those by Luisa Rabbia, Joseph Kosuth and Eliseo Mattiacci. In general and according to the standard criteria, the most vulnerable artworks are those made with mortar and paint, located outside the urban center and totally exposed to water and sunlight. Regarding institutional vulnerability, the questionnaire established that the lack of risk documentation and a management risk plan has a higher impact overall on the collections. This is a significant factor contributing to the high level of vulnerability. Nevertheless, some artists and curators do guarantee a period of maintenance that could be considered a positive factor.

3.3. Risk assessment

The risk analysis considered the frequency and impact of each hazard. Frequency was evaluated on the basis of past damage suffered by the collection, climate-related data, and natural events that characterize the territory. Impact was determined by relating the severity of the damage to each vulnerability typology.

The risk analysis revealed the greatest risks for the entire collection (Table 9). Among the natural hazards, those related to water – both rainwater and relative humidity – are the most relevant. Humidity gravely affects the entire collection, while rain causes significant damage to works with medium-high vulnerability; that is, to those works that, in addition to being composed of vulnerable materials, are situated in exposed locations. Humidity must also be related to temperature fluctuations, although this affects few works. Wind storms, although of medium-low frequency, also affect many of the structures that support the works, due to structural weakness, and many of the historic buildings in which the works are exhibited. Vandalism is a hazard that requires a detailed study as it does not affect all the accessible works – perhaps due to greater or lesser recognition of the works as artworks by the public. Finally, the results of the assessment emphasize that, in addition, diverse factors associated with coping capacity highly influence conservation, above all in the case of cumulative natural hazards and vandalism.

Table 9. Risk assessment of San Gimignano’s public art collections

HAZARD	FREQUENCY		PV	PR	CV	CR	IV	IR	TOTAL
	T	FS	IS	TS	IS	TS	IS	TS	TS
Windstorm	10 years	3	5	8	5	8	5	8	24
			4,5	7,5	4	7	4,5	7,5	22
			3	6	4	7	3,5	6,5	19,5
Vandalism	5-10 years	3,5	4,5	8	4,5	8	4,5	8	24
			2	4	4	6	3	5	15
			0	2	2	4	1	3	7
Rain	6 months	4,5	3,5	8	4	8,5	5	9,5	26
			2,5	7	2,5	7	4,5	9	23
			0	0	0	4,5	3,5	8	12,5
Humidity	Daily	5	4,5	9,5	4	9	5	10	28,5
			3	8	3	8	4,5	9,5	25,5
			1	6	1	6	3	8	20

* H = Hazard; F = Frequency; PV = Physical vulnerability; PR = Physical Risk; CV = Contextual vulnerability; CR = Contextual risk; IV = Institutional vulnerability; IR = Institutional Risk; MR = Magnitude of Risk.

** T = Time; FS = Frequency Score; IS = Score; TS = Total Score

The analysis provided an overview of the main risks to the collection that identifies the most appropriate prevention and maintenance treatments for the largest number of works. To increase the resilience of San Gimignano’s public art, exposure to humidity and rain must be reduced through the use of risk-reducing measures, such as protection features or new supports, and through risk-response actions, such as cover layers. In particular, anchoring systems need to be modified or restored where they have deteriorated as a consequence of water and salt migration from walled structures. To reduce the risk of sudden-onset events, such as seismic movements and wind storms, reinforcement or the replacement of weak structural elements must be carried out. The quality of conservation measures must be considered since most indicators do not exist or are poorly developed.

The analysis markedly emphasized high institutional vulnerability areas such as lack of control, risk assessment procedures, maintenance programs, and the availability of professional restorers. Risk planning and control is needed at an urban and site level that accounts for risks due to wind and rain storms, urban development, and vandalism. As a primary action, a control system should be established to avoid disasters such as the collapse of an artwork’s elements. Another requirement is the preparation of an emergency-response plan to provide a guide for the salvage, triage, and stabilization of the collection after a shock. Finally, a maintenance program is required for the prevention and mitigation of cumulative processes such as humidity.

4. Discussion

Despite collections having become permanent elements in the regeneration of cultural landscapes, significant losses of physical integrity occur, including the disappearance of artworks. In the case of the public art collections of San Gimignano, some works have suffered grave deterioration in only a few years since their realization. Even when artists have been attentive to the quality and durability of their works – using more resistant materials such as stone, bronze, or ceramics – the combined effect of multiple factors impacts safeguarding by creating often unexpected damage. Restoration interventions have often been carried out in emergency situations that cannot resolve the above-mentioned weaknesses. In other cases, to avoid the loss of works or part of their elements, adaptation or transformation interventions have been enacted, including reinstallation or relocation, which threatens values such as maintenance of original context. For this reason, it is essential to establish from the outset a preventative conservation plan.

Using the case study of San Gimignano, which is representative of the Tuscany territory, the aim of the research was to develop an integrated and systematic method for assessing risk, which can systematically analyze and manage disaster (Chmutina 2014, 26), as the first and essential system of a preventive conservation plan applied to contemporary public art collections.

The variety of designs for public spaces requires not only a case by case evaluation, based on a dialogue between all actors, but also that there should exist a theoretical and practical framework able to guide the types of operations necessary to reduce the risk the works are exposed to. In addition, the ever-increasing number of artworks made with different techniques and materials, which are subjected to a multitude of risks due to their location and proximate architecture, require a prioritization that guarantees the plan's sustainability. A multidimensional assessment approach and integrated evaluation tools are required precisely because of the variety of the risk scenarios that characterize public art. The case-study analysis, using a holistic approach, has endeavored to increase resilience by defining indicators that assess values, vulnerability, and risk. Since disasters are triggered by a combination of all hazards and threats, such an approach provides clarity on conservation priorities and facilitates decision making.

Despite the opportunity for proactive long-term conservation strategies, new challenges may emerge. Since disaster resilience is highly influenced by “identification and reinforcement of the local potentials and capacities” (Lizarralde, Chmutina, Boshier and Dainty 2015, 102), several factors must be considered attentively, such as policies, training, cooperation between stakeholders, control and analysis. To achieve all this, legislation is required as a first step to ensure the integration of public art conservation into the territory's cultural heritage system. An institutional framework is also needed that provides a model of cooperation at all levels between the multiple stakeholders and actors who are responsible for the management of public art. Finally, a common methodology is required, along with standard operating procedures to reduce risk that can be incorporated into local emergency plans and that provide rules to manage and protect cultural heritage in the event of a disaster.

5. Conclusion

Since the inception, in the 1970s, of events carried out in the public space, Italy has become one of the territories most supportive of the phenomenon of public art, with installations, such as San Gimignano's collections, created as the result of occupation events in decentralized places. The growing commission of urban artworks arises from a plurality of interests that lead institutions to provide public spaces for artists. Even though many of these works are not under the protection of cultural heritage laws, social recognition of their cultural heritage and integration into the urban fabric urges us to reflect on and address the question of their safeguarding. Despite the rapid degradation of, above all and from the moment of installation, the weak elements of public artworks, to date, public art still suffers from a lack of integrated methodologies in disaster-risk management.

Concurrently, public-art collections can be assumed to be complex and dynamic systems that integrate aspects relevant to the exploration of the symbiotic relationship between heritage and the paradigms of sustainability and resilience that inform urban planning. In fact, public art forms an integral part of the built environment that contributes to strengthening the citizens' sense of belonging. Moreover, it plays a significant role in economic development at a local level, attracts tourist revenue and provides financial resources. Finally, it promotes cultural diversity and traditional knowledge, for example, through collaboration between international artists and local craftspeople when creating installations.

To ensure the survival of cultural heritage, both the 2030 Agenda for Sustainable Development and the New Urban Agenda focus on the need to move from principles to actions through the use of adequate risk analysis and evaluation tools. According to Disaster Risk Management Frameworks, such an approach, upon which disaster resilience greatly relies, constitutes a fundamental contribution to reducing vulnerability. In light of this, a risk-analysis model has been developed following international policies and frameworks, the results of which could be integrated into the general-management and conservation plan for the contemporary collections in the public space.

In conclusion, this research can play an essential role in establishing a risk assessment and mitigation plan applicable to other public-art collections. To optimally implement this goal, further research is needed into the evaluation of the influence of climate change.

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Sažetak

Metoda za integraciju ulične umjetnosti u okvire upravljanja rizikom: izazovi i prilike

Cilj. Cilj istraživanja jest prikaz razvoja integrirane i sustavne metodologije procjene rizika u suvremenim javnim umjetničkim zbirkama. Prikazani su ključni elementi plana upravljanja rizikom u području javne umjetnosti. Naglašava se unaprjeđenje zaštite kulturne baštine od prirodnih nepogoda i ekstremnih događaja povezanih s klimatskim promjenama i, mnogo značajnije, raspravlja o tome na koje načine zaštita može ojačati otpornost društvene i povijesne baštine.

Metodologija. U svrhu razvoja metodologije procjene rizika, istraživanjem je obuhvaćena povijesna jezgra grada San Gimignano (Italija), upisana na UNESCO-ovu listu svjetske baštine, upravo zbog svojeg jedinstvenog kulturnog krajolika. Suvremeni elementi toga krajolika nastali su kao rezultat nekoliko kulturnih inicijativa: *Affinità Elettive* (1994), *Arte all'Arte* (1998–2005) i *UmoCA* (2011). Ovim se istraživanjem naglašava da je očuvanje javne umjetnosti u San Gimignano uvjetovano suživotom fizičkih, kontekstualnih i upravljačkih čimbenika.

Rezultati. Temeljem studije slučaja, u ovom istraživanju razvijeni su indikatori i kriteriji za analizu ranjivosti i izloženosti rizicima. U radu se analizira integracija javne umjetnosti u opći okvir upravljanja rizicima. Unatoč činjenicama da vrijednosti javne umjetnosti mogu doprinijeti otpornosti povijesnih urbanih jezgri, istraživanjem su otkriveni veliki izazovi koje je važno prevladati da bi se javna umjetnost mogla inkorporirati u smjernice općeg upravljanja rizicima.

Originalnost. Razvijen je model analize rizika, slijedeći međunarodne smjernice i preporuke, a koji se može integrirati u opće upravljanje i plan konzervacije za suvremene zbirke u javnom prostoru. Dodatno, prepoznavajući važnost društvenih, kulturnih i ekonomskih procesa u konzervaciji javnih prostora, procjena vrijednosti inkorporirana je u okvir upravljanja rizicima.

KLJUČNE RIJEČI: javna umjetnost, otpornost, povijesni kontekst, upravljanje rizikom, smanjenje rizika