DESIGNING SUSTAINABILITY FOR ALL

Edited by Marcelo Ambrosio and Carlo Vezzoli

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Designing sustainability for All was a call for contributions and actions to the whole world design community, which is not limited to design researchers, design educators, and design practitioners but also unites other disciplines such as architecture, engineering, economy, policy-making, and sociology.

The Conference has been a unique event hosted simultaneously in Mexico City (Mexico), Curitiba (Brazil), Cape Town (South Africa), Bangalore (India), Beijing (China) and Milan (Italy), on 3rd-5th April 2019. In fact, in each of the 6 venues, it has been possible to listen to any of the presentations happening in the other ones.
LENSIN PROJECT

LeNSin, the International Learning Network of networks on Sustainability (2015-2018), is an EU-supported (ERASMUS+) project involving 36 universities from Europe, Asia, Africa, South America and Central America, aiming at the promotion of a new generation of designers (and design educators) capable to effectively contribute to the transition towards a sustainable society for all.

LeNSin ambitions to improve the internationalisation, intercultural cross-fertilisation and accessibility of higher education on Design for Sustainability (DfS). The project focuses on Sustainable Product-Service Systems (S.PSS) and Distributed Economies (DE) – considering both as promising models to couple environmental protection with social equity, cohesion and economic prosperity – applied in different contexts around the world. LeNSin connects a multi-polar network of Higher Education Institutions adopting and promoting a learning-by-sharing knowledge generation and dissemination, with an open and copyleft ethos.

During the three years of operation, LeNSin project activities involve five seminars, ten pilot courses, the setting up of ten regional LeNS Labs, and of a (decentralised) open web platform, any students/designers and any teachers can access to download, modify/remix and reuse an articulated set of open and copyleft learning resources, i.e. courses/lectures, tools, cases, criteria, projects.

LeNSin will also promote a series of diffusion activities targeting the design community worldwide. The final event will be a decentralised conference in 2018, based simultaneously in six partner universities, organised together by the 36 project partners form four continents.
THE LENS CONFERENCE

The Conference is the 3rd edition of one of the largest design international conferences for lecturers, researchers, professionals, and relevant institutions and organizations. It has become a reference event where experts from all over the world get together to present and share their knowledge, projects, tools, and visions to diffuse sustainability for all.

The Conference is organized as a part of the LeNSin, the International Learning Network of networks on Sustainability project (2015-2019, EU funded Erasmus+ program) that aims to be both visionary and pragmatic, and to stimulate new ways of thinking.

The scope is to share the latest knowledge and experiences around the concept of sustainability for all.

This will be achieved through cross-fertilizing a wide range of disciplines: predominantly design, but also engineering, economy, policy-making, and sociology.
LENS MANIFESTO

A new ethos for a design community: towards an open source and copy left learning-by-sharing attitude/action.

We, the undersigned, aware of both the urgent changes required by sustainable development, the potential role of design (and design thinking) in promoting system innovation in the way we produce, consume and interact, as well as the opportunities offered by the ever more interconnected society, propose the adoption and diffusion of a new ethos within a worldwide design community:

To view design as a unique multi-polar learning community promoting, enabling and activating any possible learning-by-sharing process aiming at effective knowledge osmosis and cross-fertilisation in design for sustainability in an open and copy left ethos.

We, the undersigned, commit our selves in such an ethos, trying our best to apply this in our daily life as individuals or representatives of institutions in the design community.

In relation to our competencies and possibilities we will make our acquired knowledge to be, as far as possible, freely and easily accessible in a copy left and open source modality (while safeguarding our authorship and scientific recognised publication activity), that enable others in the design community to acquire them free of charge, with the possibility to replicate, modify, remix and reuse, through e.g. adopting creative commons licences.

As researchers, this knowledge includes our acquired research knowledge base (e.g. papers, books, etc.) and knowhow (e.g. methods and tools).

As educators, this knowledge includes our educational resources (slideshows, texts, video of lecture, educational support tools, etc.)

As designers and design thinkers, this knowledge includes the design for sustainability concept proposal of products, services, systems and scenarios, as well as a knowhow they used to design them.

We commit our selves to seek the commitment of other individuals or institutions in such an ethos within the design community. In relation to our competencies and possibilities we will:

do our best to commit individuals such as researchers, educators, professional designers and design thinkers as well as institutions such as research institutions, design schools, and designer’s associations to adopt the same ethos

do our best to generate and/or enable open learning networking of sustainability of design researchers, design educators, professional designers and design thinkers.
4. SYSTEM AND CIRCULAR DESIGN FOR SUSTAINABILITY
ABSTRACT

This paper is about the relationship between design and the prickly pear of Roccapalumba (Sicily), a product of the agrifood chain, considering it as a resource able to start innovative strategies for waste recycling and for a sustainable local economy.

The study examines the entire life cycle of prickly pear and, among the various outputs, considers the cladodes to obtain cellulosic fibres, mucilage for cosmetics and for restoration of cultural heritage, the flowers for infusions and the fruit seeds for an oil with nutraceutical properties to generate a second life of the prickly pear. This will lead to economic and environmental benefits in the territory, creating a network of companies with zero waste.

Key Words: Design, agrifood, circular economy
1. INTRODUCTION

This study is about the relationship between design and the agrifood chain of a territory to promote a sustainable local economic development.

The article examines the prickly pear cactus of Roccapalumba (Valle del Torto) and considers it, as well as for its organoleptic and nutritive qualities, also as a resource able to start collaborations and innovations within the Sicilian territory, to enhance the relationship between local actors and synergies between disciplinary areas belonging to different areas, and improve the waste management. The study examines the entire life cycle of prickly pear and among the various outputs considers the cladodes (commonly called shovel of prickly pear), the flowers and the seeds of the prickly pear fruit to generate a second life of the prickly pear.

The methodological approach follows a systemic vision focusing on the relationship between the actors of a territory and the territory in which they live, and is based on Systemic Design that contributes to the development of a circular economy (Cradle to Cradle). With this methodological approach we move from a production chain of the linear prickly to a system (output of a system becomes input for another), using the cladodes to obtain a wood fiber, the flowers for infusions and the seeds of the fruit for the oil with nutraceutical properties.

This interdisciplinary approach is fundamental to implement a systemic vision that can link the various activities through the recovery and the use of by-products of a supply chain in other productive fields and make the system zero waste. The research involves actors, researchers and SME who are interested in experimenting with innovative products related to the fruit of prickly pear and its by-products.

Interdisciplinarity and the involvement of various actors highlights the role of the design as mediator to achieve results that will demonstrate how the waste of a local resource can be transformed to develop new supply chains. These new supply chains will bring economic repercussions on the territory and with a focus on respect for the environment.

This paper is divided in two parts one about the design applied to the territory and the other on the investigation of the role of the application to agrifood sector of the Systemic Design methodology in order to generate a development of the local economy.

2. METODOLOGY

The aim of the research is to explore sustainable design practices related to zero waste of the prickly pear and the benefits that can be gained from implementing a circular economy, not only to the environment but also in economic local development.

Prickly pear cultivation is important for symbolic, historical, and territorial reasons and its study is analysed through, innovative productive techniques in order to increase consumption and to reduce disposal problems.

To do this, it is necessary to review the process that involves the entire prickly pear life cycle. So, through redesigning the processes of production, transformation and marketing of the prickly pear, it is possible to start virtuous processes of innovation and valorization within the local territory, favouring its economic development with greater attention to environmental resources.

In fact, it is important to review the process from the production of the prickly pear to its distribution on the market, passing it from a linear to a circular production.

Circular economy employs principles from industrial ecology, reuse, repair, and recycling of the materials and products. In industrial ecology the goal is to reduce resources consumption, pollution in the environment and industrial metabolism refers of industrial systems that act as natural ecosystems (Ayres,1989). Circular economy is an industrial economy that reproduces nature, optimizing the systems and following principles from nature (Ellen MacArthur Foundation, 2015)

This research shows prickly pear as a resource that, if redesigned according to the Systemic Design approach (Bistagnino, 2009) can identify new production chains that can interact with existing activities.

This methodology allows to design the flow of material and energy, transforming the outputs of one process into inputs for another, eliminating the linearity of the current production chain that generates waste, with the possibility of creating new value chains at the local level (Barbero, 2012)

This analysis clarifies the origin of what happens in all the processes, considering the inputs and outputs, the resources used for the transformation of waste and their final destination.

Furthermore, to understand the relationship between the parties involved and the context it is fundamental to identify the actors involved in the system, and their know-how.

To this end, research through the methodology of the systemic approach, investigates the production, processing and marketing of prickly pear with respect for the environment to generate local economic development. To achieve this goal, the phase of analysis of the production of prickly pear has used the methods and tools of Cycle Design (LCD). The study is based on a historical-cultural study of prickly pear, following which the production processes and the techniques used for cultivation and distribution were considered, highlighting where it is possible to make a redesigning intervention to move to a circular production.

Furthermore, the study is based on a real case developed with the support of local producers that have made the designed solutions feasibility.
3. DESIGN AND LOCAL DEVELOPMENT

The design, in the past few years, has play a role in production systems and innovative models for the management of territorial resources. In fact, design has broadened its scope of action and can play a crucial role in the development of a territory, offering solutions for the growing demand of competitiveness, and creating new products and services. This is demonstrated by how the relationship between design and territory has been explored in the discipline of design, defining and bringing the succession of three different approaches (Parente, Sedini, 2017): “design in the territory”, “design of the territory” and “design for the territory”. Design, as propose Tim Brown (Cicoria, 2013), it has become an asset in any product or service in the market and a strategic tool in the landscape of innovation. Today Design is confronted with territorial, social and economic characteristics in the place in which it operates, and highlights those aspects that help to build a production identity in a specific territory.

Within of a territory, among his elements of identity other than natural and cultural heritage, there is also, agrifood which represents a primary good, a means of expression of community’s traditions, a source of well-being and health and a symbolic element of socio-cultural and of identity.

In order to launch innovation processes with the goal of environmental sustainability, it is crucial to put the focus on the potentiality of territories based on the transformation of existing, economic, human, cognitive and cultural resources and role that different players of a territory. More specifically, to do that, is important to adopt an interdisciplinary approach where know - how, cultures, and techniques related to innovation can answer to new changes of cultural, social and economic paradigms.

The aptitude to power the typical resources, which is no possessed by others, is presented as competitive opportunity and change is determining factor in the fame of the place.

This suggests that design is becoming increasingly important in the field of innovation. It is becoming indispensable in the design process of any product or service, shifting its focus from the mere design of the product to the whole process and exploring new business models (Brand, Rocchi, 2011).

4 .ANALYSIS ABOUT PRICKLY PEAR

The prickly pear (Opuntia ficus indica), is a member of the Cactacee family, originating from Mexico and distributed in America, Europe and Africa for the production of fruit, forage or vegetable. In Sicilian production and distribution areas, located in the San Cono Hills, South-West of Etna, Belice Valley, the Valley of Torto and to Roccapalumba in the province of Palermo, and that in 2009 established the consortium of producers of prickly pear, ‘Roccapalumba and its flavors’. The bark of the prickly pear is composed of cladodes (commonly called pads) that branch in a tree-shaped. The cladodes form the stem of the plant, this stem is naturally modified to retain water. Cladodes contain water, carbohydrates and fibres, mucilage, proteins, minerals and a moderate amount of vitamin A and C. Scientific literature recognizes cladode components for use in the pharmaceutical, herbalist and cosmetic fields. The prickly pear after hand - picking is packed in cardboard boxes, the fruit and the inside of the skin, are used for the production of beverages, jams, mustards and a variety of food products From study of the cycle of production of the prickly pear among the various outputs considers the cladodes, the flowers, mucilage and the seeds of the prickly pear.

5. NEW PRODUCTS FROM OUTPUTS OF PRICKLY PEAR

This study examines the outputs of the prickly pear: flowers, seed, mucilage and cladodes. Opuntia ficus indica flowers for the decoctions and infusions can be destined to the herbalist’s shops while, as regards to the seeds that are an output from fruit is extracted an oil that represent an interesting cactus by-products. In fact, this oil has nutraceutical properties that is rich in polyunsaturated fatty acids and vitamin E content. These compounds are responsible of the antioxidant and hypoglycaemic effect mediated by the inhibition of carbohydrate-hydrolyzing enzymes. Health benefits of fruit and vegetables came from additive and synergistic combinations of phytochemicals. (Am J Clin Nutr 78: 517S-520S). In this context Opuntia ficus-indica seed oil represent a promising source of healthy compounds useful not only as antioxidant to preserve lipid components in food preparation but also as functional ingredient due its hypoglycaemic effect. The scientific results on the seed oil for human nutrition, have been developed, with the collaboration of a research team made up of chemists, biologists and pharmacists of the University of Palermo, Reggio Calabria and Marche, and can be added to the best known use for cosmetics.

Mucilages of Opuntia are compounds of great potential to be applied in different fields, such as conservation of cultural heritage, pharmaceuticals, cosmetics, foods and biodegradable polymers. Mucilage is a polysaccharide generally composed by varying proportions of l-arabinose, d-galactose, l-rhamnose, and d-xylose, as well as galacturonic acid (Sáenz C. et al., 2004), and it tends to be negatively charged (Gibson and Nobel, 1990). Thanks to its natural viscosity, its ability to form molecular networks that are able to retain large amounts of water (Saag et al., 1975), and its capability of forming gels in water, mucilage can be used for the development of bio-based innovative products, like additive and organic binder to improve the mechanical properties of materials used for the conservation of cultural heritage or as an alternative for producing added-value industrial polysaccharide gums. For example,
in Mexican historical buildings nopal juice extracted from Opuntia spp. is often incorporated in lime mortars \([\text{Ca(OH)}_2]\), it works as an organic adhesive that prevents the mortar from drying too quickly and helps to retain the necessary amount of moisture, transporting CO2 from the atmosphere that combines with the lime to form an artificial limestone, using the juice as an organic adhesive to restore and protect historical buildings (Cárdenas A. et al. 1998).

The cladodes, that come from the pruning serves to ensure the propagation of cuttings and the preparation of soil for new production, the remaining part decomposes due of the water present in the cladding, thus wasting the wood fibre within them that could be a resource. In fact to obtain the vegetable fibre it is necessary to extract it and to dry it at open air; the extraction procedure is manually carried out by the green cladodes. This extraction process is under patent phase; the extracted fibre (Figure 1) has a complex, texture and thanks to its plasticity, such as wood, it allows steam treatment or immersion in hot water at a temperature between 30 and 40°C, in order to take the shape of the mold. The natural fibre obtained from the cladode waste, has led to a return to manual work in the process of product realization. Through this approach design can to coexist with local craftsmen who propose, artifacts that reveal a material and immaterial heritage. The embroidery was chosen to be used, where necessary, as an element of union of decoration and identity, thus bring back a local tradition (Figure 2). The embroidery, together with the art of processing, are the elements for a new dialogue between craftsmanship and design, which focuses on the identity of a territory through a new resource obtained from a waste. The project and context become inseparable, and the project and production activity are in close contact with the collaboration of the artisans from the Valley of Torto.

The prickly pear fibre was applied to make a basket to carry, expose, and contain the prickly pear (Figure 3). For the production of the basket prickly pear fibre was used, the olive branch for the handle and the embroidery to join and decorate the parts that make up the basket.

Then the approach of Systemic Design has allowed to identify new productive chains that have led to the creation of the Bio-ecopuntia srl company. From the cladodes the Bio-Ecopuntia company is able to extract three natural elements: nopal powder, to be used as a food ingredient gluten-free, the natural liquid to be used in the pharmaceutical and cosmetic sectors, and the wooden lattice to be used as vegetable fibre; the cuticle (the external layer of the cladode) can be used as fertilizer or as food for animals. It is also possible to dry the flowers and to use them as phytotherapeutic products (Figure 4).

![Figure 1] Prickly pear fibre

![Figure 2] Prickly pear fibre and embroidery

The design a basket, as a first artifact, came from the necessity to expose and contain prickly pears during the XVIII edition of Opuntia-Ficus Indica Fest, Sagra del Ficodindia (Prickly pear Festival) in Roccapalumba.

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6. OUTLOOK AND CONCLUSION

The results show that from output prickly pear there are some potentialities within the project and which could be further developed (Figure 5):

**Opuntia ficus indica seed oil**
Actually used in top cosmetic products and beauty treatments, the Opuntia ficus indica seed oil could be shortly be produced for applications well beyond cosmetic, to become a new ingredient in nutraceutical, food supplement, sport drink and food.

**Opuntia ficus indica flowers**
Opuntia flowers used as medicinal plant are astringent and are used for problems of the gastro-intestinal tract, colitis and irritable bowel syndrome. This flowers could be more valued as decoctions and infusions.

**Packaging**
Packaging to enhance and distribute Opuntia ficus indica seed oil and Opuntia ficus indica flowers for the decoctions and infusions. This packagings, certainly, to reduce environmental impact will be design following certain guidelines to reduce environmental impact: single material to facilitate the separate collection, recovery, recycling or composting in end of life, used recycled and further recyclable material, to extend the useful life of the product by integrating new function coherent with the intended purpose of use.

**Vegetable fibre extracted from cladodes**
The design of the basket to contain prickly pear marks the beginning for the development of different products.

The results show that, turning these outputs into resources for the territory will give new opportunities for local development economic. If we exploit the territorial resources we may boost a type of development that favours the local dimension and will allow to produce, supply and generate autonomously.

To conclude the study shows, through the Systemic Design and the multidisciplinarity, the role of mediator of design to achieve results that demonstrate how the waste of a local resource can be transformed to develop new supply chain as: the possibility of designing new packaging to enhance and distribute prickly pear flowers decoctions and infusions and Opuntia Ficus Indica seed oil in the nutraceutical sector. It is possible to see a new path made by the interaction between design and craftsmanship development, that starting from a new local renewable material, and other products is able to bring innovation in the tradition.

**BIBLIOGRAPHY**

North Carolina, USA: Lulu Enterprises, Inc, Raleigh.


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