



Procedia Environmental Science, Engineering and Management 7 (2020) (2) 261-269

24th International Trade Fair of Material & Energy Recovery and Sustainable Development,  
ECOMONDO, 3<sup>th</sup>-6<sup>th</sup> November, 2020, Rimini, Italy

---

## **TECHNOLOGICAL INNOVATION IN BIOLOGICAL WHEAT CHAIN PRODUCTIONS FOR THE REVALUATION OF SICILIAN MINOR ISLANDS\***

**Salvatore Scilletta<sup>1\*\*</sup>, Samuele Icaro Russo<sup>1</sup>, Raffaele Puleo<sup>1</sup>,  
Agata Matarazzo<sup>1</sup>, Francesco Vescera<sup>2</sup>**

<sup>1</sup>*University of Study of Catania - Department of Economics and Business –Corso,  
55- 95129 Catania, Italia*

<sup>2</sup>*F.lli Vescera l.t.d. Viale dello Stadio, 17, 96013 Carlentini, SR, Italia*

---

### **Abstract**

Marine litter is a major environmental problem, with widespread responsibility and effects on The agricultural sector contributes to the ethical sustainability through the offer of a variety of healthy, nutrient and high quality products, completely respecting the environment and following the basic circular economy principles. Between all the supply chains “Ancient Grains of Sicily” is the one that highly guarantee this level of quality. The sicilian soil is particularly suitable for this type of cultivation, that leads to life the ancient grain rustic starting from the genetic manipulation of genomes of ancient grains, with an excellent feedback to taste and health. One of the main companies of this sector is the “Vescera l.t.d.”. The main purpose of this paper is to perform an accurate environmental and economic analysis of the possible strategies for the revaluation of one of the minor Sicilian islands through the cultivation of ancient grains. Pantelleria’s island represents a hidden treasure placed in the middle of Mediterranean Sea, on the african platform.

*Keywords:* agriculture 4.0, industrial symbiosis, minor islands, sicilian old wheat

---

---

\*Selection and peer-review under responsibility of the ECOMONDO

\*\*Corresponding author: e-mail: [salvosilletta@gmail.com](mailto:salvosilletta@gmail.com)

## 1. Introduction

Nowadays the term “Circular Economy” is the basis of any economic activity. (Achino et al., 2019; Ellen MacArthur Foundation, 2013). It is defined as an economy that is conceived to be able to regenerate on its own. In a circular economy there are two kinds of flows of materials: the biological ones that can be integrated in the biosphere, and the technical ones, whose value is destined to be enhanced without entering the biosphere (Cristina and Tassara, 2019). Circular economy is a system in which all the activities, starting from extraction and production, are arranged so that some waste becomes resources for someone else. So, in order for a food supply chain to follow the basic principles of circular economy and go toward a sustainable development, it is necessary to guarantee and control all the businesses, including institutional bodies that contribute to the production of a final good. They start from raw materials, from inputs, and get to the delivery of the product to the final consumer. Therefore, all these bodies are somehow interested in what happens in the supply chain, following a common goal that is the product placement on the market (Di Maria et al., 2017). The main strategy for transitioning toward circular economy is the “industrial symbiosis”, which is to say the interaction between the different industrial plants used to maximize the reuse of resources that are typically considered as waste (Lacy et al., 2016). A territory can boost its own environmental performances based on circular economy as well, by steering its productions in the direction of economy decarbonization, a better waste management, the implementation of sustainable tools in the existing productive process (Laraia, 2019). In the middle of the Mediterranean there are small minor islands where we can find great realities of industrial symbiosis, such as the Sicilian wheat supply chain that, despite the recent modifications in the phases of cultivation, transformation and commercialization, still has an important role not only for the produced level of income, but also for the employment that it is able to create through the different production segments.

Unlike all the other regions, Sicily stands out for the presence of a high number of first and second-stage transformation production unit and seed activity that have reduced dimensions and mainly operate by employing procedure with a medium-low technological content, or even traditional. There still are some active businesses of transformation with technologically inadequate plants and with medium-low potentialities, even though over the last years an effective adoption of process innovation, toward a 4.0 agriculture, has been recorded.

Mass tourism has a negative impact on several departments, especially in the environmental quality of landscape, air, water resources, soils' management with consequences on social factors among which overcrowding, urban uncertainty, traffic congestion ecc. In order to identify the negative impacts introduced by traditional tourism, we need to analyze three groups of issues: type of offer of the destination place, the possibility to benefit from the de-seasonal tourism, the available services on the territory. The objective of this analysis is to make a careful touristic programming, a planning of the offered services and experiences to attract a greater number of tourists in the site (Butler, 2006). Therefore, it is useful to carry out a careful preventive and conscious planning activity and management of the tourism industry, creating new incentives to encourage tourist toward more aware and sustainable behavioral changes. Sustainable tourism is a new kind of approach aimed at the economic growth of the area respecting the environment and the future generations. According to the world tourism organization, this new approach uses environmental resources in a conscious way, by preserving the cultural heritage and the traditional values of the area, maintaining a high level of tourist's satisfaction and promoting sustainable activities at the same time (Yunis, 2001). The European Charter for Sustainable

Tourism created in 1991 is among the priorities expressed by the Agenda 21 (Law 217, 1983), confirms the principles of the world charter for sustainable tourism of Lanzarote (Carta di Lanzarote, 1995). It aims at raising awareness about the safeguard of environmental resources for future generations and at creating an alternative model of management of the protected area that takes into account the environment's needs, the locals, the territorial economies and the visitors. This charter refers to all parks and reserves with an action plan that is sustainable at a tourism level. Tourism industry in Italy represents about a 10% of GDP and employs a 10% of workers. This industry is going toward the digital application that allows to access endless information fast: this is one of the tools sustainable tourism can count on (Hauksson et al., 2019). Ecotourism will also result in an increase in employment and new job opportunities, promoting as touristic destinations areas that are not well-known yet, through the adoption of renewable energies, sustainable mobility's tools, improvement of the protection of land and sea flora and fauna.

The objective of the Paper is to carry out a careful economic and environmental analysis of the possible strategies that can be implemented to reevaluate the territory of one of the smallest islands in Sicily full of unexploited natural resources through the cultivations of the ancient wheat of Sicily, an activity that has been abandoned in the smallest islands, since they are only employed in the great fields with the so called "Genetically Modified Organism" cultivations in order to optimize the production of the fruit of wheat itself. This way, with the biological techniques of wheat production, in the key of circular economy and sustainable development, that go through the whole supply chain, they create a specialty if that location with unique flavors and shape, also increasing the visibility of the island itself at an international level. Moreover, through a careful comparison between traditional and sustainable tourism the second objective is to overcome the old traditional idea of this industry, objective that can be achieved by using the cultivation of these ancient grains with 4.0 agriculture, creating something unique that can enhance the value of the territory itself. Eventually, with the implementation of the industrial symbiosis, we have the objective of the reuse of the production's waste with the transformation of waste in biomass as animal food in order to achieve the highest efficacy in terms of sustainable development.

## **2. Case study: Pantelleria Island**

Pantelleria is an Italian town of 7759 inhabitants, situated in the province of Trapani, in Sicily. The municipality covers the entire area of the island of Pantelleria which extends for over 80 km<sup>2</sup> and is located 110 km south-west of Sicily and 65 km north-east of Tunisia. The island is characterized by a great variety of fauna; in fact, in a few kilometers away it is possible to move from the sea to the mountains, from the hills to flat areas, from the beach to the cliff overlooking the sea. Sustainability has become a priority for the municipality of Pantelleria, in particular from the point of view of energy consumption. Through various European directives, in fact, it was possible to achieve objectives once unthinkable, we recall:

-EC Directive 9129 relating to the energy performance of buildings (EC Directive 91, 2002);

-EC Directive 3230 in terms of eco-design (EC Directive 32, 2005); and the European legislation in terms of vehicle efficiency. Moreover tourism, despite being one of the island's strengths, is not fully exploited due to a lack of awareness of the real value of the territory. From this point of view, it is possible to use a tool that can maximize market opportunities, and find key strategies usable to achieve a certain goal, this tool is called SWOT analysis (Table 1). It is needed to take into account the strengths, weaknesses, opportunities and threats of the third sector. Furthermore, SWOT analysis should not be seen as a static tool,

but should be used as a dynamic part of the management and development process. First of all, the main strength of the Pantelleria National Park is its enormous natural heritage, with the great biodiversity; another strong point is the autonomy of the island from different points of view, such as the waste collection system, the possibility of creating a local market based on traditional and characteristic products of the place. We have also to remember the European connections: a very large part of the island of Pantelleria, in fact, is part of the “National Park of the Island of Pantelleria” which every year receives funds to improve the offer of services and experiences for tourists. There are also some weaknesses such as the geographical position, or the very conformation of the island, which does not allow easy access to the coasts (Randazzo et al., 2019). One of the island's opportunities is the possibility of a great exploitation of renewable energy sources, from wind to the photovoltaic, or hydroelectric. With the use of this type of energy it is possible to reduce administration costs, or develop a new sustainable mobility system.

However, regarding the energy sector it is difficult to achieve excellent levels of energy efficiency, due to the dispersion of buildings on the island (Table 2). The PAES drawn up in 2013 by the municipality of Pantelleria shows the final consumption of the residential sector, they can be divided into: water heater 34%, refrigerators 14.6%, lighting 9.8%, electric stoves 8.7%, freezer 2.5%, washing machine 6.8%, air conditioning 1.9%, microwave 1.5%, iron 3.9%, electronic equipment 10%, dishwasher 3.1%, and the remaining 1.6% for other various applications (PAES, 2013). The increasing energy consumption over time is thought to be strictly linked to the obsolescence of the old electronic devices in the area, as well as to the widespread diffusion of new ones, but it is also due to changes in the demographic structure that lead to an increase in basic household consumption. The public administration had already proposed in 2009 certain programs aimed at limiting energy consumption.

**Table 1.** “ SWOT Analysis”

<p style="text-align: center;"><b>STRENGTH</b></p> <ul style="list-style-type: none"> <li>• Autonomy</li> <li>• European bonds</li> <li>• National park</li> <li>• Landscapes</li> </ul>	<p style="text-align: center;"><b>WEAKNESS</b></p> <ul style="list-style-type: none"> <li>• Geographic position</li> <li>• Few transport</li> <li>• Seasonal tourism</li> <li>• Bathing platforms</li> </ul>
<p style="text-align: center;"><b>OPPORTUNITIES</b></p> <ul style="list-style-type: none"> <li>• Third sector growth</li> <li>• Transport sector growth</li> <li>• Sustainable use of energy from renewable resources</li> </ul>	<p style="text-align: center;"><b>THREATS</b></p> <ul style="list-style-type: none"> <li>• Svaluation of the heritage</li> <li>• Brain drain</li> <li>• Lack of information</li> </ul>

**Table 2.** “Energy consumption of public buildings”, Island of Pantelleria

<b>Buildings</b>	<b>Surface (m<sup>2</sup>)</b>	<b>2009 consumption (kWh/m<sup>2</sup>)</b>	<b>Consumption after interventions</b>	<b>Variation (%)</b>
City Hall	1,833.8	47.5	40.8	-14.1%
D’Ajelli Elementary	720.0	25.7	24.3	-5.3%
Rekhale Elementary	391.0	47.5	42.7	-10.1%
Tracino Nursery	446.3	7.6	7.6	/
Kamma Elementary	336.7	34.5	32.3	-6.4%
Alighieri Secondary	2,836.0	22.6	21.2	-6.3%
Salibi Elementary	307.9	15.5	15.5	/
Salibi Nursery	362.1	25.1	19.18	-24.5%

Moreover, looking to the data provided by the PAES, it can be seen that the town hall is one of the buildings with the lowest energy performance (with a size of 1833.8 m<sup>2</sup>), with a consumption of 47.5 kWh/m<sup>2</sup>, following the Recale primary school, despite its smaller dimensions (391.0 m<sup>2</sup>). For what concern private homes, the overall energy requirement classified by year of construction of the buildings is decreasing consistently (Table 3), and this shows the difference between those of the old and the new generation, ranging from 280 MWh/a to 26 MWh/a.

**Table 3.** “Energy needs of buildings by year of construction”, Island of Pantelleria

<i>Construction period</i>	<i>Energy Requirements (MWh/a)</i>
Before 1919	280
From 1919 to 1945	331
From 1946 to 1961	252
From 1962 to 1971	129
From 1972 to 1981	115
From 1982 to 1991	40
From 1992 to 2001	26
From 2002 to 2009	76
From 2010 to 2020	77
<b>TOTAL</b>	<b>1325</b>

In the Pantelleria National Park there are different types of structures dedicated to the tourism sector: it is estimated that there are about 2141 accommodations in 2009, today there are more than 2344 structures, the residences count a number of 1745 lots and there are about 1800 beds in hotels, with a prevalent seasonal tourism (Pickton and Wright, 1998). Lately the problems relating to the management of energy resources have assumed a central role in terms of sustainable development, that's because the set of services that energy provides is a necessary component for development, and also because unresponsive management of energy it is among the main causes of the negative effects on the environment and on the stability of climatic conditions. Between other environmental impact indicators it's possible to include greenhouse gas emissions; in reference to them, in fact, there is a strong consensus on continuing in three directions: Greater efficiency and rationality in the final uses of energy; Innovative, cleaner and more efficient ways of using and transforming fossil fuels, the energy source that still prevail; and an increasing use of renewable energy sources. In particular, the well-known “energy and climate package” is recalled, in this document Europe:

- signs an EU target to reduce greenhouse gas emissions by at least 20% by 2020 compared to 1990, regardless of any international agreements;
- highlights the need to increase energy efficiency in the EU in order to reach the EU energy savings target of 20% compared to the 2020 projections;
- reaffirms its commitment to promote the development of renewable energies through a binding target that foresees a 20% share of renewable energies in the total EU energy consumption by 2020.

The Pantelleria National Park is an area of considerable naturalistic-environmental interest for various reasons including the position in the Strait of Sicily, the geomorphological characteristics of the territory, the various floristic and faunal aspects, the lava landscape that has been modeled thanks to the millennial anthropogenic activities; the island, however, as already mentioned, is located along the main migration area between Europe and Africa in western Sicily (Contribution of the Council, 2007). The Park represents a scientific destination of worldwide appeal thanks also to its geological equipment, In fact,

it is possible to remember the active volcano in a quiescent phase and all the phenomena of secondary volcanism, including saunas and sulphates, or the many thermal springs scattered along the coast. The Pantelleria landscape is also characterized by a large network of paths that connect the whole island, ranging from the flat areas to the woods, and to the sea, combining naturalistic, geological and thermal destinations. Thanks also to the mild climate, Pantelleria has a potential for a 365-day tourist season. The typical house is the “Dammuso”: a traditional architectural element of the area that is built with lava stones, with a typical domed roof. Between the other typical architectural elements there are the terraces and gardens. Alongside other minor sites, including those under the sea, the island's historical heritage also includes: the prehistoric settlement of the Sesi; the Punic - Roman Acropolis of S. Marco and S. Teresa; the vandal village of Scàuri. In the hinterland it is necessary to highlight the typical *magasèni* (rural cellars) and the variety of land products, including the “Cappero IGP”, unique in the world, and the famous “Moscato di Pantelleria”. Regarding the eno-gastronomic offer, it is formed by various typical dishes, such as kuskus and Pantelleria ravioli, stuffed squid, local pesto, *bacio pantesco* and ecc. The business sector is very fragmented, there is a high dispersion on the territory and it is mainly composed of small artisan companies in the form of individual companies. Among the main agricultural activities there is certainly viticulture, it is estimated that activities of this type are located on over 500 hectares of the island (Office of the Deputy Commissioner, 2009). The largest companies make up the 8% and own land of about 3 hectares each (D’Aietti and Cucci, 2015).

### 3. Materials and methods

The ancient grains of Sicily are varieties that were used until 50 years ago. But the introduction of fertilizers to optimize the yield of the crop, the intensive cultivation and the standardization of the production process have caused that the main characteristic of the ancient grain, the long stem, disappeared to make room for a grain with a shorter stem but with more fruit, this phenomenon was speeded the human intervention selected the wheat by cutting the longer ears.

With the technological and industrial development the problem of industrial waste grows more and more, and the best solution is recycling (Topçu and Günçan, 1995). The ancient grains have nutritional substances no longer present in modern grains that make it better both in an empirical and cultural sense, for this very reason many Sicilian and Italian entrepreneurs are investing more and more in relaunching ancient wheat because it is possible to lead companies to a circular economy where the agricultural waste or the stem are used to create biomass to be transformed into energy for sustaining the cultivation. The ancient grains are more adaptable to environmental conditions and in the hilly areas they are easier to grow. Also in the past (but still today) the wheat stem is used to make hay and become animal feed therefore exclusively dedicated to animal husbandry, while now it is more important to use biomass to produce energy with current systems even if the dedicated biomass in animal husbandry has important beneficial properties.

Biomass energy is, perhaps, one of the most controversial types of alternative energy currently used. The advantages of energy from biomass are different. First of all, biomass energy is a renewable resource. Secondly, it reduces the dependence on fossil fuels and is a carbon neutral resource: that is, it does not produce excess carbon dioxide during its transformation. Furthermore, organic waste in the form of leaves, grass and trees, but also animal carcasses and their excrement are available in abundance and can be used to produce energy (Caputo et al., 2005). This is a possible way of using waste because if it is not used to produce electricity, it increases the amount of waste in landfills. It therefore helps to reduce

waste and waste management. Huge quantities of solid waste are created that can be classified as biodegradable, recyclable, but also dangerous toxic waste. Finally, biomass can be useful to create different products from different forms of organic material: it can be used for the production of methane gas, biodiesel and other biofuels or directly in the form of heat or electricity (Hoogwijk et al., 2003).

F.lli Vescera l.t.d is a baker company that produces bread, pasta, biscuits and all grain related products. It is a very important company in the primary sector in Sicily, one of the first to invest in ancient grains, in fact all its products are made with these particular species of wheat and this leads to a slightly higher price level with higher qualities. It is also a vertically integrated company, as it is the one that produces the main input, wheat. The F.lli Vescera l.t.d. was born in 1890 characterized by its bread made with a wood-fired oven located in Carlentini. Later the company replaced the wood oven with the electric one with the aim of concentrating on the quality of the grain and therefore the use of ancient wheat. The last challenge, in fact, by Francesco Vescera (owner) is to bring the ancient Sicilian grains back to life by collaborating both with the universities and with other research organizations. The grains that are made in the Mediterranean with different climatic characteristics, give a variety of grains such as: Majorca, Il Russello, the black of the Madonie, the Tumminia, the Martinella, the black buffalo, the black Scorza and the bidet which are all produced by the company with relative products of every kind of grain. All these are produced by the company itself in Pantelleria, Mozia, Libertina, New Chain and the Madonnines and Ustica. Pantelleria has been chosen because this year the pet-climatic characteristics have been favorable so that the grain will enhance its quality. Various seedings have been made at different heights on the site of Pantelleria realizing that at each height the grain has different empirical and physiological qualities. In addition, the grain was sown in a natural way without additives and fertilizers of any kind for 100% organic. The production cycle is established based on the nutritional qualities of the grain; the first phase consists in hand-cleaning the grain or through an automatic cleaner, from this it passes to the milling and becomes flour or semolina according to whether it is soft wheat or durum wheat, based on the quality of the post-milling result the transformation processes begin to make flour or semolina into finished products, namely pizza, pasta, biscuits.

The main suppliers are the farmers who produce and supply the grain, the primary products are purchased by various companies, the choice of purchase is based very much on quality but also on economic convenience, the company where F.lliVescera l.t.d. is supplied is the unigroup, finally another supplier can be the fruit and vegetable market where it is possible to take fresh food at km 0.

#### **4. Results and discussion**

After analyzing the entire agricultural sector, and both the territorial and climatic characteristics of the island of Pantelleria, we came to the conclusion that by integrating the cereal culture with the technological innovations of agriculture 4.0, Sicilian agriculture is facing a moment of transition from which can only innovate.

Between the innovations that can give the most added value are:

- Biostimulants are attracting companies and farmers attention. That's because they can play an important role in protecting crops from the effects of climate change while offering higher quality products.
- The use of a non-linear seeder that arranges the seeds in a checkerboard pattern in order to minimize the spaces between the plants and obtain greater quantities from the least possible space.

- The implementation of sensors in tractors that allow us to scan the soil at different depths obtaining various information such as texture, to measure the amount of biomass in the soil and the vegetal vigor of plants.

- Digital innovation in agrifood that can guarantee competitiveness in one of the key sectors for the Sicilian economy.

Agriculture 4.0 on the one hand can reduce the costs of producing high quality products, on the other hand it can increase revenues thanks to greater recognition or guarantee that comes from anti-counterfeiting systems or the reduction of non-compliant products exported. But digital innovation also allow to intervene in support of the entire supply chain, guaranteeing sustainability to all actors in the sector, including production in the field, creating a uniqueness that re-evaluates the territory itself. Furthermore, through the implementation of industrial symbiosis along the entire agri-food chain of the Pantelleria island, we can achieve efficiency in terms of reuse and recycling of wastes from the supply chain. Starting from the grain wastes, you can make hay that will be given to the animals which will then create the fertilizer.

**Table 4.** “The agricultural sector 4.0” (Osservatorio Smart Agrifood)

<i>Production</i>	<i>Transformation</i>	<i>Distribution</i>	<i>Consume</i>
-Land and machinery sensors -Drones -Satellite images -Decision supports system	-Quality control sensors -Big Data Analytics -Dematerialization Systems -Integrated traceability	-Logistics optimization systems -E-commerce platform and food delivery -Blockchain	-Smart labels -Waste reduction sensors -Meal kits -Big Data Analytics

## 5. Concluding remarks

This study has made clear how today it is necessary to follow the path of the technological sustainable development in order to keep alive one of the most important sectors such as agriculture, both in terms of turnover and tradition.

## References

- Achino T., Antinori L., Bongiovanni T.E., Calogero C., Di Leo A., Gallo A., Langone S., Lo Gozzo L., Mariani L., Marazzita M., Milani C., Moratti M., Podestà M., Rigotti S., Tatarella G., (2019), *Obiettivo economia circolare, Green Economy Report*, Golfarelli Editore International Group, Bologna.
- Butler R. (Ed.), (2006), *The Tourism Area Life Cycle, Application and Modification*, Volume 1, Channel View Publication, England.
- Caputo A.C., Palumbo M., Pelagagge P.M., Scacchia F., (2005), Economics of biomass energy utilization in combustion and gasification plants: effects of logistic variables, *Biomass and Bioenergy*, **28**, 35-51.
- Carta di Lanzarote, (1995), Carta per un turismo sostenibile, Conferenza mondiale sul turismo sostenibile, On line at: <http://www.aitr.org/wp-content/uploads/2014/04/carta-di-Lanzarote.pdf>.
- Contribution of the Council, (2007), Contributo del Consiglio "Energia" al Consiglio europeo di primavera del 2007, Conclusioni del Consiglio Europeo di Bruxelles, 8 Marzo 2007, 6453/07, 12.
- Cristina I., Tassara F., (2019), Economia Circolare Verso un nuovo paradigma di sviluppo economico sostenibile, CSR Piemonte, On line at: <https://www.csрпиemonte.it/comunicazione/dwd/economia-circolare-2019.pdf>.
- D’Aietti G., Cucci G., (2015), *Pantelleria. L’Isola di Terra*, Il Pettiroso (Trapani).
- Di Maria E., De Marchi V., Blasi S., Mancni M., Zampetti G., (2017), L’economia circolare nelle imprese italiane e il contributo dell’industria 4.0, Legambiente e Legambiente e laboratorio



- manifattura Digitale, Padova, On line at:  
[https://www.economia.unipd.it/sites/economia.unipd.it/files/Rapporto\\_economicocircolare\\_industria4.0\\_Legambiente\\_LMD\\_2.pdf](https://www.economia.unipd.it/sites/economia.unipd.it/files/Rapporto_economicocircolare_industria4.0_Legambiente_LMD_2.pdf).
- EC Directive 91, (2002), Directive 2002/91/EC of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings, *Official Journal of the European Communities*, **L 1/65**.
- EC Directive 32, (2005), Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005, establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council, *Official Journal of the European Union*, **L 191/29**.
- Hauksson K., Liscia R., Antonelli C., Greco S., (2019), Il futuro del turismo sostenibile, innovativo, digitale, Conferenza stampa di presentazione della Borsa Internazionale del Turismo, On line at: <https://www.lifegate.it/futuro-del-turismo-sostenibile-digitale>.
- Hoogwijk M., Faaij A., Broek R., Berndes G., Gielen D., Turkenburg W., (2003), Exploration of the ranges of the global potential of biomass for energy, *Biomass and Bioenergy*, **25**, 119-133.
- Lacy P., Rutqvist J., Lamonica B., (2016), *Circular Economy dallo Spreco al Valore*, Egea S.p.a., Milano.
- Laraia R., (2019), Il supporto alla transizione all'economia circolare, *Ecoscienza*, On line at: [https://www.arpae.it/cms3/documenti/\\_cerca\\_doc/ecoscienza/ecoscienza2019\\_1/il\\_supporto\\_alla\\_transizione\\_alleconomia\\_circolare.pdf](https://www.arpae.it/cms3/documenti/_cerca_doc/ecoscienza/ecoscienza2019_1/il_supporto_alla_transizione_alleconomia_circolare.pdf).
- Law 217, (1983), Legge 17 Maggio 1983, n.217 "Legge quadro per il turismo e interventi per il potenziamento e la qualificazione dell'offerta turistica", *Gazzetta Ufficiale*, n. 141 del 25 maggio 1983.
- Ellen MacArthur Foundation, (2013), Towards the circular economy, economic and business rationale for an accelerated transition, McKinsey &Company, New York, On line at: <https://www.ellenmacarthurfoundation.org/assets/downloads/publications/Ellen-MacArthur-Foundation-Towards-the-Circular-Economy-vol.1.pdf>.
- PAES, (2013), Piano d'azione per l'energia sostenibile del Comune di Pantelleria, On line at: [https://mycovenant.eumayors.eu/docs/seap/3253\\_1364296900.pdf](https://mycovenant.eumayors.eu/docs/seap/3253_1364296900.pdf).
- Pickton D.W., Wright S., (1998), What's SWOT in strategic analysis?, *Strategic Change*, **7**, 101-109.
- Randazzo M., Gulisano E., Puleo R., Parisi A., Della Gatta C., (2019), Territorial and ambiental retraining of Pantelleria's island in a circular economy view: implementation of renewable energy sources as economic improvement, *Procedia Environmental Science, Engineering and Management*, **6**, 237-244.
- Topçu I.B., Günçan N.F., (1995), Using waste concrete as aggregate, *Cement and Concrete Research*, **25**, 1385-1390.
- Office of the Deputy Commissioner, (2009), Ufficio del commissario delegato, Relazione paesaggistica, Disposizione commissariale n.230/2009, 11 Febbraio.
- Yunis E., (2001), *Sustainable development of Tourism*, Madrid, Ottobre, 4-5.