1. INTRODUCTION

During the 20th Century, rural landscapes underwent rapid transformations as a result – among many factors – of mechanization of agriculture and the introduction of new means of transportation: rural territories, indeed, started being signed by new railway lines and agro-industrial facilities, necessary for the storage and distribution of an increasing amount of agricultural products. This is particularly evident in Europe for the landscapes of grain production, as well as in North and South America. A recent research by the author about the grain silos built in Italy under the Fascist regime set the basis for an in-depth analysis of grain production landscapes in Italy during the first half of the 20th century, also in comparison with the European and American contexts. To this aim, survey and representation of landscape settings become crucial, for the interpretation assessment of significance of these still underestimated cultural landscapes. Therefore, the aim of this contribution is to propose a methodology for the knowledge and preservation of 20th Century grain landscapes – and their built heritage – choosing as case studies the grain silos built in Tuscany during the 1930s.

Keywords: Rural landscapes; 20th Century cultural landscapes; Landscape representation; Rural landscape preservation; Grain silos; Adaptive reuse.
Based on the literature review, this contribution aims to propose a methodology that goes from knowledge and interpretation, to preservation and valorization of 20th century grain production landscapes and their built heritage, choosing as key case studies the grain silos built in Tuscany under the Fascist regime.

2. ORIGIN OF THE GRAIN SILOS AND LANDSCAPES OF GRAIN PRODUCTION AT THE TURN OF THE 20th CENTURY

Since the human race started to eat grain products, storage of grain has been a key factor in shaping landscapes and human settlements. Control of grain and food reserves, indeed, was the process around which communities have formed. Buildings for the storage of grain, therefore, played always a crucial role, in every epoch and in every region of the world, thus, their construction has always been the object of the highest care. After an incredible variety of typologies of granaries – some vernacular, other monumental succeeding one another from Ancient Egypt through the Medieval ages to the Modern Hera, the real turning point in grain storage systems took place toward the mid-18th Century, in consequence of the wider international trades which become possible by sea [1].

The turning point was signed by the introduction of automated machineries – the so-called bucket elevator: a sort of “leg”, powered by a steam engine, aimed to pick up the grain from the hold of the ships and to pour it into the storage facilities [8]. The use of this device in a grain storage building is attributed to the merchant Joseph Dart from Buffalo – commonly recognized as the inventor of the “grain elevator” – even if the invention of this device is due to Oliver Evans during the 1780s [9, 10]. Ancient pictures of the port of Buffalo show Dart’s pioneering “leg” next to fairly vernacular buildings made of a wooden envelope with a pitched roof.

Around the turn of the 19th and 20th century, the research of a more fireproof construction technique implied the experimentations of different construction materials. In the same period, the introduction of the electrical power allowed the use of electrically powered legs moving on rails, while the introduction of “horizontal conveyors” made it possible to move the grain horizontally above the rows of bins [8].

Steel bins were very slowly adopted, mainly because of the high cost of steel, the threat of corrosion and its poor insulating performances. A first attempt to solve these problems is represented by the set of grain elevators, endowed with a brick envelope, built right after 1895 in the key port-cities according to the design by Max Toltz – the engineering genius of the Great Northern Railway – which served the Great lakes area as “terminal” elevators [8], together with the hundreds of “country” elevators [9] in the inland territories, also built the Great Northern Railway. Still for the US, it is also worth mentioning the grain elevators in Minnesota, realized to perform railcar-to-railcar transfers, built in a thin and long format in between the tracks of the spreading railway lines. The Pioneer Steel Elevator in Minneapolis is one of the few surviving examples that shows this type at its origins [8]. At the turn of the century, also concrete bins started to be experimented. The Johnson-Record System, patented in 1895, was a sort of hybrid technique, where the bin walls were made of two leaves of concrete tiles and steel hoops placed between the leaves. The first experimentation of a poured in place reinforced concrete bin, instead, was the so-called “Peavey’s Folly”, a single reinforced concrete bin which still stands in Minneapolis; after this experiment, the Peavey’s company applied this technique to build full sized concrete elevators [8]. Many patents for concrete bins were developed during the following years [11].

American grain elevators were studied by many experts of construction history – such as W. J. Brown [9], L. Mahar-Keplinter [12], F. Gohlke [13] and R. Banham [8] – but the starting point in the analysis of such structures, is definitely the work of Bernd and Hilla Becher [14], two German photographers who, since the 1960s, started to turn the lens of their camera to a huge number of industrial typologies, including the American and European grain elevators. It’s also worth mentioning, the study by H. Torrent [15] for the grain landscapes of South America, also characterized by a capillary network of grain elevators connected by new railway lines.

Since the end of the 1880s, also in Europe, grain storage and flour milling activities tended to be concentrated in mighty facilities, built in key ports and along the main infrastructural networks. Among the many companies specialized in the construction of grain elevators (here most widely known as “grain silos”) the French Hennebique Company was probably one of the most active (some examples of Hennebique’s silos: grain silo of the Gautier Mill, Port Saint Louis du Rhône, France; grain silo of the John Herdman and sons Mill, Edimb ourg, Scotland; grain silo of the Coopérative Wholesale Society, Silvertown, England) [1]. Between 1900s and 1920s, the Hennebique built the most important port silos and
milling plants in Italy as well (some examples: grain silo of Società Anonima Semoleria Italiana in San Fruttuoso, Genoa; grain silo of Società Anonima Semoleria Italiana in Sanpierdarena, Genoa; grain silos in the Port of Genoa; grain silo and mill of Società Esercizi Molini in Cagliari; grain silo and mill of the Società Molini Alta Italia in Sampierdarena, Genoa; grain silos in the Port of Leghorn and grain silos in the Port of Naples) and it’s presumable that their constructive solutions influenced the grain silos from the 1930s, built under the pressure of the autarchic fascist policies [1].

3. THE ITALIAN NETWORK OF GRAIN SILOS AND THE REGULATION OF THE GRAIN DISTRIBUTION IN EUROPE

In 1925, the fascist regime started to promote the “Battle of Wheat” with the aim to achieve the cereal self-sufficiency. The institution of collective storages, to manage the increasing amount of grain, started to be fostered with the Royal Legislative Decree (RDL) n.1509/1927; however, the issue became of major relevance in 1929, with the outbreak of the economic crisis. During the following years, in consequence of rapid changes in the regulatory system (RDL n. 720/1932, RDL n.821/1934; RDL n.1049/1935), the collective storage system rapidly evolved, until when the RDL n.392/1936 and RDL n.1273/1936 transformed the collective grain storage from voluntary to mandatory, imposing that all grain produced in the country should have been delivered to the collective grain storages [16, 17]. The collective grain storage system was put under the control of the Ministry of Agriculture and Forests (later transferred under the Ministry of Corporations) and managed by the Italian Federation of the Agricultural Consortia (Federconsorzi) [18].

The increasing production implied the need for new facilities able to store large amounts of grain and to keep it in good conditions. M. Vaquero Píñeiro reports that, between 1932 and 1939, 200,000,000 lire were spent to build 760 structures [19]. According to Federconsorzi [18] numbers were even higher, the federation indeed reports, for 1939, the existence of 803 active storage facilities. Conditions were clearly favourable for the birth of specialized companies (such as the Società Anonima Magnaghi & Bassanini, Società Italiana Costruzioni Agricole Industriali, Società Costruzioni e Fondazioni Milano and S.I.M.A), expert in the design and construction of modern grain silos: such companies used to develop standardized projects for silos with different storage capacities (the two main typologies were silos with vertical cells and silos with floors), then, these projects were further detailed by an engineer, who was called to adapt them to the specific needs of the client, while an architect, especially in the major cities, was often called to design the envelope (Fig. 1) [20, 21]. As a result, such agro-industrial facilities were characterized by innovative technical solutions and influenced by the contemporary architectural culture, in particular, the rationalist language. The attention for the envelope, moreover, witnesses how the silos played not only a key role in the implementation of the fascist policies, but also how they represented a real propaganda tool [1].

In the same period, many other national governments issued new agricultural policies to control grain distribution. In Spain, during the civil war...
(1936–1939), the issue of grain production became of major relevance and once the war was over, with the regime established, Francisco Franco began to implement autarchic policies similarly to the fascist regime: the so-called Servicio Nacional del Trigo was established to manage the national grain harvest and a network of grain silos was realized. This process was deeply analyzed by C. Barciela Lopez [22, 23], C. A. Azcárate Gomez [24], D. Salamanca Cascos and C. Mateo Caballos [25]. Between 1920s and 1930s, also the Soviet Union established a collective storage system, however, the strategy did not give the expected results. The situation in the Nazi Germany, instead, remained less restrictive: in 1933 the “Reichsnährstand” (Reich food body) was set up to regulate the food production, it was, however, no more than a social organizations, conceived to reorganize the market and pricing, but the collective storage never became mandatory. As for the democratic European countries, public bodies were set up to control the agricultural production but, again, they were conceived primarily to price and distribute the basic products [19].

As for the silos built in Italy, only a limited number have been the object of some attention – the silos of Rome [26, 27], Cagliari [28] and Arezzo [29, 30, 31] – while no one has ever addressed the study of such facilities considering them as a whole. The only exception is represented by the studies of the economic historian Vaquero Piñeiro, that, within his research on the agricultural policies of fascism, was the first to consider the network of silos in its entirety, discussing the reasons for its construction and its strategic role even after World War II [16]. Nowadays, unfortunately, the awareness of the existence of such facilities and their interrelation is almost completely lost. Therefore – starting from the assessment of their historical, technological, formal and social significance – the aim of this contribution is to bring the attention on the whole set of Italian grain silos and the landscapes they determined, as a significant part of the Italian cultural heritage.

4. FROM KNOWLEDGE TO PRESERVATION: A METHODOLOGY FOR THE GRAIN LANDSCAPES IN ITALY

The knowledge of landscapes settings requires analysis at very different scales: from the architectural one, to the urban and territorial ones. Consequently, representation play a crucial role, providing tools and solutions for a correct interpretation of landscapes settings within their territorial contexts. The present contribution aims to propose a research methodology that goes from knowledge to preservation of grain production landscapes, including survey and representation at different scales as a fundamental step.

The grain silos built in Tuscany under the fascist regime (Fig. 2) are chosen as case studies, to interpret the changes that occurred to the grain production landscapes in a crucial period: when the mechanization of agriculture, reclamation of wetlands, the
foundation of new towns by the regime and the new railway lines radically reshaped the Italian rural landscapes. The proposed methodology provides the following steps.

1) Mapping and representation of the silos networking and distribution system

The mapping of the Italian grain silos confirmed how the new grain silos were strategically located within areas of production and along the main transport infrastructures, in order to facilitate both collection and distribution. The average capacity of the silos was around 20,000 to 50,000 quintals, with some exceptions for the major cities – such as for Rome, Piacenza, and Venice – whose silos had a capacity of 100,000 quintals, or the city of Foggia (Puglia) – called “the granary of Italy” – endowed with the largest silo in Europe at the time of construction, able to contain up to 400,000 quintals of grain. Up to now, it has been possible to identify 79 silos, distributed throughout the national territory as shown in the map (Fig. 3). However, the mapping process is still in progress due to the fragmentation of documentary sources.

2) Territorial analysis (land uses)

Territorial analysis of land uses, which can be carried out at the metropolitan or provincial scale depending on the case, provides basic information for the understanding of rural landscapes, natural environment, socio-economic dynamics and attractive poles of the wider territorial context where the silo is located: these information are useful from a historical point of view, to evaluate changes that occurred since the period of construction of the silo, as well as for the definition of a strategy for the adaptive reuse of the silo and the valorization of its context. The image (Fig. 3) shows the territorial analysis of the Province of Grosseto, which is nowadays characterized by a huge extension of land used for sowing cereals as it was at the time of the regime, as witnessed by the realization of two grain silos: in Grosseto – the province seat – and in Albinia, a small town founded by the regime following the reclamation of wetlands.

3) Urban analysis (functions, road and railway infrastructures)

Urban analysis of the functions, road network and railway network, which can be carried out on the
entire municipal territory or on a part of it depending on the case, provides basic information for understanding the attractive poles, accessibility and connections of the local context. The image (Fig. 4) on the left shows the analysis of the urban context of the silo in Arezzo, as regard to its road and railway infrastructures. To this end, the whole urban center was taken into consideration to understand the connection of the silo area with the city center as well as with the surrounding rural areas: information which turns out to be useful both for the analysis of the accessibility of the silo, and for understanding the visual perception of the silo as a landmark coming from outside the city or coming from the city center.

The image (Fig. 4) on the right, instead, shows the analysis of the main functions in the district of the silo, which is particularly useful when developing adaptive reuse strategies, allowing the evaluation of new uses for the silo which may be complementary to the existing ones, with clear benefits for the district itself but also for the whole city.

4) Historical Urban development.

Historical analysis of the urban fabric, which can be carried out on the municipal territory or a part of it depending on the case, is necessary to evaluate changes since the period of construction of the silo, and the following modifications of the functional and visual relations between the silo and its surrounding context. The image (Fig. 5) shows the historic urban development for Saline di Volterra, that is part of the Volterra municipality, a historic town in the province of Pisa.

The historic analysis is particularly useful to understand the growing importance of the little town over the time, to read the morphological rules beyond the urban growth, but also to analyze the changes in terms of visual perception of the silo from the sur-
Figure 6.
Case study: silo of Asciano di Siena. Bibliographic sources (technical drawings and static calculations) [35]

Figure 7.
Case study: silo of Grosseto. Analysis and representation of the grain silos (L: longitudinal section; R: main façade) [36]
rounding landscape, more and more concealed in the urban fabric.

5) Analysis and representation of the grain silos

Preliminary analysis of available documentary materials (historical photos, original drawings, technical reports) and bibliographic references, are needed to create a solid knowledge base of the history the silo (from the project to the construction and any subsequent modifications) and its surroundings context. The image (Fig. 6) shows the original drawings and calculations for the silo of Asciano di Siena. Then, photographic survey and architectural survey in scale 1:50 or 1:100, developed with integrated methodologies (traditional tools, total station, photogrammetry) allow to understand the geometrical aspects of the architecture, to analyze materials and to map alterations and degradation phenomena. The image (Fig. 7) shows different views of the grain silo of Grosseto, which allow the comprehension of the complex morphological articulation of the silos, taking into consideration also its main machineries.

Such information are crucial for the development of conservation guidelines and adaptive reuse strategies, which should be based on considerations about the adaptability of the silo’s structure to new functions, taking into particular consideration the new loads and structural modification which could affect the silo’s static behavior.

6) Analysis of grain production landscape

Photographic survey of the urban context and surrounding landscape of the silo is useful to identify and analyze the elements built contextually or prior to the silo, such as the railway line, railway station and road network, as well as further buildings usually built within the silo’s lot, such as small warehouses and the petrol station. When developing photographic surveys, it’s crucial to pay attention both to the silo’s views from its surroundings and to the silo’s context as perceived by silo (i.e. from its top floor or its roof terrace). The images (Fig. 8) show the surrounding context of the silos of Arezzo, Albinia, Grosseto and Asciano di Siena, underlining their role as landmark, as well as the physical and visual connections with the railway and road network.

5. CONCLUSIONS

The mapping of the Italian grain silos allowed to understand their historic value as witness of a relevant part of the Italian economic and political history, as well as their technological value, their formal value and their landmark value. The proposed methodology allowed to verify for the Tuscan case studies the still existing physical and visual relationships of the silos with their surrounding landscapes, which also include important elements deeply related to the silos themselves, such as the railway lines, rail-
way stations and road networks, as well as further buildings complementary to the silos, usually built within the silos’ lot.

The analysis of the Tuscan case studies, therefore, suggest that, when developing conservation and reuse proposals for this particular typology of facilities, we cannot ignore their territorial and urban context and the presence of significant elements in the surroundings which could give an important contribution to the narration and understanding of the site. Also, the selected case studies suggest that we should analyze the relationships among the silo and the surrounding landscape, which, over time, may be changed or even compromised: improper changes which may alter the silo’s visual perception represent, indeed, one of the principal risks in terms of preservation. In particular, strategies for preservation and valorization should take into consideration the following elements: layout of the silo’s lot and all the buildings (other than the silo) which may be found in the silo’s lot; evolution and changes in the physical and visual relationships of the silo with the surrounding landscape and with the built elements of the surrounding context, such as the railway line, railway station and road network; new constructions and other built elements (i.e. road infrastructures, industrial facilities, etc.) that may have affected the silo’s visual perception.

The analysis of the urban and territorial context of the case studies, moreover, suggests some principle to assure the economic viability of adaptive reuse strategies: multiple uses for the silos should be considered to keep the building and site continuously alive and, to this end, both indoor and outdoor spaces should be designed to be as flexible as possible to allow different and unforeseen uses; the site accessibility should be verified and improved through private and public transportation; especially for the largest silos, which may become a catalyst for the wider territorial context, reuse interventions should be planned in phases to make the site operational as soon as possible to start get funding for subsequent phases.

To conclude, it should be part of the adaptive reuse strategy, making re-emerge and enhancing the physical and visual relationships of the silo with its context, in order to give a consistent narration of the site as a significant historical document and give it a new role and life within its urban and territorial context.

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