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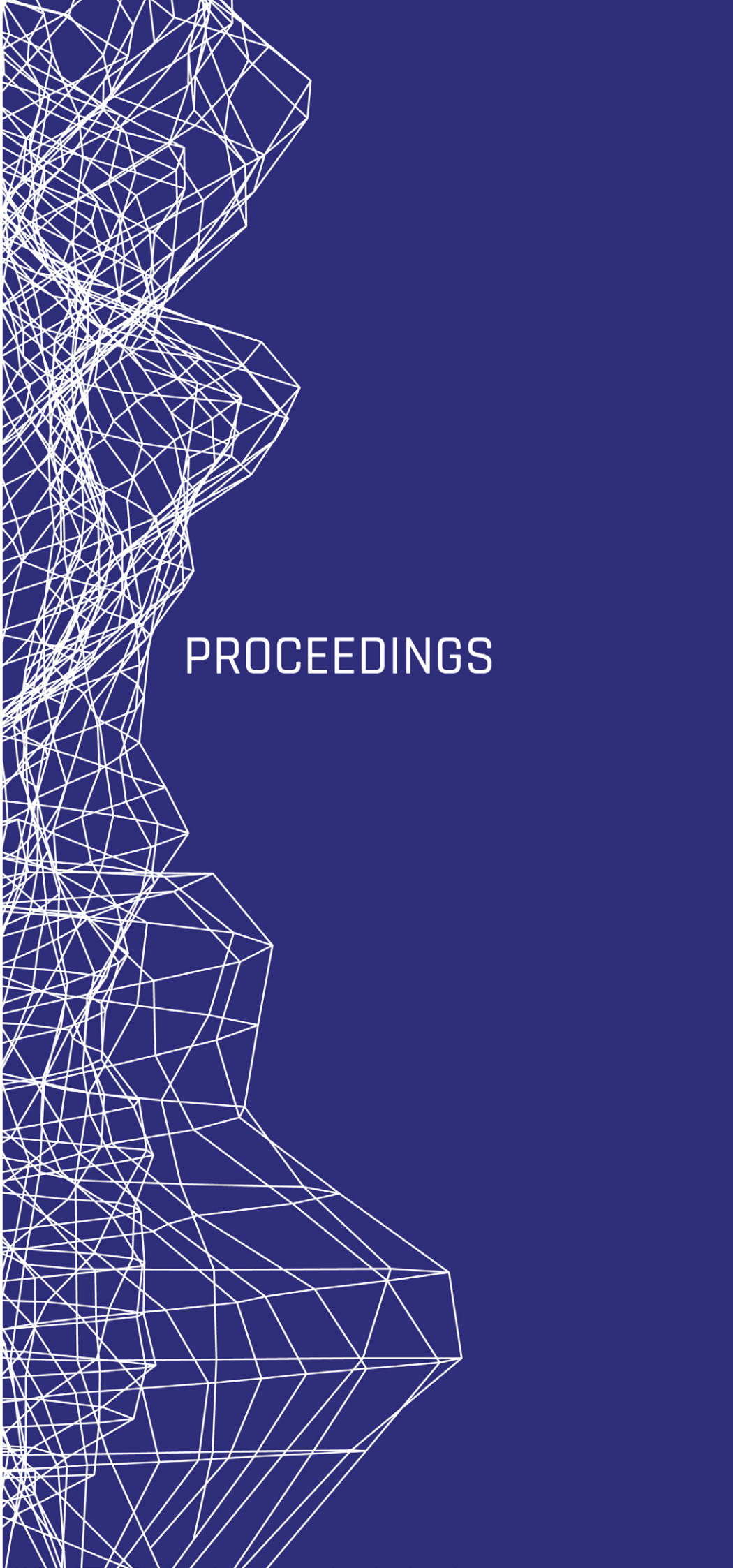
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WORKING PAPER

The impact of food production on public health: systemic strategies for a diffused and transversal prevention plan

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Abstract: Linear agro-food production systems have led to a high social impact, translated into a growing spread of chronic diseases and prolonged health costs. This obvious disconnection between food networks and health systems has often led consumers to make unhealthy food choices. The problem, in its complexity, is currently mainly faced by exponents of the Integrative Medicine, without however reaching transversal dissemination. Through the analysis of representative projects aimed at managing and resizing the problem, the purpose of this article is to identify new fields of investigation and action for systemic designers, who deal with the re-planning of food and health experiences of the individuals who wish to protect their health. This happens through the creation of relationships, the mediation of different languages and the sharing of knowledge. Furthermore, the paper traces the foundations for the definition and development of future design solutions in the field of Food for the Healthcare.

Keywords: systemic design, food production, public health, prevention strategies, multidisciplinary collaboration

1. Introduction

Nowadays talking about industrial agri-food production also means referring to different environmental, economic and social repercussions. Although attention given to the way in which the food is produced has grown, the social costs linked to food production have been investigated with a more superficial approach. In many cases the most common mistake is to separate human health from the quality of production processes of food, forgetting that social costs also translate into health costs if they become burdensome and prolonged over time. However, an insufficient and fragmented level of information about the strong link between food undeclared contaminants and chronic diseases has reduced the consumer's capability of choice in the purchase of food, further diminished by food primary selection executed by the large-scale retail trade (Figure 1).

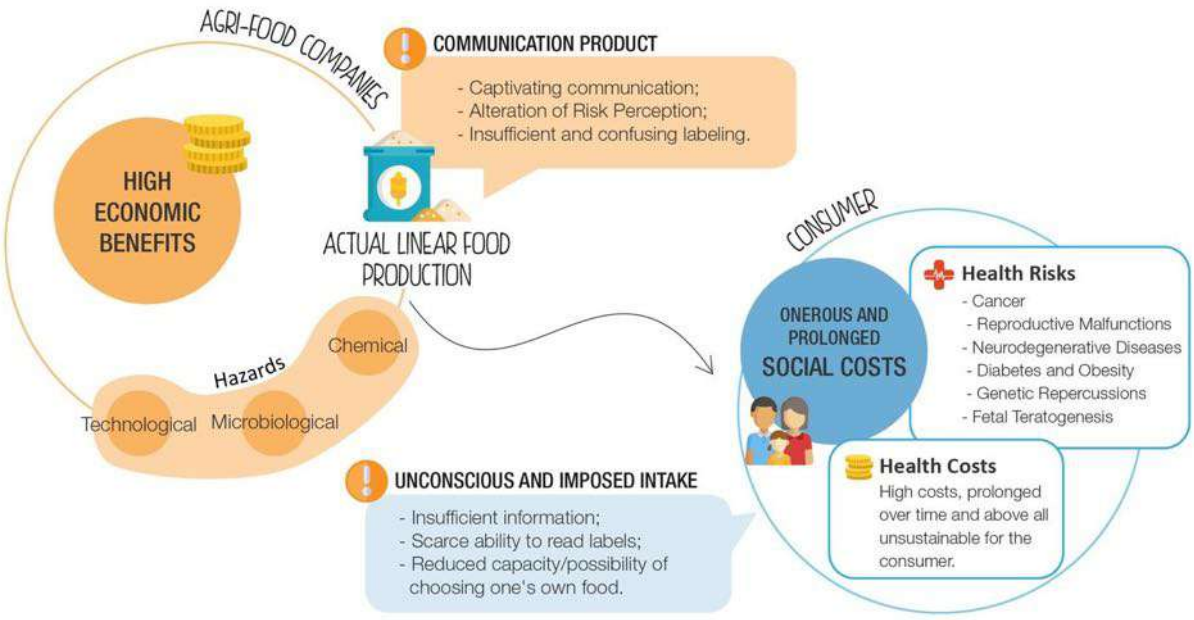


Figure 1. Overview of a Food and Health System (by authors)

It is good to make a comparison: while smoking is a choice, getting sick through unreported contaminants contained in our food is not. Smoking is a bad habit, food is a necessity and as such, it should not *poison* humans. In fact, it is right to know that the most widespread diseases such as diabetes and obesity are not the only disorders related to the quality of food production processes, where production processes refer to all the activities carried out along the entire production cycle, from seed to sale. In this complex scenario, a systemic design approach acts as a tool for reading and analyzing linear agri-food supply chains, characterized by chemical inputs such as antibiotics, hormones, pesticides, and fertilizers (Bistagnino, 2011). However, nowadays the range of such contaminants is widening, especially considering all the chemical additives used during the extensive

phases of food processing and all those substances released from polymeric packaging in the industrial or domestic conservation phase (Figure 2). In the human body, they act as endocrine disruptors, interacting with other contaminants assimilated during the years (Maga, 1995) and therefore representing huge risks that are hard to predict. The purpose of this contribution is to investigate how systemic designers can serve the community through powerful tools, methodologies, and potentialities, in order to prevent the emergence of complex global problems through the design of a system of relationships among a variety of specialized figures. This system aims to generate, in the near future, a complete service available to the citizens who seek the improvement of their health status, whether ill or not, within their own territory.

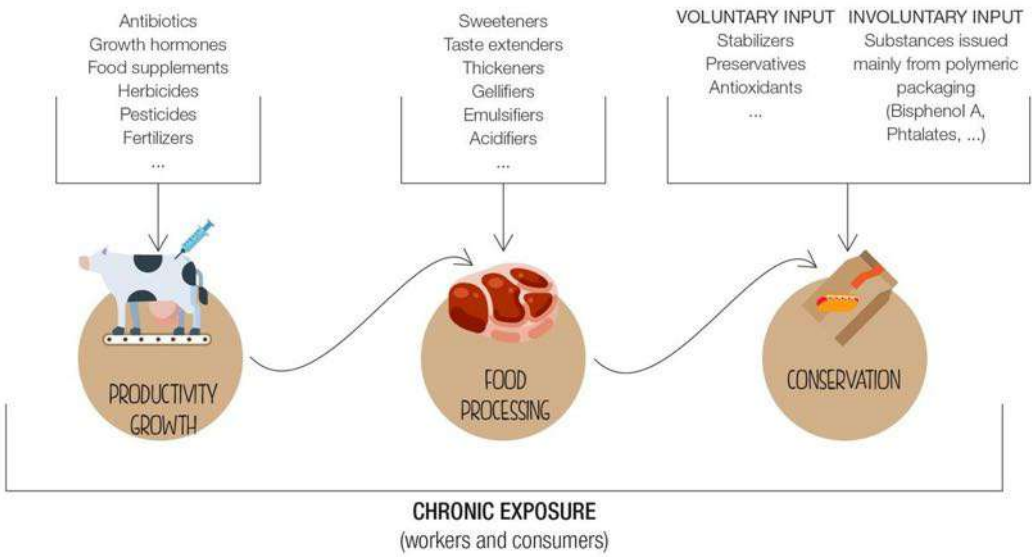


Figure 2. Phases of administration of chemical toxic pollutants in the Linear Agri-Food Production (by authors)

2. Food production and health: an overview

Food safety in Europe has become an important issue of public interest, particularly since the advent of the *Bovine Spongiform Encephalopathy* (BSE) and after the spread of genetically modified organisms. Today, food consumption is attracting global attention because of the constant chemical risks to which humans are exposed daily. On the subject of food risk[1], it is necessary to deal with its sources. They can be essentially classified into three categories (Yeung & Morris, 2001):

[1] The risk is defined as "a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence" (Royal Society, 1992; HMSO, 1995). Specifically, within the agri-food sector it is not only relevant the analysis of pre-sale food risk, but also and especially the perception of the same risk by the end-consumer at the time of purchase.

- Microbiological sources, connected to the negative action of microorganisms such as bacteria, fungi, and yeasts that can cause food spoilage and the consequent possible poisoning of the consumer;
- Technological sources, referring to the potential negative consequences of technological processes in the food sector, such as the irradiation and genetic modification of food;
- Chemical sources, associated with the use of chemicals in the agri-food industry, aimed at maximizing market returns or preserving specific product characteristics.

This article focuses on the consequences of the chemical risk associated with food production, which in most cases coincides with the development of chronic diseases of different nature. To fully understand the complexity of this phenomenon, it is necessary to further grasp two concepts. These are the *Acceptable Daily Intake* (ADI), that is the quantity of pollutants legitimated to be swallowed daily without any apparent risk to health and the *Chemical Body Burden*, that represents the accumulation and interaction of chemical contaminants in the body (Robin, 2012) (Figure 3), that is usually not taken into account in the diagnosis of illnesses, despite its relevance. The effects and the mutual interaction of these chemical substances, not chosen by the consumer, are responsible for what the *World Health Organization* defines as an *epidemic* capable of perturbing the health of present and even upcoming generations. The list of diseases related to industrial food production is destined to lengthen, especially considering neurodegenerative diseases, reproductive dysfunctions and cases of teratogenesis in the fetus. It is estimated that most of the future pathologies will be of fetal origin and the transgenerational effects will gradually increase. For this reason, it is of primary importance to translate the concept of sustainable development and the same sense of environmental responsibility also in the field of public health. It is crucial to start from prevention, to defend the health of our posterity.

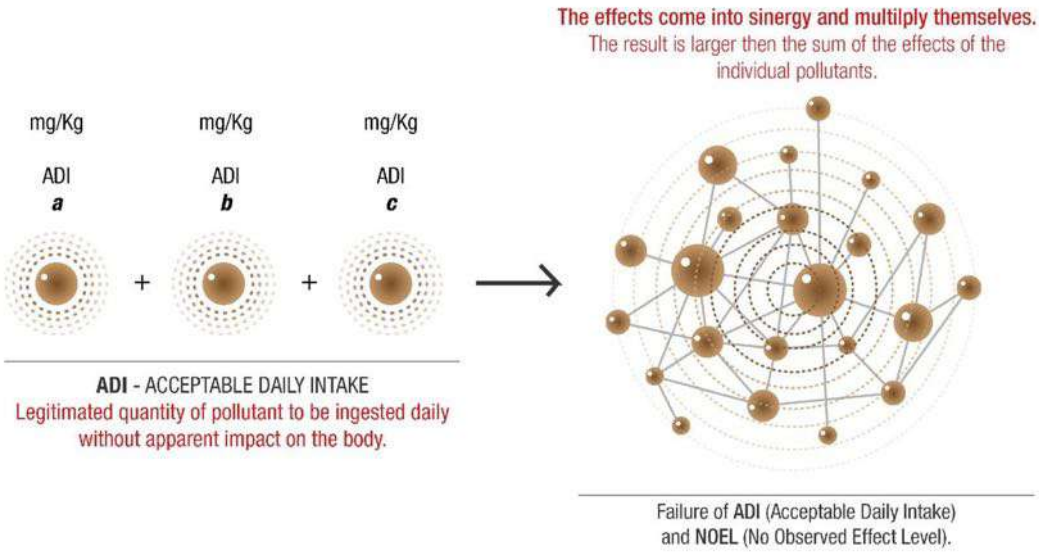


Figure 3. Interaction between the acceptable daily doses of several toxic substances (by authors)

This problem, intrinsically complex and not immediate to manage, is currently mainly addressed by medical professionals in the field of the *Integrative Medicine*[2], in particular biologists, pathologists and oncologists who conduct independent studies, whose disclosure sporadically reaches the community of consumers, that remain passive victims of an agri-food system bankruptcy. However, between the 1980s and 1990s, the topic of food consumption related to the health status of a reference population has witnessed considerable growth, particularly in urban North American settings, such as Canada and the United States (Calori & Magarini, 2015). As a matter of fact, they were the first countries to develop food policies aimed at improving the lifestyle of citizens, starting from their health conditions. Citizens were negatively affected by the consumption of fast-food and by the lack of availability of fresh and nutritious food in the so-called *food deserts*[3].

Within these sensitive contexts, there are few cases in which the potentials of systemic design have been taken into account. Most of the times, designers have been distinctly dealing with problems connected to the themes of health and food, while rarely intersecting the two contexts. If in the first case it is possible to talk about *Medical Design*, therefore of the design of equipment, services, and sanitary structures, within which extreme importance has been given at the involvement of the user in the treatment and prevention process (Pereno, 2017), in the agro-alimentary context instead, the systemic designer focuses on the redesign of the production chains in order to optimize resources, reducing environmental impact and enhancing the local culture of a territory[4] (Fassio & Tecco, 2018). Nevertheless, on the basis of these research paths that have been already explored to a large extent, systemic design can still offer a significant contribution, in the creation of greater awareness within the communities, on the connections between food production, choices of purchase and the correlated chronic diseases. Moreover, the involvement of psychological and social sciences can lead to a behavioral change both in the end consumers and in the actors involved in health and agri-food fields. In fact, in order to allow the future population to enjoy an optimal state of health, a radical paradigm shift needs to take place within the management of the public health sector, involving a focused and widespread prevention system, that starts from the control of pollutants during the entire food production process.

[2] Born around the 40s and spread in the 70s by doctors, biologists, psychologists, scientists, and even nuns, *Integrative Medicine* considers the patient as a whole within the diagnostic act (which precedes the therapeutic steps). This means that the patient is interpreted as a single sick entity, and not connoted by single disconnected disorders. Formerly known as *Holistic Medicine* or *Alternative Medicine*, it pursues a unitary vision of the human organism, opposite to that of the official medicine.

[3] According to the definition given by the American Nutrition Association (2009), food deserts are parts of the country vapid of fresh fruit, vegetables, and other healthful whole foods, usually found in impoverished areas. This is largely due to a lack of grocery stores, farmers' markets, and healthy food providers. More info at americannutritionassociation.org/newsletter/usda-defines-food-deserts

[4] At the University of Gastronomic Sciences of Pollenzo (Cuneo, Italy), within a Master's Degree in Food Innovation and Management, the Systemic Food Design Lab was established by Prof. F. Fassio. It is a laboratory of analysis and systemic design that aspires to develop (on a theoretical and applied level) an approach based on the design of collaborative and valuable relationships. It is applied to food in its multiple meanings. See unisg.it/ricerca-unisg/systemic-food-design-lab/ for further information.

3. Redesigning relations among stakeholders

Since the 1930s the industry has controlled and influenced research on the toxicity of products, counterfeiting the veracity of scientific results (Robin, 2012): this fast-growing phenomenon has allowed higher thresholds of ADI and the legitimization of new hazardous substances. This is the reason why a bottom-up paradigm shift needs to take place within communities and the involved stakeholders. The systemic designer has a responsibility in this sense, not only as an activator of relationships but above all as a processor of a sustainable action strategy that necessarily includes a reversal of the approach to chronic diseases and food production/consumption. In order to plan a *social sanitary service*[5] (Capra & Luisi, 1997), it is of primary importance to act simultaneously on three different fronts. Firstly, the collaboration with professionals closely linked to the biological and medical fields and with public and private health facilities: the doctor should keep his mentorship, rebuilding it with greater awareness and considering the links between diseases, environment, lifestyles and eating habits. This broader and complete vision implies an attentive listening of the patient within the treatment path. Listening means tracing past and present of the individual, pursuing an analysis of the social and natural environment in which he lives, deepening his disturbances, eating habits, lifestyle, relationship with the food and with people, places where he spends his time and in which he suffers potential exposures. This is a complete investigation that has to become the basis of any systemic project for healthcare: a product, a service, or a strategy. In support of this analysis, there must then be a unitary conception of the human organism as a system of closely interconnected organs, which interacts with the natural and social environment. Secondly, it is of great importance the interaction with patients and less aware individuals, so that a system of prevention and precaution can be put in place, extending also to those who are not affected by any diseases but who seek a balanced state of health. This implies a health education program, in order to lead the consumer to understand how the eating habits affect his state of health, helping him to discern misinformation and advertising of unhealthy products and lifestyles. Finally, the third factor is the active involvement of food producers, so that they can move towards a production free from chemical contaminants, that follows the seasonality and that favors the production of local agricultural varieties. It is also essential to adopt recognized certifications and labels to reassure, inform and guide the users towards conscious consumption.

In a multidisciplinary scenario involving health, biological and agro-food disciplines, systemic designers draw a dense network of relationships among different actors mentioned, within which the patients and the healthy individuals to be protected represent an active part of the system, directly

[5] In the book "The web of life. A new scientific understanding of living systems" (Capra & Luisi, 2014), the authors affirm that a Social Health Service provides for both the integration of health education programs and health policies. In the first case, the aims are to increase the level of awareness of people on the link between health, environment, and lifestyle and to encourage companies responsible for the health costs involved in their production processes. On the other hand, Health Policies envisage the production of nutritious and chemical-free food, social policies that improve the economic and educational level, and health taxes for the producers that endanger the health of citizens.

involved in the treatment and prevention process, where prevention means knowledge, conscious purchase and even self-production (Figure 4).

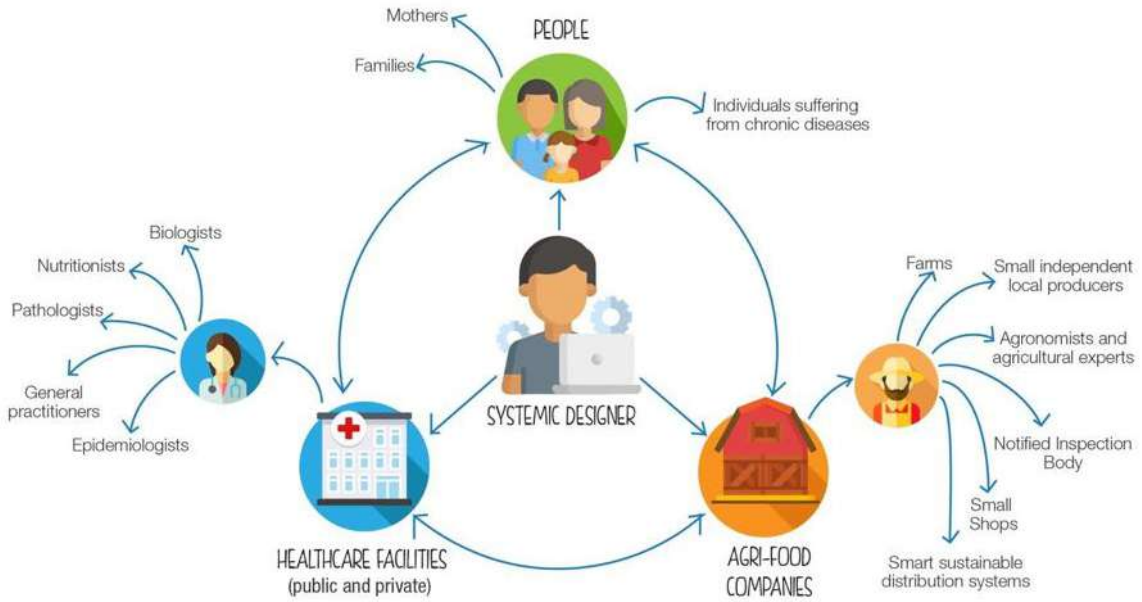


Figure 4. Connected actors of a sustainable Food and Health System (by authors)

4. A systemic approach: the role of designers

It is legitimate to ask why the designer assumes such a significant role in this network of relationships, even without possessing health and agro-scientific skills. The first answer is represented by the fact that he is simultaneously planner and user of food/health systems, consumer and *health seeker* (Jones, 2013). The real motivation lies instead in his transdisciplinary education, that allows him to deal with the most disparate branches of knowledge. By working in the perspective of sustainability and territoriality, the designer responds to global challenges with ethics and great intellectual honesty, always taking into consideration the peculiarities of the communities and of the places in which he operates, that are an integral part of a sustainable, functional, and efficient project. Nevertheless, there is another aspect that is not negligible: an ethical systemic designer stands above all the conflicts of interest, moving away from the will of the big agro-industrial and pharmaceutical corporations, planning for sustainable well-being shared by the collectivity, that does not allow tampering and disinformation. Therefore, the designer plans a path that can become a guide towards a behavioral change, through educational projects that stimulate daily qualitative actions and choices (Wendel, 2014). Products, services, and territorial strategies change their focus, moving from the maximization of profits to the health of individuals and the environment in which they live. However, in order to achieve constructive and long-lasting

connections between users, producers, food and health institutions, the designer needs to create a dialogue between disciplines, languages and distant professions, minimizing conceptual and communicative obstacles, reconciling different cultural backgrounds. Thus, its mediator role becomes fundamental for the achievement of sustainable compromises between different visions, through the objectification of critical points and possibilities. He, therefore, stands as a designer and observer of the system, avoiding imbalances in terms of costs and benefits (Figure 5).

The lack of sectorial skills is what makes systemic designers able to achieve a great disciplinary permeability. Far from a weakness, this is the main strength of a generalist (Rodgers, 2007). In addition, with constant attention to the social and environmental systems, they interact to mitigate the perturbations and trying to mend the wounds of a compromised organism. This starts from the basic societal needs: food production, health management, protection of resources and of territories. In this way, a systemic designer assures a holistic vision and places the human at the center of the project (Germak, 2008), interpreting it as part of a larger whole, such as the environment that nourishes and supports it. Through this methodology, it becomes easier to trace and understand the links between human health and the health of the planet, where for the health of the planet we refer to a set of factors, such as the quality of resources, soil, water, and food. The current health crisis reflects, indeed, a long series of critical elements belonging to the environmental and economic sphere, among which it is possible to mention: a failed food system, the alteration, and contamination of the soil, water, and air, the abandonment of natural and organic food systems, and the adoption of high impact production, processing, and distribution processes[6] (Shiva, Shiva, & Patwardhan, 2018). Therefore, in order to cope with this crisis, it is essential to act in a systemic and collaborative manner, not only at the health level but also and above all through the further involvement of the environmental, food and production system.

[6] In 2018 Navdanya International Association presented the “Food for Health” Manifesto. It is a document that denounces the limits and the costs of the current food production system, addressing the important risks to human health. Furthermore, it is a mobilization tool to claim a transition to a local, ecological and diversified food system. For the preparation of this document, some of the main international experts in the food and health sectors were brought together in the international Food for Health campaign and in continuation of the work of the International Commission on the Future of Food and Agriculture. Association's official website: www.navdanya.org/site/

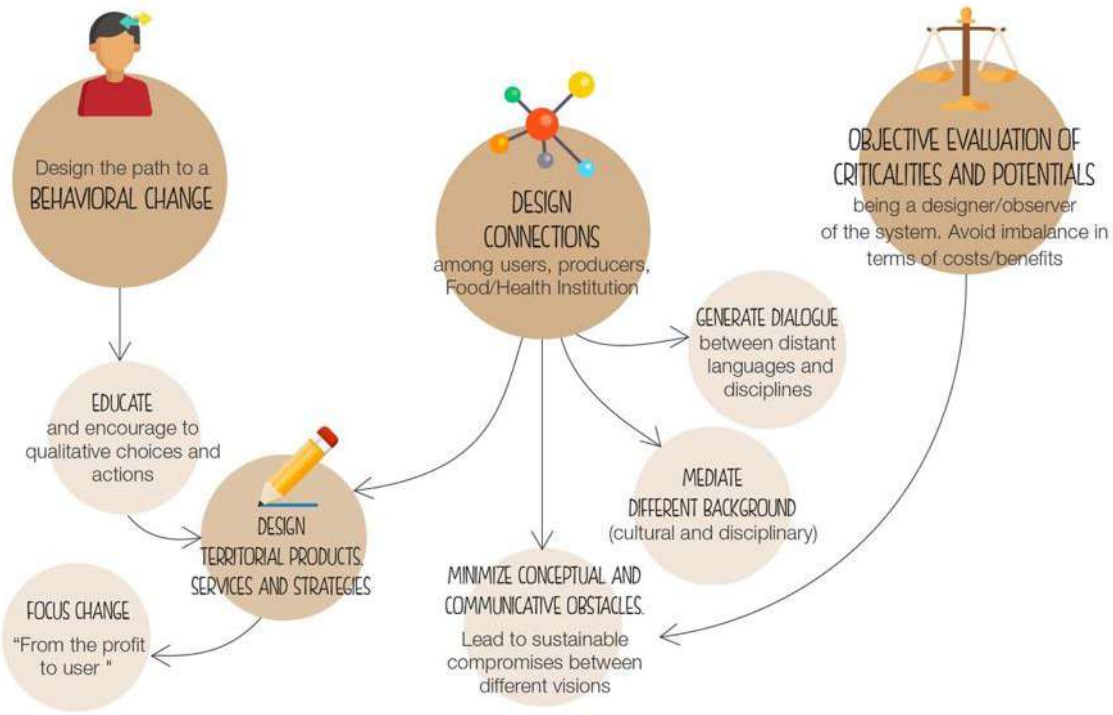


Figure 5. Transversal roles of a Systemic Designer (by authors)

5. Limits and possibilities of interdisciplinary synergies

As a designer, responding to such a vast problem of great significance, means facing a very important challenge. Certainly, the issue of healthcare costs linked to a bankruptcy food system (made up of highly impacting productive practices and serious misinformation) is a common question to most of the countries worldwide, even if manifested in different forms[7]. For this reason, it is necessary to act from the micro to the macro scale, starting from a given territory, in order to develop a flexible and sustainable design model, to be replicated (Bistagnino, 2016) with the appropriate re-adaptations. Addressing a project that involves the health and agri-food sectors, undoubtedly puts the systemic designer in front of different difficulties, especially when acting outside the academic world to put the results of the research into practice. The first step to be taken is, without any doubt, the clear communication of the own role, so that it can be understood by other professionals such as doctors, biologists, agricultural experts, food producers, health and agri-food institutions and the final users. The acceptance and the overcoming of mistrust is an essential phase. In most cases, the lack of

[7] In the book "Food and the Cities" (Calori & Magarini, 2015) it is possible to consult an overview of the different types of food policies implemented in many cities worldwide, according to the challenges they are facing. While in North America these policies aim to fight and reduce obesity, in Latin America, Africa, and Asia there is an attempt to guarantee food security and economic development, together with the support of local NGOs. The cases reported in Europe mainly focus on enhancing the producer-consumer relationships and the fairness of the food markets.

knowledge on the evolution of the design discipline in the last decades leads the actors to ask themselves why trusting a professional figure whose skills are so distant from the sector in which he is acting. “Mutual understanding of each expertise” in interdisciplinary collaborations between designers and scientists is crucial (Dawson, 2009). The acquisition of trust by all the parts becomes the basis of a successful systemic project in which there is a disciplinary confrontation, sharing of information and sectorial notions, and concrete contributions from all the parties involved. It turns out to be even more relevant if related to the end user, especially if the goal of the project is identified in the modification of a rooted wrong mentality and therefore in the generation of a higher level of awareness. Finally, another main difficulty is the monitoring of the results. Rittel and Webber (1973) suggest that complex problems, defined as *wicked problems*, cannot be treated with a conventional approach and, the case of health costs connected to a high impact productive food system, is a tangible example. Being a multi-disciplinary topic, it possesses in all its aspects the characteristics of a wicked problem. Even if, as emerges from the scientific literature, there is a precise formulation of the phenomenon, it is extremely difficult to trace rigid limits since these would be subject to continuous changes and redefinitions. For the same reason, it is not possible to define with certainty how the designer can precisely act to contain the problem. Moreover, representing a scenario whose developments will be visible only in the long term (therefore foreseeable only within the limits), there is no range of precise solutions and immediate proof of the effectiveness of the experiments undertaken (Jones, 2014).

6. Representative projects to reconnect food and health systems

Despite the extreme complexity of this social problem, nowadays there are several projects developed to bridge the disconnection between food networks and health systems. A very interesting reference model is a Canadian project called *Nourish. The future of food in HealthCare*[8], which is based on different strategic levers including the measurement of the patient's nutritional experience, the development of sustainable menus and careful research on food for health policies. These areas of research are accompanied by initiatives for the well-being of patients and residents, concrete strategies to generate awareness through a constructive influence on people, wrong beliefs, and flows of resources entering and leaving the food/health systems. The concept of users expands: the patient and the health personnel are involved, up to the entire community, with a view to positive repercussions. Certainly, among the winning aspects of such a complete project, there is the close collaboration between specialized and institutional figures that range from the field of design to the health and agri-food sector. The research shows that, at present, this type of interaction is often absent. For example, in Europe, there are many case studies developed to bring people closer to the theme of psychophysical well-being through food. However, in most of these cases, the collaboration between professionals from different fields of research is rare. By

[8] More info on the official website: www.nourishhealthcare.ca

comprehending the numerous points of contact, it has been possible to break them down into three categories, based on their final objectives:

1. purchase of local products and direct meetup with producers;
2. guide to a greater awareness of food choices;
3. prevention and treatment of health problems through natural products and healthier preparation techniques.

The largest number of cases belongs to the first category, with the intent of helping users to find local goods and meet direct producers. Most of them involve the use of online media such as mobile apps and websites, to facilitate the purchase. Their target users are the health seekers, people that want to improve their health through qualitative and local products[9].

The second category consists of projects that aim to guide users towards a more knowledgeable purchase, through the disclosure of information that is often neglected, such as the seasonality of the products, their nutritional values, and the ingredients that move the food away from its naturalness, among many others. Frequent common negative aspects of these platforms are the absence of a reliable source of information and the lack of involvement of specialized supporting figures.

The third category collects some very interesting isolated cases that do not take the involvement of designers into account, but they successfully lead the interaction among patients, medical figures, chefs and food-producers for the prevention of diseases. One example is the *Diana 5 Project*[10], conducted by Dr. Franco Berrino and the *National Cancer Institute*, based in Milan (Berrino, 2017). This project helps to prevent breast cancer and to support the healing process through special cooking classes. Users rediscover the properties and the benefits of food, the seasonality of vegetables, and have the chance of meeting local farmers. Through this type of project, the level of awareness increases, thanks to the direct involvement of the patients in the production process of their daily meal. This category is an excellent example, consistent and aligned with the Systemic Design approach: it draws strength from relationships, from concrete and educational experiences, and from direct meet up with specialized figures.

The collection of these cases is an important support for the future and potential applications of the current research, even if this classification is not intended to be stiff. The attention to the theme of food and health is growing slowly but considerably. For this reason, it will be necessary to revise and keep this collection up to date.

[9] A representative example of this category is L'alveare che dice sì, a startup company incubated at Politecnico di Torino (Italy), that operates all over Europe. Consult alvearechedicesi.it/it for further information.
[10] For more information it is possible to consult the official websites of Foundation IRCCS - Istituto Nazionale dei Tumori (www.istitutotumori.mi.it/modules.php?name=News&file=article&sid=304) and AIMAC - Associazione Italiana Malati di Cancro (http://www.aimac.it/download/allegati/Progetto_Diana.pdf).

7. Conclusions

The holistic way of approaching this research is not far from the one adopted by the frontier of the *Medical Design*, however, it considers an additional variable, that is the potential impact of food and food practices on human health. By capturing the critical elements of a high-impacting food system and the enormous social consequences, through the research of representative projects developed globally, this article identifies the salient points in which the systemic designer can operate, the actors with whom can collaborate, and the main challenges to be faced. The rediscovery of the centrality of the designer as a reader of complexity, activator of relationships, and mediator of knowledge lays the foundations for redesigning the food/health experiences of consumers, patients, and health seekers. In the following phases of the research precise guidelines for a concept development will be defined, in order to test and assess design experimentations in real-world contexts to prevent, rather than cure, chronic disease. The scientific community of design is invited to further explore the possibilities presented so that, through the implementation of projects characterized by a high degree of social responsibility, consumers can turn into aware decision makers. Already in 460 BC the philosopher Aristotle, who made important contributions to the development of Ancient Medicine, wrote: “Let thy food be thy medicine and thy medicine be thy food”. Today, the application of this timeless ancient wisdom would be desirable. Health is, in fact, a balance to be sought, achieved, maintained and defended with constant individual commitment and with an honest and sustainable contribution of those who manage the health, food, natural and economic resources (Dimonte, 2005). For this reason, a double revolution is urgently necessary, both in the production of daily food and in the management of public health. However, this can only be carried out through the redesign of the entire food-health system, by connecting two entities that are dissociated. It is therefore essential to start from the schooling and food rehabilitation of adults, so that knowledge and awareness can become an instrument of power, while food a mean of prevention, rather than the cause of diseases.

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