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SYSTEMIC DESIGN GOES BETWEEN DISCIPLINES FOR THE SUSTAINABILITY IN FOOD PROCESSES AND CULTURES

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Keywords: Systemic Design, sustainability, food processes

Abstract: An healthy and safe feeding is the key element to ensure a sustainable development for the entire planet. The theme of food is one of the major challenges for the near future, indeed it involves every aspect of our lives. The paper investigates how the Systemic Design approach applied to the food sectors can contribute to decent life and, better, well-being for all, maintaining the planets ecological capacity for future generations.
This research shows the social, economical and environmental benefits generated to real cases that apply the Systemic Design methodology in different food sectors and in different local context. One case is "EN.FA.SI.", in which the value chain related to one PGI bean endorses the entire area involving the small family producers and the local SMEs. The other one is "Fondo Noir", in which the spent coffee ground from the coffee bars in the metropolitan city centre are collected in order to generate many new businesses.
The purpose is to give empirical and theoretical contributions, arising how the complexity of food systems impacts the simplicity of the everyday life solutions. The complexity involved in that kind of design processes interested a wide range of players and it aims to contribute the scientific debate on the role of design as mediator and facilitator among different specific disciplines. The polytechnic culture, at the base of design disciplines, guarantees a model for the eco-innovation also in food sector, with strong and solid approach.

1. Introduction

An healthy and safe feeding is the key element to ensure a sustainable development for the entire planet. The theme of food is one of the major challenges for the near future, indeed it involves every aspect of our lives: a correct behaviour in relation with the territory means respect for ourselves and our health.
The environmental sustainability related to the complex system of food involves the entire food's life cycle and every stakeholders who takes part in it. That includes food's production, transformation, conservation, transport, direct sell to the final consumer, consumption habits and disposal (Figure 1).
In food production phase, the hegemony of intensive farming and livestock have caused huge social, ethic and environmental debates (Shiva, 1993), like the consideration for animals and ecosystem exploitation, workers' rights defence and care of consumers health. These needs of huge amount of food force some risky adulteration in production, like the massive use of chemical pesticides or the use of organisms genetically modified, with the consequences related to the food security.
The market request for ready-to-eat, long-lasting meals has determined the actual food processing system. Frozen, long-lasting and freeze-dried meals are worldwide sold in supermarkets, one of the social consequences is the lost of cultural and geographic peculiarities. The transformation fakes and flattens out the appearance of the food that everybody eats. Food's flaws disappear and it's not that rare to get to the phenomena of sophistication and food fraud. Other aspects to be considered in the

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transformation phase are the high level of industrialization in all the processes, with great attention in the sanitation of food (Collins, 2010), that is not bad from itself but should be managed in a sensitive way in case of high migration fluxes like nowadays.
Processed foods are moved among the five continents following fixed roads defined by a highly vertical distribution system. In order to assure to the food a fictitious freshness and a good shape despite the long time and space transportation, sophisticated systems are required. In that situation, the large-scale distribution has a big power.
For sure, the consumer has a crucial role because decides what to eat and consequently what the food system should produce. The main problems related to the consumption phase of food are the loss in the perception of food seasonality, and in the culinary traditions, furthermore people are asking more and more for low-cost food. At global level the contradiction between obesity and malnutrition should be faced in a long term and serious programme for the health and wellbeing of local communities.
Last, but not least, is the disposal phase: every year one third of the food intended for human consumption is thrown away. The struggle against food waste and losses is one of the challenges of this century.
The change in human diet habits can have the power and the responsibility to modify the entire system. The increase of awareness in the personal food and nutritive choice will lead that change. A great possibility consists in the promotion of new behaviours and new model of consumption: re-discovery the culinary practices of waste reuse, well known to the previous generations, it becomes essential to create new ethical systems to share the nourishment in excess as well as to avoid upstream the food over-production.
The paper investigates how the Systemic Design approach applied to the food sectors can contribute to decent life and, better, well-being for all, maintaining the planets ecological capacity for future generations (L. Bistagnino, 2009).

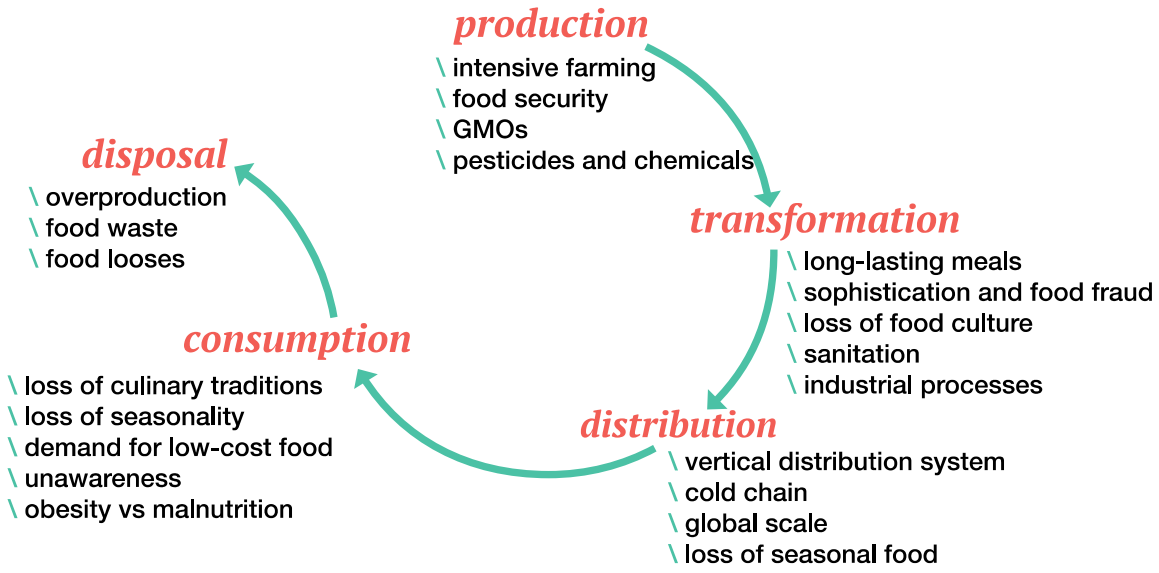

Figure 1. The main problems related to the life cycle of food system.

2. Justification

The problems expressed in the introduction are interrelated each others in a complex network of relations and implications, hence, it is needed a new way facing the food productive processes in order to obtain multi-benefits for the environment, the society and the economy.
The theories about complexity help the management of the entirely food systems and the design approaches help the planning of different divergent elements.
The complexity theories evolved on the basis that living systems continually draw upon external sources of energy and maintain a stable state of low entropy, as the physicist Erwin Schrödinger asserted after the WWII, on the basis of the General Systems Theory by Karl Ludwig von Bertalanffy. Some of the next rationales applied those theories also on artificial systems: complexity models of living systems address also productive models with their organizations and management, where the relationships between parts are more important than the parts themselves. Treating productive organizations as complex adaptive systems allows a new management model to emerge in economical, social and environmental benefits (Pisek & Wilson, 2001). In that field, Cluster Theory (Porter, 1990) evolved in more environmental sensitive theories, like Industrial Ecology (Frosh & Gallopoulos, 1989) and Industrial Symbiosis (Chertow, 2000).
The design thinking, as Buchanan said in 1992, means the way to creatively and strategically reconfigure a design concept on a situation with systemic integration. This needs a strong inter- and trans-disciplinarity during the design phase (Fuller, 1981), with the increasing involvement of different disciplines including urban planning, public policy, business management and environmental sciences (Chertow, Ashton, & Kuppali, 2004). However, the design thinking doesn't explicitly include the social aspects, so new evolution in the discipline is needed: the Systemic Design (Jones, 2009). Food is an overarching social phenomenon that incorporates the very essence of the humanity (Maffei, 2015).
The Systemic Design is planning the flows of matter and energy that flow from a system to another one towards zero emissions, creating a new economic-productive model, a community of strongly related people and a conscious connection with the territory. According to comprehensive approaches, as Systemic Design and Blue Economy (G. Pauli, 2010), they define many eco-guidelines, based on different practices and systems of goods production, transformation and consumption. This would allow defining new food systems, promoting social and environmental development.
The purpose of this paper is to give empirical and theoretical contributions with developed, developing and transition perspectives. From two of the case studies, directly developed by the authors in the last five years, arise how the complexity of food systems impacts the simplicity of the everyday life solutions. Its role is crucial in the environmental context and in the development of the local territory.

3. Methodology

Before dealing with the projects, it is necessary to clarify the applied methodology: Systemic Design.
The first step in planning with that methodology is the holistic survey of the current state of affairs: it clearly outlines all the steps and actions undertaken and/or undergone by the context in question. In order to do so, the description of what enters the system (input), its origins, what happens inside it and, finally, what comes out of it, its destination and its possible use (output) is done. The analysis of these inputs and outputs will have to be of two different kinds: quantitative, so as to know the quantities that are moved around; qualitative, to know exactly what can be fully used.
In addition, the identification the players involved in the system, their nature, their know-how and their reciprocal relations is crucial.

These actions help to understand the relationship occurring between the parties and the context, as well as the communication they have, one with the others and with the production, transformation and marketing sites.
These steps enable to have a clear idea of:

- the needed resources, their features and origins;
- processing waste, their specific qualities and their final destination;
- what occurs throughout the processes, comparing the specific differences of inputs and outputs.

The result is a chart with the global vision of the process and of the overall relationships that characterize and make the system work. At this point one can notice how useless and contradictory it is to focus merely on the individual parts, ignoring the links with the elements existing inside, outside and all around the process. Moreover, an approach by single parts has proved to be in contrast with the dynamism of the whole and with the "traditional" efficiency of the natural systems.
At the state of affairs, one can ascertain that, within the current intensive productions, many choices are made uncritically, sometimes according to maintain a linear-oriented tradition which has proved, at present, to be rather defective.
The safeguard of this global vision, beneficial to the sustainable transformation of the processes, can be attained by drawing a graphic chart, allowing us to retrace both with eyes and mind, the flows of matter and energy, their use, the knowledge capitals, the relationships between the actors, and the contextualization of the system in analysis. These graphic schemes allow simultaneous synoptic views of the values at stake, and for the overall number of criticalities to be faced and solved. Particularly the latter are represented within a process and are to be taken into account in comparison with it. The causes of problems can be ascertained when they occur, or in the light of previous choices or phases, or because of their misinterpretation, or even within the value generated in the course of the following steps. Every problem is assessed according to different parameters, such as advantages and economic value, environmental sustainability, correlation with the territory and production flexibility. Each of these parameters is evaluated both from a quality and quantity point of view. In turn, the study of the quantity allows to outline an economic scheme of the whole, giving conclusive evidence of the fact that the entire process, besides being based only on the production focus, can only be improved by increasing the number of products considerably.
This peculiarity of the present economic/productive system, and the consequential on-going increase in the quantity of waste, are real issues to be dealt with in the forthcoming future, if we wish to develop our society in a positive and satisfactory way (Campagnaro, 2011).
Identifying the problems and trying to understand them leads to a clearer perception of the phenomena they have arisen from. Physics, biology, chemistry, mathematical sciences, history and economy, are the indispensable tools for this analysis. A designer is asked to coordinate, enhance and harmonize their contributions and to change the faults in the dynamic flow of the production.
Nature is the system par excellence, following nature‘s footsteps the designer reorganize the starting point of the current situation, to identify less energy-consuming processes and productions, and to emphasize the neglected qualities of the outputs as much as possible. By doing so, all kinds of matter may be turned into input for other productions or systems, via connections that may be entwined with the productive realities carried out on the territory.
A systemic project prevents focalisation only on one product and tends to privilege complexity, local dimension and flexibility. This enables to revitalize and resume the normal links between each firm and its own context, based on the outputs it has produced, and to prioritise the decrease in the number of items that have not been adequately enhanced (waste).

Thinking by connections is the only applicable solution when attempting to solve the problem of the environmental impact, a burden placed on the territory, on account of intensive productions. In conformity with the consistency between outputs available and required inputs, a designer may conceive useful connections and interactions, and think of more innovative ways to employ matter. This will enable one to arrive at new productions and forms of energy generation, and will commit the many players of a territory to modern, flexible and multipolar economic models.
The heart of the project is set on very specific assumptions. The presence of pollution and disposable waste, implies that human and material resources are being misused. A more adequate employ of the same may result in new production processes, new opportunities to make profits and new forms of coexistence between production and reproduction activities, in compliance with the new parameters for a modern and sustainable balance within the ecosystem.
A new graphic table can be done with the systemic view, so it shows a remarkable increase both in the flows of the energy production and metabolized materials.
This designing methodology has different types of positive outcomes: a decrease in the number of individual products, focussing on building a balanced relationship with the resources of the territory; an exponential growth of production capacity of the territory; new and more useful material assets; better quality services, administered to the community; increased productivity; more job opportunities. These outcomes, which are not detrimental to the quality of life, should also prove that, a positive dialogue with the territory, involves taking notice of the material culture and enhancing knowledge that one needs to place within the historical context of reference.
The field of research regards multidisciplinarity, which provides the foundation for the systemic approach, as the only way to go for future development. The possibility of observing real examples of systemic integration on the ground, starting new scientific, economic, sociologic and politic research partnerships with the other actors from the territory, leads towards an open dialogue among the players, a strong sense of collective sharing and triggers a highly innovative territorial development that takes its components into account.
Systemic design opens up the possibility of innovative and virtuous business models in which the waste, that is today a burden, tomorrow can become a resource for new industrial systems offering numerous opportunities of development in the region, in productive areas and in connected services.

4. Analysis and discussion of findings

This paper shows the social, economical and environmental benefits generated to real cases that apply the Systemic Design approach in different food sectors and in different local context, in order to enforce the potentialities of the application of this methodology.
The first one is “EN.FA.SI.” (co-funded by the Piedmont Region) in which the value chain related to the PGI bean, Fagiolo Cuneo, endorses the entire area involving the small family producers and the local SMEs.
The second one is “Fondo Noir” (funded by Lavazza company) in which the spent coffee ground from the coffee bars in the metropolitan city centre are collected by cargo-bike in order to generate many new businesses.
Thinking about a food territorial system means the guidance of politic, scientific, organisational, designing processes, based on the generation of increased relationships, shared visions and strategies (cross, pervasive, and fundamental ones).

4.1 EN.FA.SI

The agri-food sector is proving to have particularly high impact because of the use of pesticides and fertilizers, the consumption of energy and natural resources, the emissions of greenhouse gases and the large amount of waste produced.

Recently, Politecnico di Torino has engaged in research activities in the agro-food industry, using the Systemic Design methodology, especially in the Cuneo Bean cultivation because it showed several conceptual criticalities and a production system which required redesigning, initially employing an excessive use of natural and artificial resources, such as synthetic products, energy, as well as waste of secondary raw materials (Fiore & Tamborrini, 2014). The project included a feasibility study, followed by the industrial testing of each stage of production. This involved many local SMEs (in some cases family-owned businesses).

The design of a complex system in which outputs are valued as input of other production sectors, ensures environmental benefits such as the reducing of wastes. It evolved also economic benefits, such as the development of several new economies in the area. A graphical view of the system complexity with all the interconnected activities helps to underline material and energy flows, inputs and outputs (Figure 2).

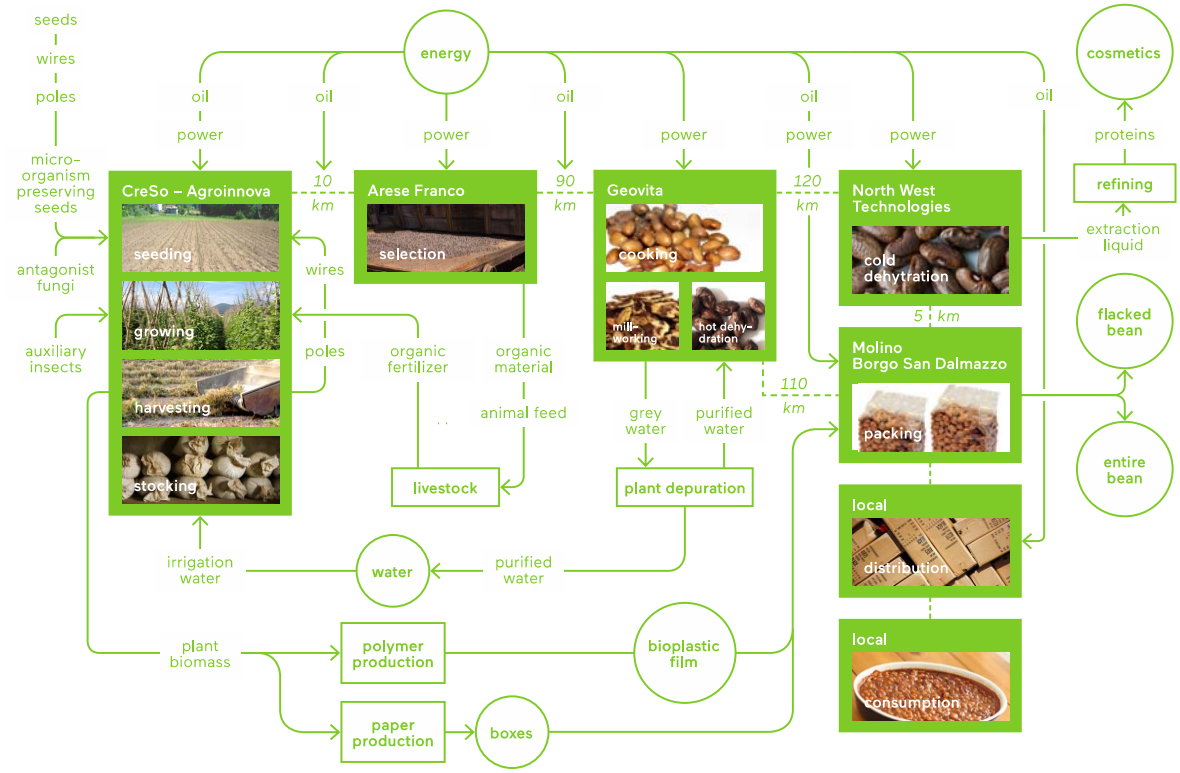

Figure 2. The complex system designed for the EN.FA.SI project.

4.2 Fondo Noir

Annual generation of Spent Coffee Grounds (SCG) is estimated around six million tonnes per year. They currently do not have a commercial value and are disposed of in landfills or as compost. The Systemic Design project provides a holistic vision in which these production are linked together through relationships, output and input, flows of energy and materials, in order to make the SCG recovery activity complex, with almost no waste.

Nowadays, SCG need to be disposed of in a controlled way, because the residual caffeine, tannins and polyphenols could have negative effects on the environment (Panusa et al., 2013). In addition to the elements listed, SCG contain also other elements such as minerals, melanoidins, lipids and waxes, lignin, proteins, ashes and polysaccharides (cellulose and hemicellulose are a little less than 50% in the anhydrous SCG). These components have high quality and physical characteristics that can be exploited.

The objectives of the work are not only the creation of a system that gives new life to the SCG but also the educational and social aspects related to the valorisation of waste. The project is carried out by Politecnico di Torino (Department of Architecture and Design), in collaboration with the biggest Italian coffee roasted company (Lavazza SpA) (Barbero, Fiore, 2014).

SCG should be split into their two constituent elements: the oils and the exhausted coffee grounds, each of which finds different application sectors. The first one can be used in cosmetics, energy and cleaning sectors; the second one in agronomy, print, energy, plastics and building sectors. It is necessary to systematize the activities, to understand what should be done first, the necessary working operations and the characteristics of the material after such operations (Figure 3).

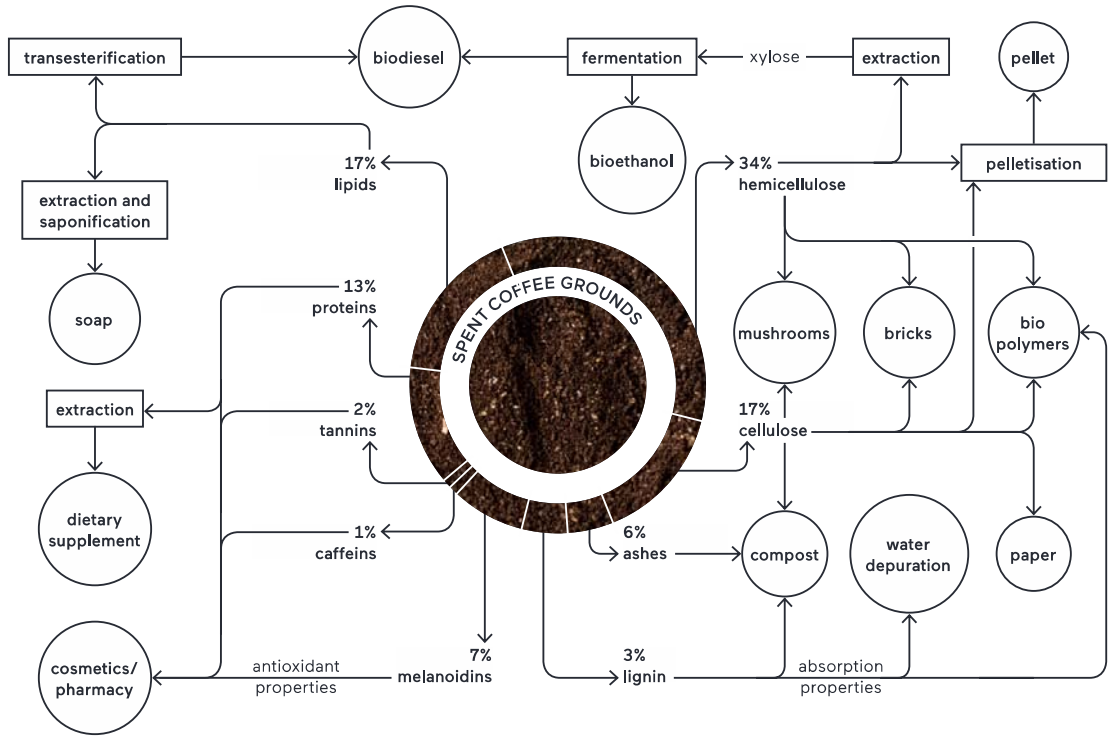

Figure 3. The complex system designed for Fondo Noir project.

5. Conclusions

Data show that major levels of overproduction, waste, surplus and underutilization are consequential to intensive productions, in addition to its core business. Turning these features into resources for the territory means giving new opportunities to all those who are more likely to incur the costs of their disposal. If we exploit the sense of territorial belonging of the resources we may boost a type of development that favours the local dimension and allows the sprouting of self-sufficient realities, able to produce, supply and generate energy autonomously, and there will be a dramatic decrease in the number of long haul transportation.
The complexity involved in that kind of design processes interested a wide range of players and it aims to contribute the scientific debate on the role of design as mediator and facilitator among different specific disciplines (Germak, 2009). The polytechnic culture, at the base of design disciplines, guarantee a model for the eco-innovation also in food sector, with strong and solid approach.
This methodology can be fostered because it is proven and gives answer to the problems listed in the introduction. It has the promising ability to deliver new diplomas in this field.

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