Sugar cane industrial heritage in oriental coast of Málaga. A tourist route opportunity

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Abstract: Industrial heritage, as a historical and cultural heritage typology, can be considered a new opportunity to generate tourism interest in a zone. Along the 19th century and at the beginning of the 20th century, the oriental coast of Málaga (Spain) was considered a reference area in the sugar cane cultivation and manufacturing. Nowadays, different sugar cane factories assets remain. These assets can be considered an opportunity to increase visitors and to improve the economy of this area. In this work, six sugar cane factories have been evaluated. Different characteristics has been proposed and a value has been assigned to each one. Finally, a route to visit the proposed sugar cane factories has been designed. The main advantage of this tourism route is that can be done in one day, reinforcing the current touristic offer and attracting new visitors to this area.

Keywords: Sugar cane, Industrial heritage, Factory, Tourism, Málaga.

1. Introduction

The historical and cultural heritage has been considered as a representation of how was a society in the past, showing the community identity. In this sense, the study and analysis of the historical and cultural heritage allow to transmit this knowledge to present and future generations [1]. Industrial heritage has been accepted internationally as a heritage typology. In spite of this, different singularities can be considered against other typologies. Most of the industrial heritage assets are more recent that other typologies. In addition, technological advances originate continuous changes in industrial activities, requiring to leave records of this activities in short time periods [2].

On the other hand, industrial heritage is associated with a work activity, but also with historical events that represent abuses against workers. However, these facts should not be an exclusion cause. The study of industrial equipment associated with each historical moment, taking into account the technologies used, the social relations, the historical moment or the social movements originated by the industrial activity, are sufficient reasons for its study. In this sense, these singularities have caused a greater interest of the society for industrial heritage, compared to other more globalized typologies [3,4].

Tourism has become relevant to the economy of many countries. This has made it possible to survey small populations that had no other economic activity. In this sense, the industrial heritage can be considered an opportunity to generate visitors and to grow the economy of some areas [3]. Industrial heritage tourism highlights the importance of old industries and strengthens the local identity. Also, its
development creates opportunities for raising awareness of historical processes, creating new centres of urban life and promoting a better image of the region in order to attract new investors [5]. In this sense, the case of Almaden, a municipality located in Ciudad Real (Spain) with the highest mercury reserve in the world and which productive activity ceased in 2003, can be a good example. In 2012 this industrial site was added to the World Heritage List from UNESCO as “Heritage of Mercury. Almaden and Idrija” [6]. Nowadays, different buildings related with the mercury extraction can be visited. Among the buildings open to the public, the mining, the mercury museum, the miner’s royal hospital or an old jail can be visited. The conservations of these elements enhance the possibility of having around 15,000 visitors per year that strengthen the economy of the zone [7].

The San Blas Ironworks, in the town of Sabero in León (Spain), was built in 1846 and the mining operations ceased in 1991. Nowadays, the forge and laminating building can be visited. The restoration and conservation of these industrial buildings is another example of how industrial heritage can be considered as a tourism opportunity to revive the economy of a zone. In the last ten years the tourism interest has grown from 20,000 to 37,000 visitors in 2019 [8].

Along the 19th century and early 20th century, sugar cane industry was widely developed in the east coast of Málaga (Spain). This area presents good weather conditions for the sugar cane cultivation. The mountain orography near the coast allowed the collection of the rain water for the cultivate irrigation and also needed for the manufacturing process. Furthermore, the proximity to the sea facilitated the sugar distribution to other countries. All of this turned this area into a benchmark for sugar production nationally and internationally [9,10].

This activity was gradually closing through the 20th century and the economic activity of the zone was redirected to the tourism activity, specially focused on the “sun and beach” tourism. In spite of this, there are still different remains of factories that were dedicated to the manufacturing of sugar cane [11,12]. This fact, can create opportunities to generate new tourism activities or reinforce the tourism offer of the zone.

In this work, different sugar cane factories, as industrial heritage assets, have been analysed. Different characteristics have been valuated in each one. The main objective is to propose a new tourism activity in the east coast of Málaga which will reinforce the national and international tourism relevance of the zone.

2. Methodology
Different sugar cane factories have been selected in the east coast of Málaga, considering both the proximity between them and their conservation state. In this case, six factories have been selected:

- Ingenio Nuestra Señora del Carmen (I), in Torre del Mar
- Ingenio San Javier, in Torrox
- Ingenio San Rafael, in Torrox
- Ingenio Nuestra Señora del Carmen (II), in Frigiliana
- Ingenio San Joaquín, in Nerja
- Ingenio Armengol, in Maro, Nerja.

The maxim distance between the industrial heritage proposed is 23 km, corresponding from Ingenio Nuestra Señora del Carmen (I) to Ingenio Armengol. All of them are connected by road and it suppose no more than 30 minutes by car.

These factories have been visited and different images have been captured using a conventional photography camera and an unmanned aerial vehicle (UAV). The UAV has been employed only in the Ingenio San Joaquín. This technique could not be implemented for the other factories due to the aeronautical normative that restricts its use. It is important to highlight that the image of the assets can be considered a good tool for the study and analysis of the heritage assets [13,14]. In addition, different geographical information about each factory has been collected.
Six characteristics have been analysed in each factory and then valuated using a metric scale between 1 to 5, where 1 means low presence of that aspect in the asset analysed and 5 means high presence. The features considered are exposed below:

C1. Conservation state: Due to the conservation and restoration actions which can affect this kind of assets, different conservation states can be observed. Public or private property characteristics, factory age or the environment, where the factory is placed are factors that affect the actual state of the assets.

C2. Accessibility: A wide variety of factors, such as the public or private property, restrictions on visiting hours or risks due to poor state of conservation, can make the visit easier or more difficult. These aspects have been considered to value the accessibility of the assets.

C3. Factory environment: The heritage analysis requires an evaluation of the environment where the assets are placed. In the case study this fact has higher interest because the environment was adapted to the manufacturing activity, e.g., worker houses, aqueduct, cultivation area, among other. This environment analysis enriches the information around the industrial activity.

C4. Antiquity: Industrial heritage is commonly related to manufacturing activities originated since the first industrial revolution. Despite this, different manufacturing processes were carried out previously, contributing to generate information about a period not widely studied.

C5: Architecture singularities. The architecture of the factory is an element that can offer information about the materials employed or the architectural style in different periods of time. In addition, the layout of each asset offers key information of how the manufacturing process was designed.

C6. Technological singularities: Occasionally, some factories conserve different equipment related with the manufacturing activity and they can be seen and studied. In addition, other elements were built in the proximity of the factory to facilitate the manufacturing process.

Finally, the values obtained have been analysed and the main characteristics of them have been discussed.

3. Sugar cane factories description

The Ingenio Nuestra Señora del Carmen (I) (figure 1(a)) is located in the municipality of Torre del Mar. Sugar cane production began in 1796, generating the movement needed in the manufacturing processes by animal effort. In 1846, the factory was reformed to adapt the production to the use of the steam machine. The manufacturing activity was ceased in 1991 due to economic reasons. In 1993 the building was restored and dedicated to cultural activities.

Inside the building, visitors can find a replica of the steam engine employed as well as different equipment that have been conserved too. Outside the building, two chimneys from the factory can be seen.

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Figure 1. (a) Ingenio Nuestra Señora del Carmen (I) (Torre del Mar). (b) Ingenio San Javier (Torrox).

The building of the Ingenio San Javier (figure 1(b)) in Torrox was finished around 1827. Nevertheless, it is known that it ceased in 1845, having a very ephemeral life. In spite of this, nowadays,
different elements of the factory can be visited, although it presents a poor conservation state. The factory includes an aqueduct that provided water for the manufacturing activity.

The Ingenio San Rafael (figure 2(a)) in Torrox, was built in 1568, using pre-industrial process for the sugar cane production. In the middle of the 19th century, the factory was adapted to the steam engine. The activity ceased in 1945. In fact, the structure of the factory still remains and it can be visited. Since 2005, this building stays under the protection of the municipal legislation.

The Ingenio Nuestra Señora del Carmen (II) (figure 2(b)), in Frigiliana, is dedicated to manufacture sugar cane honey since 1630. Initially, the Ingenio was called San Raimundo, until 1920 when it was renamed as Nuestra Señora del Carmen with the change of the ownership. The Ingenio can be visited, showing the traditional process to obtain the sugar cane honey, being the only factory in Europe that continues this activity. In addition, different old equipment is still preserved.

Figure 2. (a) Ingenio San Rafael (Torrox). (b) Ingenio Nuestra Señora del Carmen (II) (Frigiliana).

In the municipality of Nerja are located the Ingenio San Joaquín (figure 3(a)) and the Ingenio Armengol (figure 3(b)). The Ingenio San Joaquín was built in 1879. The main activity was dedicated to the sugar cane production and to alcohol distillation obtained from the sugarcane. These activities ceased in the middle of the 20th century. Some singularities can be considered in this construction as the factory was walled and nowadays some wall parts remain. Among them, it can be highlighted that this factory had housing for workers, located in the north of the enclosure. Also, the chimney of the factory is the only one in Europe that is decorated and at a distance around 300 m, there is an aqueduct (the aqueduct of the Aguila) that supplied water for the sugar production.

Figure 3. (a) Ingenio San Joaquin (Nerja). (b) Ingenio Armengol (Nerja).

The Ingenio Armengol is preindustrial. It was built in 1585 and the activity ceased around 1860 due
to a factory fire. It has thick masonry walls and a voluminous chamfered buttress that supports the building from the slope of the land on one of its sides.

4. Results and Discussion
For the different characteristics proposed in the methodology, a value of each one has been assigned for the different sugar cane factories. These values can be observed in Table 1. In addition, the results have been represented in figure 4 for the Ingenio Nuestra Señora del Carmen (I), the Ingenio San Javier and the Ingenio San Rafael, and in figure 5 for the Ingenio Nuestra Señora del Carmen (II), the Ingenio San Joaquin and the Ingenio Armengol.

Table 1. Value per characteristics in the different sugar cane factories.

| Characteristic                          | Ingenio Nuestra Señora del Carmen (I) | Ingenio Javier | Ingenio San Rafael | Ingenio Nuestra Señora del Carmen (II) | Ingenio San Joaquin | Ingenio Armengol |
|----------------------------------------|--------------------------------------|----------------|--------------------|----------------------------------------|---------------------|-----------------|
| Conservation state                     | 5                                    | 2              | 4                  | 5                                      | 3                   | 1               |
| G2. Accessibility                      | 4                                    | 3              | 2                  | 4                                      | 4                   | 5               |
| G3. Factory environment                | 2                                    | 3              | 4                  | 2                                      | 5                   | 2               |
| G4. Antiquity                          | 3                                    | 3              | 4                  | 4                                      | 5                   | 4               |
| G5. Architecture singularities        | 2                                    | 5              | 3                  | 3                                      | 5                   | 5               |
| G6. Technological singularities        | 4                                    | 2              | 1                  | 5                                      | 2                   | 1               |
| Total value                            | 20                                   | 18             | 18                 | 23                                     | 23                  | 18              |

Figure 4. Values for Ingenio Nuestra Señora del Carmen (I), Ingenio San Javier and Ingenio San Rafael.
Figure 5. Values for Ingenio Nuestra Señora del Carmen (II), Ingenio San Joaquín and Ingenio Armengol.

The Ingenios Nuestra Señora del Carmen (I) and (II) dispense in their instances of different equipment related with the sugar cane production. These can be considered the most interesting elements of these factories, especially in the case of the Ingenio Nuestra Señora del Carmen (II), where the traditional manufacturing process still remains. In spite of this, both Ingenios are located in urban areas, so currently it is difficult to relate the manufacturing activity with the cultivation process of sugar cane.

In this sense, the Ingenio San Joaquín contributes to relate the manufacturing process with the cultivation of the sugar cane. Nowadays, around the factory, there are growing areas that allow to understand how the sugar cane plantations were during their period of operation. Furthermore, the aqueduct of the Aguila, near the factory, and the water pond in the factory show the importance of the water in these manufacturing processes. Similar conditions can be observed in the Ingenio San Javier, which presents significant land extension around the Ingenio and which also is associated to an aqueduct. Thus, both industrial assets can be understood as industrial complexes.

The Ingenio Armengol and the Ingenio San Rafael are the oldest assets of the ones analysed and both are considered pre-industrial. In spite of the poor conservation state of the Ingenio Armengol, its architecture can be considered of great value due to its pre-industrial architecture. On the contrary, the Ingenio San Rafael was restored in different periods of time, although its architecture can be valued as postindustrial.

Finally, the sum of the scores given to the different characteristics in each case has been considered to evaluate the general interest level of each study case (figure 6). Thus, the Ingenio San Joaquín and Nuestra Señora del Carmen (II) obtained the highest total scores. On the other hand, Ingenio San Javier, San Rafael and Armengol were the least valued. In spite of this, all of them show interesting aspects and they are perceived as representative examples of the industrial heritage and of a traditional productive activity in this region, as sugar cane production is.
Figure 6. Total values for the different Ingenios evaluated.

Thus, these factories must be seen as opportunities to promote tourism activity in the area, both providing added value compared to other coastal areas and taking advantage of the intense tourist activity in this area to attract visitors who are on vacation in nearby areas.

For this reason, a route to visit these different factories has been proposed. In Table 2 visits have been organized for the factories. In addition, the distance with the previous one and the displacement time by car has been indicated.

| Factory                          | Distance with the previous one (km) | Displacement (min) | Visit time (min) |
|----------------------------------|-------------------------------------|--------------------|------------------|
| 1 Nuestra Señora del Carmen (I)  | -                                   | -                  | 60               |
| 2 San Rafael                     | 18,8                                | 15                 | 40               |
| 3 San Javier                     | 1,3                                 | 3                  | 30               |
| 4 Nuestra Señora del Carmen (II)| 13,2                                | 15                 | 90               |
| 5 San Joaquin                    | 9,1                                 | 14                 | 40               |
| 6 Armengol                       | 2,6                                 | 5                  | 20               |
| Total values                     | 45                                  | 52                 | 220              |

These values show that all factories can be visited in one day, requiring less than 5 hours for the tour. In addition, it can be considered as an opportunity for the local restaurants because the tourists will seek a breakfast, lunch or dinner.

5. Conclusions

Throughout the work, the existence of interesting vestiges of an industrial activity deeply rooted in the oriental coast of the province of Malaga around sugar cane production has been appreciated. In addition, 6 heritage elements have been analysed and have a maximum separation of about 25 km from each other.

All of them, are well connected to each other from the axis that constitutes the A7 highway (Spanish section of the European route E-15) with a greater distance from the coast in the case of Frigiliana, but only about 8 km. However, if the Ingenio de Nuestra Señora del Carmen (I) is excluded, the remaining 5 heritage elements are located in a section of only 13 km of distance. This justifies the proposal of common visit offers for these industrial tourism resources. For this reason, different administrations are
encouraged to develop joint promotion strategies, as well as the development of interventions for the conservation and recovery, in part, of the main technological characteristics of such assets in order to improve their knowledge and visit by the citizens.

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